

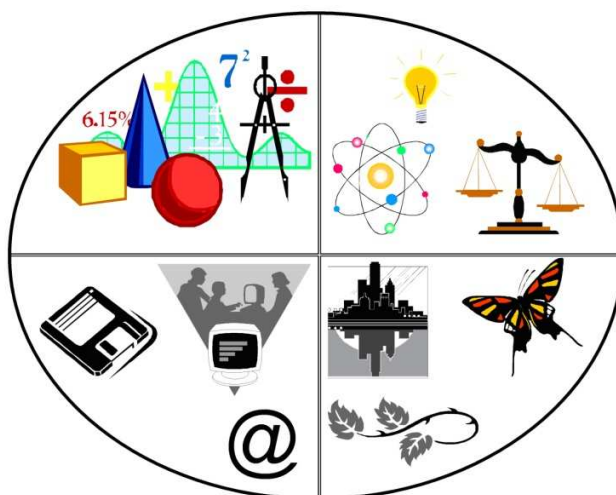
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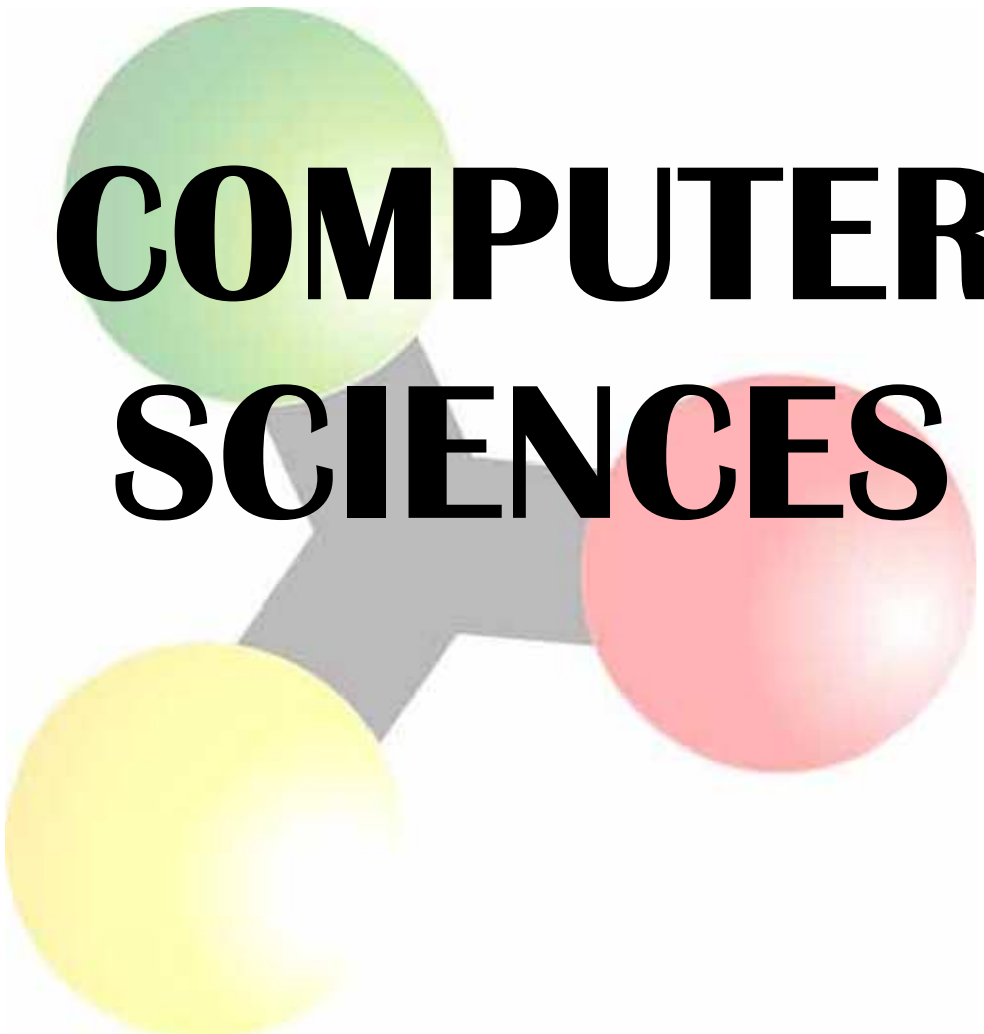
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THE BOOK OF ABSTRACTS

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COMPUTER SCIENCES

Additional POV-display for your computer

Kabak Dmitry, Minsk, Belarus

Abstract

My project is dedicated to building some accessory device for personal computer to display additional information like incoming messages, memos, time/date and so on. I decided to use POV technology for building such device, because it greatly increases usability and beauty, but decreases the price of whole device. My work consists of two parts: hardware and software.

The device itself consists of several homemade PCB boards with electric components on it, spinning basement which holds it, motor with propeller to spin it and some IC's to connect the whole thing to computer. The display itself has three boards with 16 LEDs on each of them, which create glowing and like hovering in the air picture. The display also has one board with AVR processor, which runs my firmware and controls all the LEDs and wireless communication. I have another AVR that works on the other (still) side and transmits data to display. It also connects to USB port of computer. All components were made by me and with the help of my schemes almost anyone can make his own copy of such display.

I also created the program to control all this AVRs. The program acts like the server and receives messages from other programs via standard WinAPI methods. There how any program (of course, if it has access rights) can interact with my display. As the example of such interaction I made plugins for Winamp player, QIP program and Total Commander that allow displaying data from these programs on my display. Also, the API of communication is completely open to allow anyone to write programs and plugins with support of such displays.

So, the aim of my project is to make POV displays much more common, than they are now. The POV technology allows creating of useful and good-looking accessories.

Electronic mushroom identifying (emID)

Ádám Lipécz
Árpád Vezér High School 13.
Sárospatak, Hungary

Hungarian
adam.lipecz@gmail.com

1. About the mushrooms

In this project I have used only the Basidiomycota and Ascomycota mushrooms. Today, we know about 100 000 species, but the existing ones can reach fourfold of this number. In Hungary, the number of the known mushrooms is above 2000, but most of them hasn't got important eating value, they are too small, or too hard to collect, or hasn't got such a good taste.

2. Today's identifying methods

Nowadays we can identify them with handbooks, or with keys. Most of the handbooks haven't got more than 3 or 4 categories, so it isn't easy to identify an unknown mushroom. The identifying process with keys is very slow, and it is very hard for beginners, because of the mycology specific words. There are a few internet-based applications, but they are complex for a beginner, too. They are more likely to be searchers, where you can find your mushroom by selecting the correct parameters of it. In general, they don't explain the parameters with pictures or with short explanations, I think, beginner people can't decide, that his or her mushroom has got adnexed or adnete lamellaes, etc. And they are unusable in the forest; we can't use them while collecting, because we can't connect to the internet under the big trees, even with today's high-tech devices. Possibly a weekend tourist won't carry a portable pc to his or her trip, but a mobile phone is indispensable.

3. My concept

My aid was to create a program that can run on mobiles or any smart device, and it should identify the selected mushroom through easy and understandable questions. I thought that my most important target is that the program should be accessible and usable by anyone. It was a great idea to develop this program for phones, today almost everybody has got cells, and increase the youth's interest in mushrooms, and by the way, in the nature. I think the biology curriculum of the high school is neglecting mushrooms, but they are necessary in the nature, they are the key of the earth's carbon-circle.

4. The application

The software is ready for PC and for smartphones too. It is based on C#, and Silverlight. It uses an own XML database, and I have developed an own database manager software, to add, edit, or delete questions, mushrooms, or

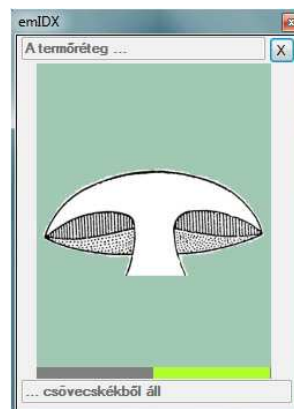
anything else. Despite the amount of the loaded mushrooms, the questions are remained quite understandable for anyone, and the application shows a little picture or drawing with every choice if available, to help the decision. The user can switch from the choices with the right or left key on the phone, or with cursors on the PC's keyboard. If needed, the program can jump back to the last question. When the program reaches the exact genera or family, then the program shows a short brief, and then shows the matching mushrooms. To identify the specific mushroom in the family or in the genera it shows photos of the mushrooms. It is much better to show pictures, because instead of them, the specific mushrooms can be only identified by special chemical processes, or the property can't be determined by vision. After selecting the right mushroom, the application shows more pictures, and some details, for example the eating value, the specific time and place of appearing, the status of protection, the option of selling, etc. To avoid wrong identifying, the database stores and displays the almost same species.

5. Conclusion

The software is can be a useful tool for the youth and the elder, it can promote collecting mushrooms, and hiking in the nature. It is important to note, that the rate of fatal poisoning is growing, and they could be avoided by knowing at least the *Amanita phalloides*, „The Death Cap”. The main advantage of this program, that it is free, and very simple. People, who don't want to spend money on books, can get a real and much better alternative solution.

6. Keywords

electronic mushroom identifying, mobile phone, software, mushroom identifying methods



Question in the program

An Interesting Way to Learn Gamelan

Ninda Frisky rahmawati, Annisa Fitriani, Miftah Adiyaksa Luckyarno

1 Yogyakarta Senior High School, Indonesia, smasiji_teladan@yahoo.com

1 Introduction

Yogyakarta, one of the Indonesian city, has a very wonderful musical instrument called gamelan. A lot of foreigners are very interested with this musical instrument, but the ironic is that Indonesian people especially the teenager do not care anymore with this musical instrument. They rather play modern musical instrument which are modern and easier to be played than gamelan. If this condition still continues, soon gamelan will become extinct. On the other hand, games are now become popular around the world. Children, teenagers, even adults play game in their free time. But some of these games have no education side at all. It is will only waste our time to play gamelan in our free time.

2 Content (recommended by LOC)

2.1 The purpose of the investigation

The purpose of this investigation is to make an application that make Indonesia teenager care about gamelan so that wanted to play gamelan and at least make this traditional musical instrument keep exist. Besides, this investigation is also purposed to make an application (game) that have educational side, so that people who play this game not only get fun but also know and can play gamelan.

2.2 Method of the investigation

This application is made in the form of flash. The concept of this application is like this:



Fig 1. Concept of the virtual gamelan game

First music will be played in this game, than balls will fall from the top of the layer following the rhythm of the music. We have to press the key in the keyboard when the balls touch the key in the game. When we press the key in the keyboard at the right time, we will get score. This

application wills also being applied in the social network so that a lot of people play this application.

2.3 Results of the experiment

This application can be used as an interesting method to learn gamelan. By applying it in the social network, lots of people will play this application and soon it will make the popularity of gamelan increase.

3 Conclusion

This application can be an alternative way to make the popularity of gamelan increasing.

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Mandau OS : “Say No to Piracy”

Ganang Albryansah

SMP Negeri 1 Bontang, Indonesia, newbie.hck@gmail.com

1. INTRODUCTION

As we know in this world especially in Indonesia, there are so many OS piracy which the use is allowed by people to the government. This thing certainly break out the copyright and can damage our nation image and if the use of this piracy product getting larger it can turn off software industry and the creator of software.

Not only that, many students or workers which cannot buy Genuine OS product and the original one because the main problem is the high price for OS product which the original one.

2. CONTENT

2.1 Purpose of the Investigation

The bigger piracy of OS or software can stop the development of a technology. This can interfere with future technological civilization. If it happening is estimated the future will paralyzed of technology. To avoid it, we come with the solution with the creation of “Mandau OS”. The goal of this project is to change how people look about piracy and present new OS which is free for the solution of this problem.

2.2 Method of the Investigation

I combine literature study method with experimental research for this research. At the beginning we search the base of this piracy problem. Finally we find high price of OS is the main factor of piracy. Therefore we conclude to make a solution which is cheap and like by many people. For this case we use re-mastering OS concept. We use Ubuntu 10.04 as the basic. We only use the body from Ubuntu 10.04, therefore many various application we applied according to needs and give something different for attract users to move to Mandau OS

2.3 Result of the Experiment

Re-mastering “Mandau OS” have various features which required by people but with the different way to operate “Mandau OS” make users to hard work. Because lack of people to know about open source (Mandau OS). Actually every OS is same if the OS is introduce to people periodically.

This following table is the result of my investigate with 10 student which response about “Mandau OS” :

Very Well	Well	Enough	Bad
1	6	2	2

Table 1 Responds from Students about Mandau OS

3. CONCLUSION

The development of piracy actually can be overcome with giving a contribution or solution. Which one is with “Mandau OS”. With that OS beside help to suppression the piracy, we can enjoy it. With various features available on that OS. So with the innovations like this can accelerate a development of technology and there is no that called static development of technology. Because with this, there is no any party who feels aggrieved.

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From Ancient to Modern Structural Design

Reza Abdurahman

Taruna Nusantara Senior Highschool, Indonesia, admin@taruna-nusantara-mgl.sch.id

1 Introduction

How architects design constructions today is different compared to how our ancestors built it back then. Today, even the smallest building used blueprints, which is different compared to our ancestors. Despite the fact that no exact measurements existed during those times, somehow they managed to create a living place strong enough not to collapse and thus protected themselves from the wild. Even now the remnants and relics of the ancient past still exist around us. Therefore there must be some way, a basic principles that they used to create their buildings.

2 Content

2.1 The purpose of the investigation

Learning how our ancestors live may lead us to a new way of living, a more eco-friendly way that protects the nature as it was protected before. To learn how they live means to learn to live in-line with nature. Not by defying, but following it. This research will try to capture and adapt the mind of our ancestors by studying how they built their buildings.

2.2 Method of the investigation

The research method used is by doing experimental research on ancient buildings. My research is primarily conducted on Borobudur Temple, Indonesia. By implementing some method I was able to create Borobudur virtually. And thus with the same way Borobudur was built, other kinds of structures can be generated. Theoretically the basic principles of self similarity that exist within Borobudur had become the base of doing a discrete way of implementing self similarity, which is known as Cellular Automata. By using the method of a 2 Dimensional Cellular Automata there are several other kinds of buildings that can be generated using the same condition as Borobudur Temple. Brute force searching for a certain structure is approachable, as the run time for each generated buildings is swift.

2.3 Results of the experiment

The program that was made using Java generated a structure which design looks similar to that of Borobudur Temple. The measurements generated by the program was compared to the measurements from the actual Borobudur Temple and a match was found, both horizontally and vertically aligned. Other kinds of construction can be generated as well. The condition on how to build other

structures may vary, however, as each buildings were built in different places with different environments.

3 Conclusion

The buildings that our ancestors made was built corresponding their environment. By doing that, it has been proven by fact that the buildings can withstand natural disasters because the building itself was built based on some things that the ancestors themselves need to avoid or protect. It is different from ours, which buildings were built more to its fashion or favor.

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e-Learning

Mihailo Ristov

SOU „Vancho Prke”, Vinica, Macedonia mihailo_ristov@hotmail.com

The purpose of the investigation

Online learning is a relatively new phenomena delivered courtesy of the availability and pricing of the computer. This new trend in learning, however, is taking off at the speed of light. As more and more students realise the benefits of these courses, and the current economic climate means that people are re-evaluating their options, distance learning degrees are becoming more common.

Distance learning allows students to attend class anytime day or night. Another advantage of distance learning is that makes it possible to take almost any course from any learning institution.

Distance learning does not require commuting. This saves you money and time that you'd otherwise spend on travel back and forth to school.

Live anywhere, study from anywhere. You don't have to live in the same city or the same country to attend the learning institution of your choice. You can study wherever you have access to a computer and Internet connection.

Method of the investigation

Every student reported on the portal receives lessons complete with tests of knowledge. The lesson is considered successfully completed if the test

is solved by over 75% correct answers. Finally, after finishing the Thread, when all lessons will be completed and the tests successfully solved portal gives a result that grade student finished the theme. The portal also contains homework assignments and e-mail of professor who reviewed the tasks.

Conclusion

This way of learning will help students who have Internet access and are unable to attend classes does not lag behind, will help the students themselves to check how much material they have learned, and if that system is worked out for all subjects secondary education will raise the level of education in our country

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Digital music school

Rik de Ruiter

Harlingerweg 80c, 8801 PD Franeker, The Netherlands

1 Introduction

A digital music school is a device that can help someone to learn to play music. The user can get feedback straight away. This way, the user knows immediately what the issues are that require extra attention, but also remind people with reduced mobility. They may experience difficulty to go to a local music school. This innovation offers a solution; people can stay at home to get feedback and instructions.

2 The purpose of the investigation

The goal was to create a concept device that can help people to learn music in a user-friendly and low-priced way. The device analyses the sound and gives based upon that an advice. One key question emerged in order to achieve this advice: to what extent is it possible to objectively assess how much a piece of music played on the points: pitch, rhythm and dynamics correspond to the theoretical performance of the score?

3 Method of the investigation

3.1 Requirements

For the investigation several things are needed: a high-end computer, a proper microphone, speakers or headphones and, of course, a musical instrument. The microphone should be placed a few centimeters away from the instrument to get the best sound quality. The user can also choose to sing.

3.2 Capturing the sound

The first step is capturing the sound using a microphone. The vast majority of microphones have a diaphragm which is vibrated by the pressure difference in the air. Through converting this vibration (= movement) into a voltage an electronic signal is established. This voltage is created by the coil which is moving relative to the magnets. This leads to a change of magnetic flux. The induced voltage across the coil is constantly changing. For computer processing a digital representation of the voltage is needed. An ADC (analog-to-digital converter) converts an analog display into a digital display. This is done by using binary coding.

3.3 Processing

The second step is the processing of these voltages. Different software can be used for getting the sound spectrum, but the use of FMOD Sound System [1] is highly

recommended. This spectrum can be plotted in two charts: one with the amplitude versus time and the other the relative strengths (0-1) plotted against frequency groups of about 2.93 Hz.

The pitch and the signal strength can now be determined. If the relative strength of a frequency group is more than 70 percent, the corresponding frequency group is converted to the corresponding tone using a table of tone frequencies. Using the signal strength (ranging from -120 to 0 dB), the dynamic changes can be observed.

3.4 Comparing

In the third and final step, the above data is compared with a special data file in which all tones and dynamics are described as they should sound. Rhythm is limited to comparisons that measure relative shifts to the reference material. If the values of the sound spectrum and the values of the comparison file match, points are awarded. Per second a constant number of comparisons are performed, as shown in Eq. (1), so that in the reference material integers instead of times or point numbers can be used.

$$CP/s = (60/BPM) \cdot \frac{1}{16} \cdot 2^n \quad (1)$$

With n an integer and $n \leq 0$. When $n = 0$, a $1/64$ note is equal to one step. The lower the value of n , the more accurate the results.

The points awarded to each category are converted into an advice. Per verse, chorus etc. advice is given to the user. The user can focus on those elements the user is having difficulty with. When the user completes a song, the process starts all over again. The curriculum adapts automatically to the user.

3 Results of the experiment

The way of comparison is and will not be the best, although there is not one best way to identify what the perfect comparison is. Music is art. Music is not entirely an objective assessment. On the points: pitch, rhythm and dynamics it is indeed possible to give an objective judgment. Not the objective assessment, but an objective judgment by a particular algorithm. And thus remains the question which algorithm is the most sufficient.

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Computer program for testing students in chemistry

Gusev Alexey

Advanced Education and Science Centre of Moscow State University, science@aesc.msu.ru

1. The purpose of the project

The purpose of the project is creating a computer program for viewing and editing the structural formulas of chemical substances.

2. Program features

The developed project was designed to be used in educational process. On the first step the teacher can draw the formula of some chemical substance. The formula includes atoms or radicals connected with bonds. The bonds can be multiple. The resulting formula can be saved in the file in XML format. On the second step the teacher can ask some question and the student provides an answer in the form of drawing his formula. After it these two formulas can be compared and so, the answer can be checked.

The checking algorithm is the main feature of this project. The program should recognize complex structural formulas, which can be drawn in different ways.

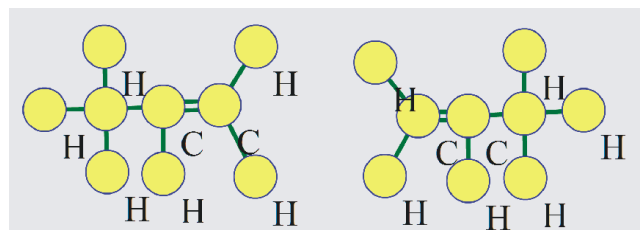


Fig.1 This two formulas of the same molecule look different

3. The Algorithm of comparing two formulas

The comparing algorithm is rather complex and can be divided in four main steps:

- 1) Checking the number of atoms in both of the drawn substances.
- 2) Pulling up the "tails" (atoms of the substance, which have only one connection). This step is done to optimise the work of the algorithm in next two steps.

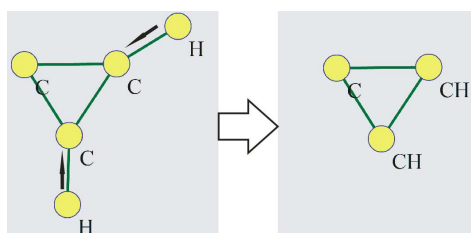


Fig.2 How the second step works.

3) Creating list of possible mappings between atoms in substance being checked and the original one.

4) Processing the lists of possible mappings for each atom and deciding if molecules are identical or not.

4. The developing process

The project is created as a RIA (Rich Internet Application), because this concept is the most suitable for distance education process. That is why it was chosen to develop the program in Adobe Flash CS5 environment using the ActionScript 3 programming language (it is the most common way of creating RIA).

5. The results

A build of the program with all main features working has been created (see Fig.3).

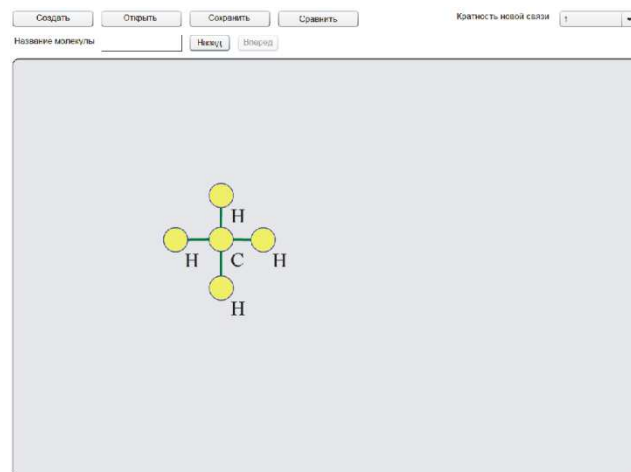


Fig.3 The screenshot of the program

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Recognizing some of the modern CAPTCHAs

Dmitry Nikulin

Laboratory of Continuous Mathematical Education, Saint-Petersburg

Introduction

The Turing test has been extensively studied since it was created, but in the last few years the reverse Turing test has become the object of interest. The word “reverse” means that it is the computer which is presented the challenge to distinguish a human and a computer. These tests are also known as CAPTCHAs (Completely Automated Public Turing test to tell Computers and Humans Apart). As a rule, a CAPTCHA consists of an image with distorted text and a text field where a user has to enter the text. The study of CAPTCHAs is also of great commercial interest since large companies demand protection against automated use of their services. For instance, a company which offers free e-mail in exchange for viewing ads will not profit if thousands of mailboxes are registered automatically since no human sees any ads; on the other hand, registering a lot of mailboxes is necessary for spamming. Theoretically, a good CAPTCHA has to block any attempt to be recognized by a computer program and at the same time it should be simple enough for a human to read. This presents a challenge for a researcher: are these images actually impossible for a computer to recognize?

Objective

The research carried out lately reveals that this problem can usually be solved but the results are often too abstract to be applied easily. On the other hand, this research was aimed to recognize some of the widely spread CAPTCHAs encountered on the daily basis. The target was accomplished: using the publicly available instruments and standard methods algorithms for CAPTCHAs used by four popular web sites were developed and performed well enough.

Methods

This project used only free software in order to guarantee the ease of reproducing the results. This includes Python programming language, OpenCV (computer vision library) and a library for neural network processing called FANN (Fast Artificial Neural Network). The process of recognizing a CAPTCHA was split into three stages. The first was the preprocessing where noise and distortions were removed. The second stage was the segmentation where characters were extracted and post-processed. The final stage was the recognition itself where characters were separately classified by a pre-trained neural network. Several hundreds of images were collected and labeled manually in order to train the networks and assess their

performance. The most errors were due to the segmentation while the recognition was much simpler.

Conclusion

The result shows that recognizing many of the common CAPTCHAs does not present any challenge for a programmer. Also, it is possible to interpret the result as another argument in favor of the hypothesis that it is impossible to create an efficient reverse Turing test.

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Speeding up Inter-process Interaction in Microsoft Singularity

Osmanov Gadji

Laboratory of Continuous Mathematical Education, Saint-Petersburg

1 Introduction

Singularity is a new experimental Microsoft OS, based on type-safe languages and manageable code. The core of the OS is the system of Software Isolated Processes (SIPs), and almost all user- and system-level functionality (including hardware drivers) is performed in such SIPs. Communication between SIPs is carried out through safe higher-level channels, controlled by contracts. However, this safe architecture considerably limits performance of the OS.

2 Methods

To solve the performance problem, author introduces new technology – Contract Shared Memory (CSM). It is implemented as a kernel extension and provides both safety and efficiency for inter-process interaction in Singularity.

As a part of the technology, the author introduces a CSM channel — a component of CSM, which provides functions for high-performance communication between SIPs. A channel is a bi-directional message conduit with exactly two endpoints. A channel provides a lossless, in-order message queue. Sending on an endpoint enqueues a message on the other endpoint's receive queue. The channel is supervised by a contract, which provides sufficient safety for the exchange operations; however, the actual data exchange is performed through the type-safe shared memory.

3 Results

The CSM technology was incorporated into Singularity: its support was added to ABI, and to disk drivers. The technology was tested on inter-process communication (CSM technology improves its speed by seven times) and was tested on Spec Web web-server, which was ported by Spec Web company from Windows to Singularity. The Singularity version is 8.3 times slower than its Windows version. Rewriting of important web-server parts using this technology improves its speed by about five times, making it close to the speed of the original Web server.

4 Conclusion

This research demonstrates viability of the new Microsoft OS approach, and shows that with minor changes this system can be made as effective as any other without losses in its security.

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Creation of Programmatic Complex of Operational Control of Spaceships

(Computer Science)

Gorinov Maksym

Abstract

Today planning and production of space vehicles not only the states but also private companies engage in. Therefore now extraordinarily actual are developments of complexes of operational control of spaceships alternative state.

A complex, worked out within the framework of this work, gives possibility in the mode of simulator to carry out going into a circumterrestrial orbit and define the most optimal managing commands which provide the conclusion of ship on a circumterrestrial orbit.

Thus, the purpose of this work is development of programmatic complex of operational control of spaceships, which would allow to model flight of spaceship from a terrene, his flight in circumterrestrial space and landing.

Theoretical part

Cosmodynamix is foundation of general theory of space flight (like that, how aerodynamics is foundation of theory of flight in the atmosphere of airplanes, helicopters, zeppelins and other aircrafts). It partakes the role of cosmodynamix with rocketdynamix - science about motion of rockets. Both sciences, closely interlacing, are the basis of space system engineering. Both they are the divisions of theoretical mechanics which is the separate division of physics.

For an imitation design at any moment on a formula we can calculate a gravity acceleration which is revealed to the space vehicle by every celestial body separately, and, can calculate (by a vectorial stowage) a total acceleration. Knowing a size and direction of initial velocity of space vehicle, it is possible, taking into account the calculated acceleration, to expect position and speed of vehicle through the small interval of time, for example after a second. For a new moment it is necessary it will be again to calculate an acceleration and then expect next position of vehicle and his speed etc.

Experimental part

By realization of experiments the created model allows to educe the sequence of managers of commands, which will allow to place a ship in an orbit with preset parameter, conduct an orbital maneuvers, carry out landing on a terrene. Thus the program can be used in quality a simulator for the studies of controllers of center of operational control and cosmonauts.

Results

Creation of programmatic complex of operational control of spaceships became a job performance, which gives possibility of realization of numeral experiments in relation to the start of spaceships and imitation of their flight in circumterrestrial space.

Discussion

Conducted discussion in relation to the method of realization of this model and programming environment

Literature

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2. Andre Lamot "Programming of 3D games for windows"

THE DYNAMIC MODEL OF A TELESCOPE-REFLECTOR (Computer Science)

Ihor Holovatsky, Lyceum #1
Chernivtsi, Ukraine

The aim of this research is to construct a dynamic model of a telescope-reflector which allows to choice such dimensions and physical parameters of telescope constituent parts which help to get the desired characteristics determined by following applications: watching stars, planets and their satellites or investigate the Moon surface. Our dynamic interactive model is constructed on basis of the software environment *Wolfram Mathematica* [1] (Fig.1).

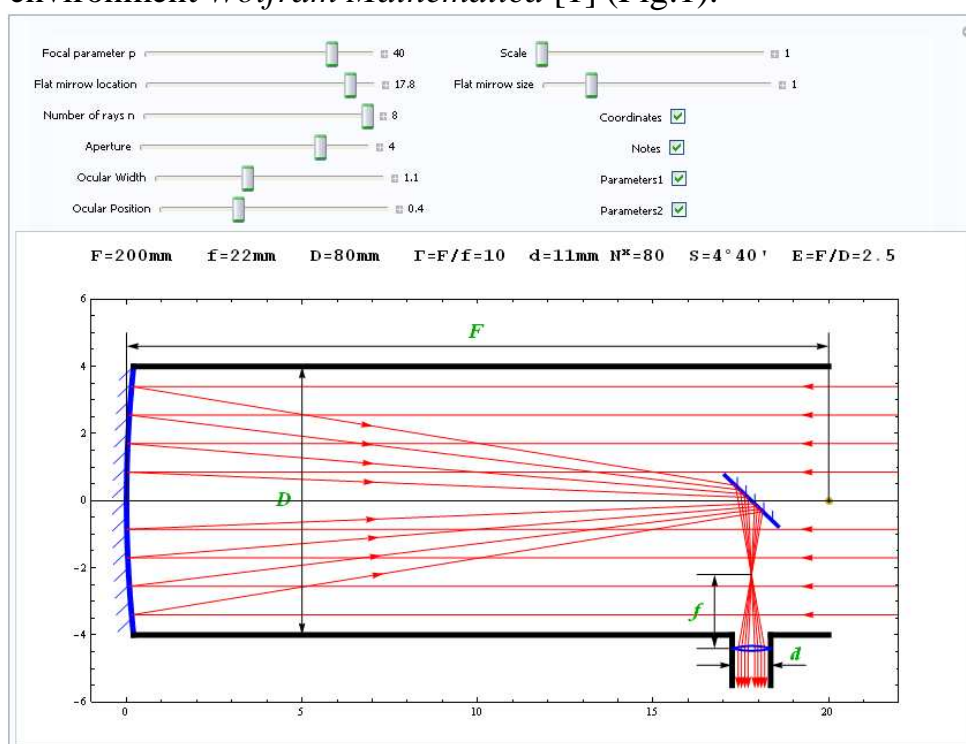


Fig.1

PROGRAMING.

The program consists of the following two blocks:

- manipulation block;
- construction of a telescope body;
- optical system (parabolic and flat mirror and ocular);
- path of optical rays;
- mathematical calculations for a geometric construction;
- calculation of physical parameters.

All blocks are dynamically interrelated that allows to influence the ray path by changing the dimensions and parameters of telescope constituent parts with the help of the mathematical calculations block and get the physical characteristics value of an optical device.

Mathematical calculations block allows: **a)** to obtain a grid point of ray reflection from a parabolic and flat mirror at different value of a focal parameter and the location of the flat mirror; **b)** to get grid points of a ray path of an ocular; **c)** calculation of a flat mirror decentration from a telescope optical axis; **d)** calculation of the ocular lens form at its focal distance; **e)** calculation of the quantity and position of bars that mark a specular surface.

CALCULATION OF PHYSICAL PARAMETERS

The calculation of physical parameters of the telescope model is made on basis of the theory of telescopes [1-2]. At some input data (a focal distance of a parabolic mirror, telescope aperture, ocular diameter and position, inclined mirror location and dimension) the model of the telescope allows to calculate such telescope characteristics as FOV (field of view in degrees), an aperture ratio, the resolution, the star magnitude limit for a given observation, the angular magnification and other parameters (Fig.2).

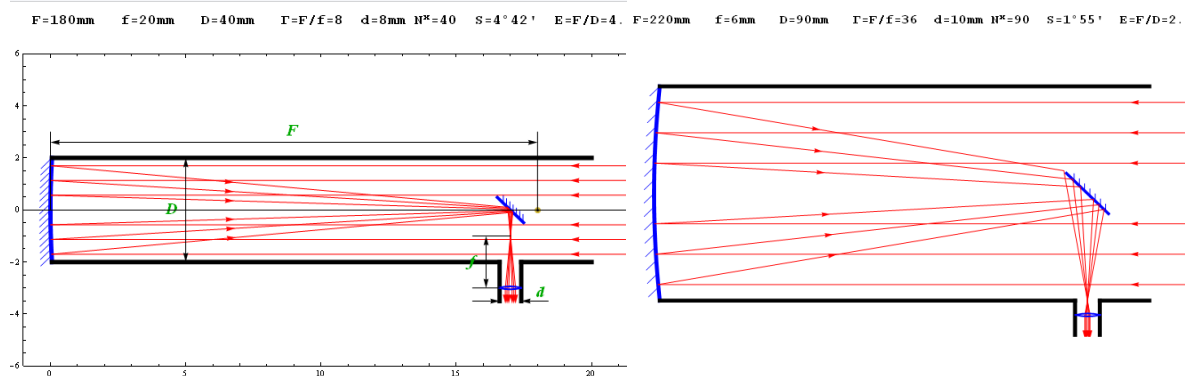


Fig.2.

SUMMARY

An animated dynamic model of the Newton telescope-reflector system was constructed on basis of the computer algebra system *Wolfram Mathematica 7*. This program allows the simultaneously calculating and selecting of telescope optimal characteristics taking into consideration its main application, and also to demonstrate them graphically. This model may be applied by students and amateur astronomers for the comprehension of a complex influence of different telescope parameters on its main technical characteristics.

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The virtual laboratory for learning electric chains

Yerokhin Maxim

Kharkov university lyceum, Kharkov, lyceum@univer.kharkov.ua

1. The purpose of the investigation

Because of increase distribution the computing engineering in educational establishments of Russia, Ukraine and other developed countries of the world and necessity of ability application it in different industries, the question of demonstrating mathematical modelling, design physical processes on computer and learning it by pupils has large actuality; also focusing attention on the high rates of development all directions of our life and permanent change standards, the students are hard to adjust to the almost annual increase of volume of necessary knowledges, that is why alternative sources of the information and facilities of its mastering are needed. As the reason of creation this project has served almost total absence of alternative programs for educational establishments (but there is a lot of professional program modules for engineers and others).

2. The investigation

According to pupils opinion the virtual laboratory is successful addition to manuals, it promotes subject fastening, and also it is convenient for private use. The project implementation among pupils in Kharkov university lyceum has shown that the program allows anybody to experiment with parameters which it is impossible to find out in the real life, to analyse the results we have got by charts in part with RLC-chains or by ampermeter and voltmeter indications in part with usual direct current, to see such phenomenons, as resonance and lag of phase of current in inductance from the phase of tension. Also it is important to notice that the project is an evident working example of computer realization mathematical model by different programmatic structures (cycles, objects and others), that allows to use a programmatic code in quality a manual with the set of examples in language of high level of C++ .

3. Results of the investigation

The offered laboratory allows pupils of different type directions to understand better the theme of «Electrician» at the study of physical processes in electric chains, enables to check up Kirchhoff's and Ohm's laws, results from the action of five different RLC-chains,

demonstrating dependence of current and tension on time and frequencies, and also helps at the decision of concrete tasks, design and research of electric processes in electric chains, an interface is simple and does not tangle. The program is intended mainly for the students of higher (10 and 11) forms, however the fully possible using it by the students of earlier classes which are interested in physics. It can be used as a main and unique instrument for the leadthrough school laboratories works, that obviously would be more comfortable and rather than by traditional methods.

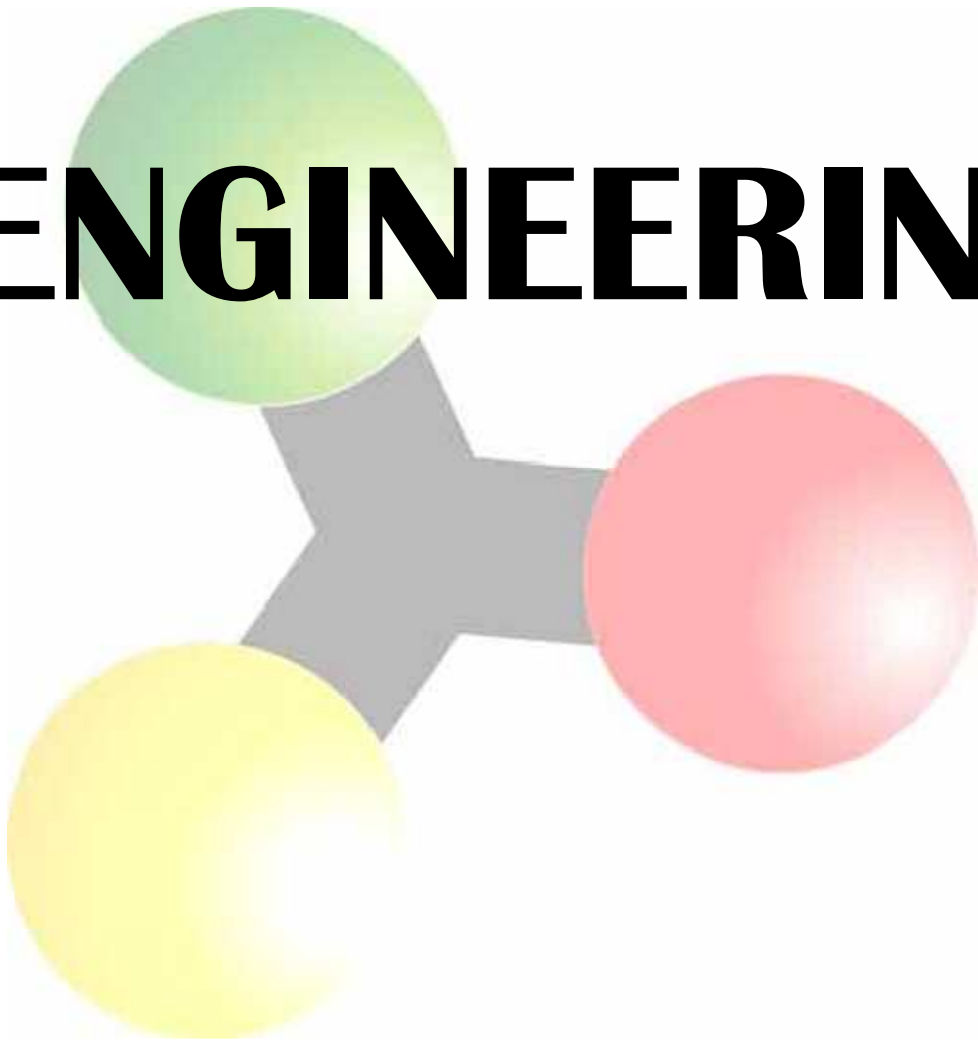
4. Conclusion

The program assumes future expansion of the base package of chains and elements of scheme at user's desire for providing actuality of using the program not only in the circles of average students but also that prepare to the olympiads, which are fond of physics or even to the students; it does not require long preparation for use both from the side of human and from the side of computer (the program can work fast even on sufficiently badly equipped computers), also in a prospect there is a question about adding to reviewing in this laboratory other passable subjects of electrician and getting the large enough complex for the studying the theme of «Electrician» widely enough within the framework of the school program.

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ENGINEERING



The ambivalence of the turbulent flow

Johannes Martin & Bilal Yildirim

Heidehof-Stiftung, Stuttgart, Germany, johannes.f.martin@web.de

1. How it came to be

While playing golf, my friend and I were wondering about the structure on the golf balls. We researched in the web and found out, that these so-called dimples lower the air resistance of the flying golf ball. However, not much is known about the way this works. In my presentation, I will explain the current state of research.

2. The purpose of the investigation

The basic idea was to find out whether or not we could use this structure to lower the air resistance of vehicles.

3. Method of the investigation

To find this out we first had to prove, that the dimples structure on golf balls really lowers their air resistance. It could be an advertising myth, or it could be that this structure only shows its effect under certain conditions that are not given in traffic such as, for example rotation, or fast acceleration. So we had to test the golf balls in a wind channel, where the air velocity stays constant, and where the ball is not rotating. When we had to test a ball of the same size and the same material, but without dimples under the same conditions and then compare the results.

To do that, the Heidehof-Stiftung allowed us to use their wind channel. In the beginning of our measuring, the air velocity of the wind channel was so low, that we could barely differentiate the two curves, so we had to improve the structure of the wind channel. We decided to close the measurement section with acrylic glass, so the whole channel was a closed system, this bumped its maximum speed up to 32 m/s

The closing of the channel also made it possible to measure in a laminar flow.

After finding out that the golf ball structure actually lowers the air resistance we tried to find ways to optimise this effect. We started by researching different forms of dimples and tested the three major types we could find. Usual dimples, a hexagonal network structured one and one that was stamped into the surface.

The stamped one was the best, probably because of its sharp corners.

4. Results of the experiment

We tested a model-Formula 1-car with dimples and found out, that it clearly increases its maximum speed. Now we were wondering if it is possible to draw as a conclusion, that real cars could profit from this discovery. The problem was, that we only tested small objects compared to a car. but still, it is possible to project the results, because the Reynold's number doesn't variate too much.

5. Conclusion

As the energy consumption of fast moving vehicles such as cars, trains or planes is mainly attributed to its air resistance, it would be possible to reduce energy waste. Another effect would be, that cars could drive faster if the air resistance was smaller. Planes could fly farther, and even boats could profit from a dimples structure because water-resistance is basically the same as air resistance, yet the dimples would have to look different. Even rockets could profit from this technology, because very high air-friction happens when they exit or enter our atmosphere.

6. The presentation

In the presentation, I will explain our measuring methods and show our results. I am going to explain the theory, why dimples lower the air resistance and I will elucidate why it is possible to project our results on real size cars.

7. Sources

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<http://www.crunchgear.com>

Blue Energy:

The influence of flow rate on the net energy production of a reversed electro dialysis stack with varying spacer thicknesses

Pascal Pieters, Bernard Smilde

Christelijk Gymnasium Beyers Naudé, Leeuwarden, The Netherlands, pascalaldo@gmail.com, bernardsmilde@gmail.com

1 Introduction

Recent studies have revealed that global warming is speeding up and fossil fuels are running out. The world is in dire need of new energy sources. The more we learn about the environment, the more we realize that we are currently on a course of self-destruction.

Reversed electro dialysis (RED) is a clean, sustainable source of energy with great potential. It uses the difference in salinity between salt and fresh water (sea- and riverwater) to generate energy, hence the more popular name 'Blue Energy'.

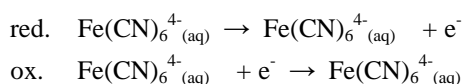
Calculations show that Blue Energy can provide for up to 80 percent of the current world energy demand, if fully efficient and used to its full potential.^[1]

2 Technology

Sea water has a relatively high concentration of ions due to the high amount of salt dissolved in it. If a solution of lower salinity is brought into contact with a solution of higher salinity, the ions in the concentrated solution will diffuse to the diluted solution.

To achieve the production of electricity we let fresh water flow past salt water separated by a series of alternately anion exchange membranes (AEM) and cation exchange membranes (CEM).

By doing so we will achieve that the positively charged particles migrate to one side, and the negatively charged particles to the other. Thus we have created a difference in potential. The following redox-reaction, taking place at the electrodes, will convert this difference in potential to electricity:



3 Our research

Situated between the two membranes lies the main focus of our research: the spacer. The spacer is a gauze that makes sure that the water is evenly distributed across the membranes and that the membranes never touch.

The maximum power output of the Blue Energy stack is given by the following formula:

$$P_{\max} = \frac{(V^o)^2}{4R_{\text{stack}} \cdot A} \quad (1)$$

Thinner spacers will lead to less resistance and more power. They will, however, also require more pump power to pump water through them.

Our research aimed to find the optimal flow rate and spacer thickness that leads to the maximum net output: the output minus the required pump power. To find this optimum we built stacks with 500, 200, 100 and 50 μm spacers and ran water through them at different flow rates. These spacers are thinner than ever before in the research regarding Blue Energy.

4 Results

The research mentioned above led to the results displayed in fig. 1. All results in the research regarding Blue Energy are given in Watts per square meter membrane, because the membrane is by far the most expensive part of the stack and as such the restricting factor.

We can conclude that efficiency increases with thinner spacers, but not infinitely. The 50 μm spacer is clearly less efficient than the 100 μm spacer.

In our research we measured a maximum output of 2,07 W/m^2 . We gladly announce that this is the highest value ever measured in Blue Energy research: a world record.

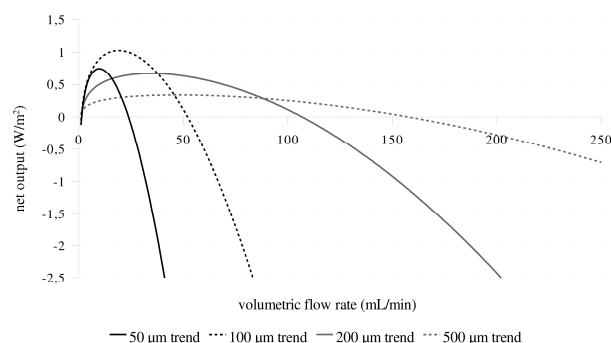


Fig.1 Net output of a RED stack plotted against the volumetric flow rate.

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The Robotic Arm

Floris van Elteren, Rob Tierolff and Patrick Deenen

Jan Tinbergen College, Roosendaal, The Netherlands

florisvanelteren@hotmail.com / verkeerslicht@gmail.com / patrickdeenen@hotmail.com

1 The Purpose

Our purpose was to build a robotic arm and to do research on modern day used techniques. Where possible, we tried to improve on these techniques and to be innovative. Many existing robots are pre-programmed with many mathematically intensive programmes. However, pre-programmed robots leave little room for human interaction. We tried to implement human interaction and be as innovative as we could be. Accordingly, we designed and built a robotic arm which mimics the movements of our own arm. And even more, we also decided to attach an end-effector to our arm, which allows us to pick up objects.

2 Cost Effective Design

We were responsible for all steps in developing our robotic arm. While designing we were constantly reminded of one issue. Because of our limited funds it was necessary for us to incorporate elements into the design of the robotic arm that kept our expenses at a minimum. One of the key design elements which reduced our costs significantly was the addition of counterweights on our robotic arm. If the robot is not holding anything they provide a torque of 0 Nm on the joints. This increased the effectiveness of our servo motors enabling us to use less expensive products. We also simplified the intricate 7 DOF (Degrees of Freedom) human arm to a more practical 3 DOF robotic arm. For the other components we recycled old parts of an inkjet printer, recycled aluminum sheets, inexpensive pieces of wood and a recycled PVC pipe. For input devices we used the readily available Nintendo Wii remote. The total price of the robotic arm amounts to only € 150,-. As this is only a tiny fraction of the price of other robots the price-reducing elements make our robotic arm unique in its league.

3 Processing of movements

This construction, complete with actuators, will naturally not just 'move'. Actuators do not possess such intelligence. We first need information on the movement, and intelligence to process it and send it off to the actuators. We need to acquire 6 acceleration values (two times three axes) from a Wii-controller using Bluetooth wireless. This information is fed into our suitcase-computer – a refurbished and modified office PC. This computer produces two streams of data, one stream controls a device that will open or close the hand with variable power. The other stream controls a device that will signal the servos their new positions. We would like to point out that the actuator for the hand is refurbished, and the control-device is

completely self-designed and constructed. The software running on the barely-300 watt computer is also mainly self-designed and written, with the exception for the Wii-controller software library. It is called ChIps and allows the user to design mathematical operations in a graphical, schematic way, and use actual hardware for input and output.

4 The Result

After combining many aspects of science, such as mechanics, electronics and programming, we succeeded in making our robotic arm which mimics the movements of a human arm. We had many different models and using the program called 'Wings 3D' we could easily make a 3D sketch. We chose the best one and started building, where after we run into problems and had to adjust our model again. Especially the end-effector is a complex construction. After finishing the construction we still encountered many difficulties in making the arm move. These involved the electronics and the software we used. Ultimately, we overcame every difficulty and could finally make our arm move very suitably using our own arm as its controller.

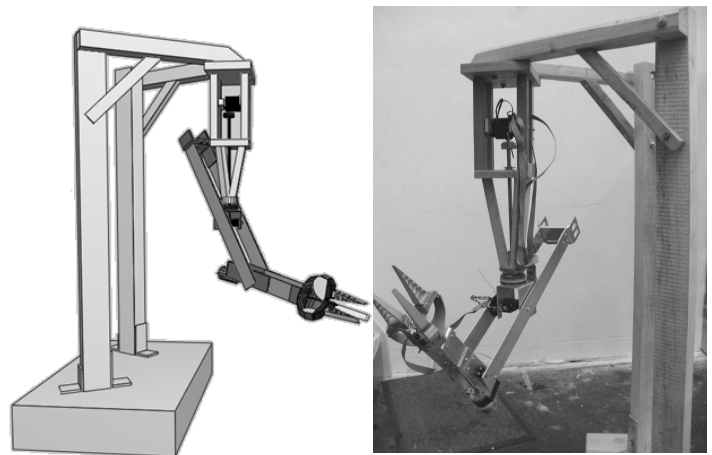


Fig.1 Our robotic arm

On the left-hand side the 3D model made in 'Wings', compared –on the right hand side- to the real robotic arm we built

We would like to stress that this document or our presentation is not, and will not be a replacement for the actual arm. It will merely provide some theory and the reasoning behind the choices we have made and the subject we are dealing with. Stated thus, this document is only supplementary to the robotic arm and we would like to dissuade anyone from assessing our project without having seen the actual robotic arm at work. We recommend watching a short video of our robotic arm, which can be found on the internet: www.tinyurl.com/ICYS-Robot

Control of the airflow by a vortex cavity

Mateusz Górecki

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 Purpose

The aviation industry is developing quickly nowadays. Better and more economical technologies are needed. As a prospective pilot, I know the problems of general aviation these days. Every pilot of a small and light aircraft wants to fly safer and more efficient machines. So I decided to investigate a new way of improving performance of aircraft. There are many types of improvements. In my opinion, the best one for general aviation is the vortex cavity. It is a promising way of reducing the take off speed.

2 Method of the investigation

My research is based on measurements of aerodynamic forces of an airfoil (a cross section of a wing). I have constructed several different airfoils and carried out experiments for each of them for many angles of attack. After investigating all of them I selected only one which was the most appropriate for my flying model. My goal was to maximize the lift while keeping the drag of the wing as small as possible. The performance of a wing depends on many factors, for example symmetry of the airfoil. To optimize the flight of my aircraft, I was investigating these factors and constantly adding some improvements.

In the second part of my research I designed airfoils with vortex cavities. I used three simplest types of cavities which are presented below.

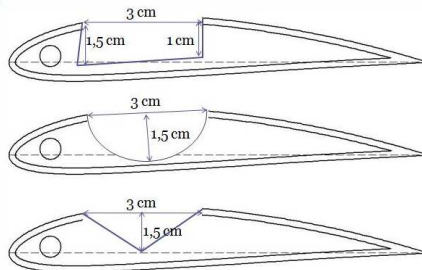


Fig. 1 Airfoil with cavity (square, circular, triangle)

The location of the vortex cavity is determined by the separation of the airflow. For high angle of attack the airflow separates from the wings surface. The cavities help the air to stay in touch with the surface.

Finally, I have constructed a flying model. I decided that it should be a glider because it is light and can be easily transported to the Conference. I conducted the experiment in a wind tunnel of my construction.

Although there are many theories modeling the behavior of a wing, none of them allows us to create a mathematical model that describes the reality accurately enough. To construct an efficiently working wing, engineers need to use wind tunnels. Therefore, the investigation of wings (airfoils) generated by a computer program in aerodynamic tunnel is main part of my work.



Fig. 2 Wind tunnel

3 Results of the experiment

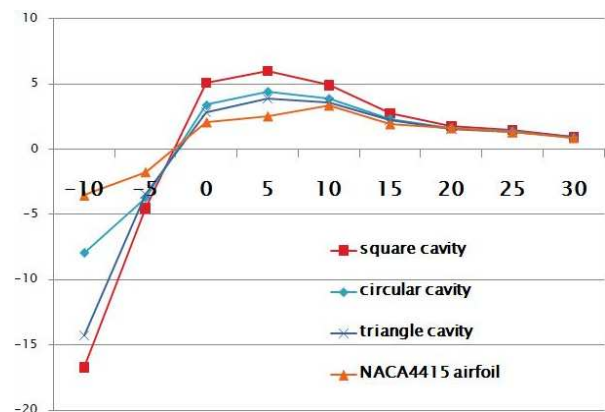


Fig. 3 Efficiency of wings

4 Conclusion

- A wing shows the highest efficiency when the angle of attack is between **5-10 degrees** of angle of attack which is typical for most aircrafts,
- the best wing for my aircraft is the wing with the modified **NACA4415 airfoil**,
- the wing with the **square cavity** turned out to be the best one from the set of wings I investigated,
- **vortex cavities** enable aircraft to fly with lower speeds and fly at higher angles of attack,

Title: «Hybrid Electric Motor Vehicle for Countryside»
(Engineering)

Avramenko Alexandr

Zhitomiryan Ecological Lyceum №24
Zhitomir, Ukraine

Abstract

The problem of environment-friendly, convenient, individual vehicle is particularly acute in rural areas. Leading scientists, designers, material scientists are involving to solve this problem. Understanding the perspectives of this type of transport, the most famous automobile concerns are investing in their development of millions of dollars annually: Renault, Nissan, General Motors, Mitsubishi, BYD, and others. My purpose is to offer an environmentally friendly vehicle that enables you to partially solve the problem of communication in rural areas.

Theoretical part

Solving tasks, including: examining the evolution of electric vehicles, we analyzed and systematized the main types of modern electric cars and battery power for them, described their advantages and disadvantages. Also in the filed study we investigated the possibility of using nanotechnology and nanomaterials in the modern automotive and offered my own concept of a combined electric motor vehicle for countryside, thereby I attained the aim of the work.

Results

Produced a model of combined vehicle Eco-Grig according to own sketches and drawings. (Appendix 4. Photo 7.1-7.3). Corps was cut out of foam and glass fibre and then glued. Wings and all other parts are made of polystyrene with further processing. The model has two main and one auxiliary buffer wheel. Two micro motors installed at the ends of the wings and the battery power capacity 3V or 6V. In the cabin there are two seats for pilot and remote control apparatus, batteries. Wings can be made up for easy storage.

Discussion

Speech at the Forum MAN (Junior Academy of Sciences) 21-23.12.2010 (Kiev)
School-aged pupils Conference of members of MAN 01/19/2011 (Zhitomir)

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ENVIRONMENTAL SCIENCES

ABSTRACT

Pesticides are substances used to attract, repel and kill insects, and their discovery, toxicological evaluation and environmental impact a broad topic of research and have been developed in the last decades. New substances are necessary for effective pest control, offer greater safety, biodegradability, economic feasibility, applicability and low environmental impact. Plant extracts have been used by man since old age, a practice that persists to Today, with more than two thousand species of plants known for their insecticidal properties. For this work it is proposed to use of an insecticide to the base of the plant extract spearmint (*Mentha arvensis*) and Basil (*Ocimum basilicum*), an alternative with low cost and that does not harm the environment, or health of plants and people that make the management. To obtain the extract was acquired from the high green leaves, processing them in a blender with water. Soon after united the two and so gets the insecticide, which was chemically characterized through chemical reactions. For the test of extracts were used four plants with a high rate of insects; respectively Strawberry (*Fragaria vesca*), Raffia Palm (*Raphis excelsa*), Tomato (*Lycopersicon esculentum*) and lettuce (*Lactuca sativa*). After forty-eight hours, was found to decrease the insect without that plants suffer changes in their structural aspects, vital and biological. The insecticide to the base of Spearmint and Basil proved true, considering the reduction in the level of insect plants test.

Keywords: INSECTICIDE, EXTRACT, PLANTS

ALTERNATIVE METHOD OF WATER PURIFICATION

Bianca Cruz de Moura – biancacmoura@hotmail.com

Laís Oliveira Moura – Laís.mouraa@hotmail.com

Paula Andressa Bezerra Rodrigues – paula_andressaa@hotmail.com

Walber Santos Herênio – walberherenio@hotmail.com

ABSTRACT

The potable water of good quality is basic condition for human health and welfare. However, most of the world's population still lacks access to this essential property. In the most part of poor population there a precarious availability and many times drink water scarcity, causing serious diseases and many times irreversible, like the innutrition, diarrhea and/or until de dead of some individuals. So, is necessary a production of an alternative method for the effective water purification using discarded materials. To realize this work, proposes the creation of an alternative water purifier, using those discarded materials: CDs, DVDs, cardboard boxes and plastic bottles. A low alternative cost that offers selectivity, low environmental impact and effectiveness water purification. The construction of an alternative purifier system was made by manufacture of these materials and the storage of 500ml of contaminated water with bacteria in the purifier. After six hours, the water collected was analyzed by laboratory, having your effectiveness proven in the microbiological purification, making the water potable.

KEYWORDS: WATER - SYSTEM OF PURIFICATION - MANUFACTURE

ABSTRACT

Nowadays, petroleum is the most important energy source, and the grand part is extracted from the deep ocean. Some accidents can happen during the extraction and transport, causing terrible consequences. Petroleum is a mixture of hydrocarbons and it causes a dangerous environmental pollution. When the petroleum is on the water, it forms a film in the surface that blocks the aeration and the lightning of the water. In addition to this, the petroleum has toxic substances. The degradation of oil occurs naturally, but very slowly. The project aims to isolate a micro-organism with potential to degradate the petroleum and to find a method to accelerate the biodegradation of crude oil on water. For that, it was done a screening of micro-organisms in the soil and isolated a yeast that interacted with petroleum. The test for checking the power of the biodegradation of micro-organism was carried out with three studies groups: G1-control (only petroleum), G2-experimental group (with addition of petroleum and micro-organisms) and G3-experimental group (with addition of petroleum, micro-organisms and nutrients). The groups were incubated in a shaker at 28°C with constant stirring along 7 days. The biodegradation was analyzed by the variation of molecular weight of hydrocarbons chains by thin layer chromatography (TLC), with aliquots removed in the days of test 3 and 5, and by infrared spectroscopy, with aliquot from the last analyze day. The results indicated that the yeast showed potential to biodegrade oil through the development of compounds with molecular weights lighter than those present in the control group, especially in the study group with addition of nutrients as shown by chromatography and spectroscopy. Thus, based in the results, we conclude that it is possible to accelerate the biodegradation of crude oil by the addition of micro-organisms resistant to the medium containing hydrocarbons and optimized by bioestimulation (addition of nutrients).

Keys-words: Biodegradation. Crude oil. Bioestimulation.

Construction of a continuous flow SODIS system with PET bottles integrated to a water and wastewater treatment system.

Karoline Elis Lopes Martins

Centro Federal de Educação Tecnológica de Minas Gerais, Belo Horizonte, BRASIL

Waterborne diseases are common in many Brazilian regions where basic sanitation, including potable water supply, are lacking. This is especially evident in rural communities, where alternative, often precarious; water and wastewater technologies are the only available solution for sanitation. My main goal was to design and build a Solar Disinfection (SODIS) system with PET bottles connected for continuous flow and water treatment. The SODIS is also connected to other sanitation technologies, including biosand filters, stabilization ponds and wetlands, to provide an integrated water and wastewater solution that could be applied to small rural communities. I tested the hypothesis that a continuous flow SODIS is capable of heating the water to temperatures above 50°C for 2 hours, which is enough to eliminate thermo-sensitive bacteria such as Coliforms and E. Coli. Methods include mathematical simulation of the continuous flow using a time discretized, finite difference approach to propagate the flow from one bottle to the next. The simulated flow was then used to determine the number of bottles necessary to provide the minimum water detention time to allow temperatures reach over 50°C for a period of 2 hours. The solar concentrator's shape was defined based on a composite parabolic curve. The connected bottles were tested for water tightness and performed well. Based on a 6hr/day sun exposure, 144 bottles and 72 solar concentrators were necessary to disinfect 140.69 liters of water. The SODIS tested demonstrated potential for application combined to other sanitation technologies, resulting in a low cost, yet robust solution for sanitation. Further research is required for larger scale field testing.

Allium test - The impact of the aqueous tobacco extracts of different concentrations (from classic and light cigarettes) on the growth and mitotic activity of the cells of onion bulb roots

Viktorija Belobrajdić, Mirta Stantić

XV. gimnazija, Zagreb, Croatia

1. Introduction

Allium test, as a standard test in environmental monitoring, is based on an examination of growth inhibition and mitotic ability of the onion bulb roots (*Allium cepa*) after exposure to the toxic substances [3, 4]. Toxic substances in this experiment are aqueous tobacco extract which differ in mass concentrations (0.05 g/mL, 0.025 g/mL, 0.017 g/mL, 0.005 g/mL). The impact of aqueous tobacco extracts on the meristem tissue of the onion bulb roots is estimated by the length of roots and the mitotic index [1, 3].

2. Methods and materials

Onion bulbs were prepared for exposure to the toxic solutions [2, 3]. Six sets of experiments were carried out: three with the aqueous tobacco extracts of classic Marlboro and the other three with the aqueous tobacco extracts of light Marlboro. In each set, four different mass concentrations of aqueous tobacco extract (0.05 g/mL, 0.025 g/mL, 0.017 g/mL, 0.005 g/mL) and tap water as negative control were tested [3]. Also, three test samples were used for each mass concentration. Bulbs were exposed to toxic solutions for 96 hours. The lengths of the onion roots were measured after 48 and 72 hours [3]. After 72 hour exposure period, one or two out of the three onion bulbs from each conc. of the toxic solutions were placed in tap water for another 24 hours. In this way, the regeneration ability of the onion bulbs were investigated [3] Cytogenetic analysis of the onion root cells resulted in the calculation of the mitotic index for each tested solution [2, 4].

3. Results

The degree of toxicity of the aqueous tobacco extracts were estimated by measuring the onion root lengths. (Table 1).

Test sample mass conc. (g/mL)	Length of the exposure (h)	The average root length (mm)	
		CLASSIC	LIGHT
0 (water)	96	15.35	16.58
0.05	96	1.38	1.17
Recovery	72 a.e. + 24 w.	2.75	2.54
0.025	96	2.25	1.95
Recovery	72 a.e. + 24 w.	3.75	2.42
0.017	96	2.70	2.94
Recovery	72 a.e. + 24 w.	5.25	5.05
0.005	96	4.40	5.38
Recovery	72 a.e. + 24 w.	7.38	8.20

Table 1 The average root lengths in two type of cigarettes (a.e. – aqueous extract, w. – water)

Mitotic index = No. of cells undergoing mitosis / total number of cells (Table 2) [1, 2].

Mass conc. of the sample solution (g/mL)	Mitotic index (%)
0 (water)	11.39
0.05 (classic)	5.40
Recovery 0.05 (classic)	5.96
0.05 (light)	2.71
Recovery 0.05 (light)	8.96
0.025 (classic)	5.40
Recovery 0.025 (classic)	10.19
0.025 (light)	6.96
Recovery 0.025 (light)	7.94
0.005 (classic)	7.39
Recovery 0.005 (classic)	7.36
0.005 (light)	6.52
Recovery 0.005 (light)	11.71

Table 2 Mitotic index

4. Conclusion

Based on the conducted morphological and cytogenetic analysis it is concluded that aqueous tobacco extracts from classic and light cigarettes cause:

- 1) Inhibition of root growth [3]
- 2) Morphological changes – formation of hooks and spiral roots [3]
- 3) Decrease in the mitotic index [1, 2]
- 4) Increase in the number of chromosome anomalies in toxic samples (chromosome bridges, micronucleus) [1, 2]

References

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- [4] G. Fiskesjoe, „The Allium test as a standard in environmental monitoring“, Hereditas 102, 1985, 99-112 pp.

Don't make a 'dump' out of the forest!

Eliška Bendáková, Lucie Térová, Lenka Šimonová

The First Private Grammar School, HradecKrálové, simonova.lenka@psjg.cz

1 The purpose of the investigation

This project is focused on improving the condition of the forest in Roudnička by eliminating the illegal 'dump', or a landfill site. The main aim was to chart the vegetation of given habitat and to compare the vegetation of the landfill site with the rest of the forest, with the natural environment of vegetation. The secondary aim was to raise an awareness about the problem to fellow citizens and to propose an alternative for the disposal of Organic waste which would prevent further landfill and pollution.

2 Method of the investigation

Within this project we decided to find out, if the organic dump dramatically changed the plant structure and degraded the local habitat or not. Another interest of ours was to discover if the creation of the landfill site has been stimulated by insufficient usage of organic containers or not.

First of all we asked permission the forest owner to allow us to carry out our experiment on his property. Then we made a chart of the forest's vegetation and defined the expansive and invasive species and their bad influence on given habitat. In the spring we made a survey among the citizens of Roudnička and then, as a final part of the project, we organized a number of volunteers to clear the landfill site and enhance the forest by planting more trees.

3 Results of the experiment

We discovered that in the given habitat, there were both expansive as well as invasive species in such an amount that they strongly degraded and changed the forest. The invasive species '*Rubus fruticosus*' (Common Blackberry) was forming almost $\frac{3}{4}$ of the territory of the vegetation in the area where our experiment took place. The other spreading species which occurred near the landfill site were '*Quercus*

rubra' (Northern Red Oak) or '*Impatiens parviflora*' (Small Balsa).

4 Conclusions

Thanks to our experiment both parts of our hypothesis were confirmed to be true. Furthermore, as we have completed the ecosystem analysis, we proved that the existence of the local landfill site affected the vegetation and therefore it was harmful to the forest.

According to our survey, the second part of the hypothesis was also confirmed correct. The citizens of Roudnička were using the landfill site because they did not know about the existence of containers for Organic Waste.

5 References

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- [2] **Kubát, Karel, et al.** *Klíč k úplné květeně České republiky*. Praha : Academia, 2002.
- [3] **Chytrý, Milan.** Metody fytoecologie. [Online] 2007. [Cited: Listopad 20, 2010.] <http://www.sci.muni.cz/botany/chytry/metfytoc/>.
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Ecotoxicology of shampoos

Martina Brožová, Zuzana Ezrová

First private language grammar school Hradec Králové, Czech Republic, brozova.martina@psjg.cz

1. Content

1.1. Purpose of the investigation

This project is intended to examine the toxicity of chosen spectra of shampoos.

1.2. Method of the investigation

We used white mustard on the tests of toxicity, which were examined via growth inhibition of roots. The aim of this experiment was to determine NOEC, the highest concentration of tested samples that does not significantly influence growth inhibition compared to a control sample (inhibition must not be higher than 30%) [1, 2].

1.3. Progress of the experiment

These shampoos: Gliss Kur, Pantene Pro-V, Palmolive natural shampoo, L'Oréal Paris Elsève, Garnier Fructis, Avon advance techniques, Oriflame HairX pure balance, Bentley organic shampoo, Tesco březový šampón, Schwarzkopf professional bonacure were chosen.

Each tested shampoo was diluted by pond water to achieve solution with basic concentrations - 10 000 mg/l, 5 000 mg/l, 1 000 mg/l, 500 mg/l and 100 mg/l. For the duration of 72 hours, 30 seeds were cultivated with constant temperature of 25°C in Petri dishes with filter papers soaked in the tested concentration of shampoo. Similarly was also prepared the control sample with the pond water only, without any shampoo. The measurements of the lengths of sprouted roots began after 72 hours, the results were noted and the inhibition was counted in comparison with the control sample.

1.4. Results of the experiment

Shampoo	The highest concentration that does not cause growth inhibition higher than 30%	Growth inhibition
Palmolive	All concentrations were toxic	-
Elsève	1%	3,4%
Birch shampoo	1%	6,9%
Gliss Kur	5%	6,9%
Schwarzkopf	5%	27,6%

Pantene	5%	20,7%
Oriflame	5%	- 13,8%
Avon	5%	0,0%
Garnier Fructis	5%	10,3%
Bentley Organic	50%	24,1%

Table 1 The highest concentration of tested shampoos that does not cause growth inhibition higher than 30%

2. Conclusion

The results of the experiment proved that the highest concentration, which does not reach more than 30% of inhibition, achieved Bentley Organic Shampoo with its 50% concentration. Less than 30% inhibition achieved just 5% concentrations of other shampoos. The worst results were detected with Palmolive shampoo. All its concentrations had higher inhibition than defined 30%.

References

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NAVIGATION OF THE VIKINGS

Bettina Stegmaier

Kreisgymnasium Riedlingen, Germany; bettinastegmaier@yahoo.de

1 Introduction

Vikings are generally known as bellicose adventurers, yet they are more! Christopher Columbus discovered America or did he? The Vikings arrived there 400 years earlier. They must have been great navigators and probably possessed certain navigational aids, but which ones?

Vikings didn't know about a magnetic compass, nor did they use maps or nautical charts. Instead they had an unimaginable amount of experience passed on over generations and – according to an archeological find – the “sun compass”. However this aid could be of no use when the sky was overcast. Under such conditions Vikings are considered to have used a “sunstone”, a crystal with polarising properties. Holding it against the sky (skylight is polarised) and rotating it, you have to look for the darkest position or for a certain colour - depending on the crystal you use. The optical axes points at the sun now.

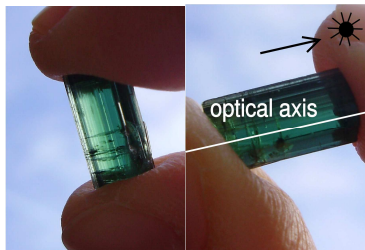


Fig.1 determining the location of the sun by rotating a sunstone (tourmaline) against the sky

The purpose of the investigation

The validity of this hypothesis is controversial and has never been properly examined and that's what I wanted to begin with my investigations. Is it possible to find out the location of the sun with the help of a polarising crystal? What conditions are necessary for it? How accurate would this kind of navigation eventually be? Does it suffice as a possible explanation for the voyages of Vikings?

2 Experiments

For my experiments I decided to use a tourmaline as a sunstone, because it's one of the crystals where the optical axis coincides with the natural striae. Before I started with the proper experiments I had a setup to analyse my tourmaline (2x1x0.5cm), a dichroite changing intensity and colour (yellow-green to blue-green) while being rotated in

polarised light. Basically the same, I measured the degree of polarization of the sky, divided grid-like.

As the aim of my investigations was to examine the accuracy of my tourmaline as a navigational aid for the Vikings under several weather conditions, I didn't try to create a scientific setup for my experiments but matched the methods with theirs. Therefore I just scanned the sky with the crystal, noted date, time, the weather situation, the determined position of the sun (azimuth and altitude) by means of a compass and downloaded a weather chart which provided extra information about clouds and air humidity. In the end, the measured position of the sun was compared with the real one.

3 Results

The average of my azimuth deviation is approximately 7.4°, that of the altitude 2.3°. Examining the connection between weather and accuracy of my measurements, I could find several dependencies. The location determination of the sun is e.g. exacter if it's only partly cloudy or if there are at least tiny spots of sky visible through the cloud cover.

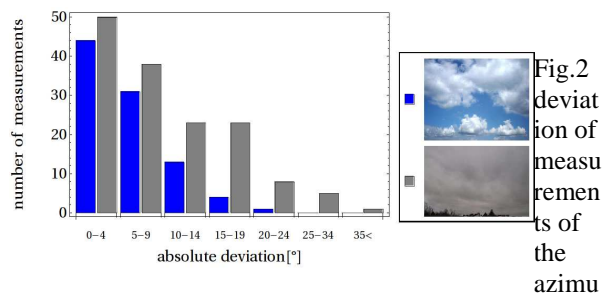


Fig.2 deviation of measurements of the azimuth

depending on the weather (partly cloudy or absolutely overcast)

5 Conclusion

It is difficult to assess how helpful sunstones were to Vikings as we know so little about their way to navigate in general. Though this method is not really accurate for today's standard it can be seen as a real help to hold the course during overcast days and weeks at the time of the Vikings!

References

- [1] <http://rspa.royalsocietypublishing.org/content/463/2080/1081.full.pdf>
- [2] Praxis der Naturwissenschaften, Physik in der Schule, Aulis Verlag Deubner, Köln/Leipzig, 2007, 56. Jahrgang, S.33-38

Hydrogen-Oxygen-Accumulator made of charcoal

Jakob Rosenbauer

Kepler Seminar Stuttgart, Germany, Jakob.Rosenbauer@arcor.de

1. Introduction

Most of the accumulators, which have been developed in the last decades and are used in industry, consist of rare and dangerous metals like lithium and cadmium. So they're very expensive and poisonous. Current systems with fuel cells are also very expensive and difficult to produce.

I found a way, to build an accumulator, which consists just of charcoal a liquid and some cloth. It's easy to build and the material is cheap. A disadvantage is that the amount of the stored energy is slightly humble.

2. Description

1.1. Construction of the battery

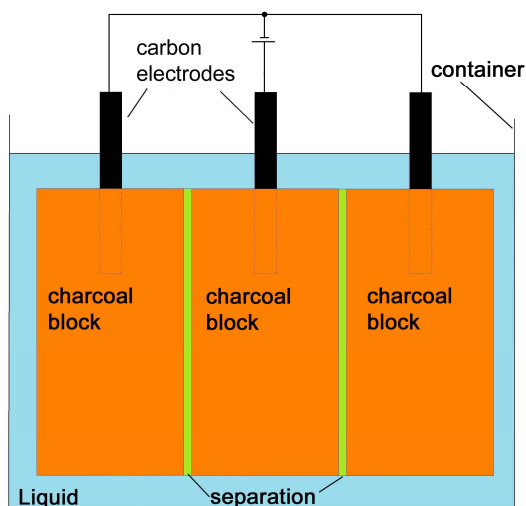


Fig.1 Sketch of the battery while loading

The battery mainly consists of three blocks of charcoal, which are divided by a separation of cloth, so they don't touch. These are stored in a liquid, in our case lye. Each block has a connection for the power supply, which is made of carbon electrodes. I didn't want to use metal, to minimize corrosion caused by the electricity.

1.2. Method

When the electrodes are connected with a voltage supply electrolysis starts and the liquid gets split up into gases. In the experiments I made sure that only hydrogen and oxygen were produced. These gases center in the porous structure of the charcoal blocks.

After disconnecting the power supply, there is a voltage between the inner block and the outward blocks. This voltage can be used to operate a motor or a small light bulb.

The voltage is evoked, because the battery works like a fuel cell.

In one block the oxygen is stored in the two other blocks the hydrogen is stored. To set free the energy which is stored in the gases, they have to combine to H_2O . To afford combination they need to have contact but the separation, which divides them can only be passed by protons and not by electrons. The hydrogen gets ionized so the protons pass the separation. To complete the H_2O the electrons are needed, but they can't pass the separation, so the electrons flow through the appliance and cause a current, which can be used to drive the appliance and make it work.

3. Research

In the research it was my aim to get to know under which conditions the charcoal battery had the best efficiency and would store the maximum amount of energy and I wanted to find out the theoretical background.

To discover the efficiency of the battery I had to quantify the amount of energy which was put in during charging and the amount of energy which is released while discharging. Both are electric energies, which can easily be measured. To get the values, I connected the measurement instruments with the computer and recorded a measurement reading of voltage and current every second. So I could calculate the energy.

In order to find out, under which conditions the battery worked best, always one parameter was changed. The first thing to change was the liquid in which the battery is stored. To get split up, the liquid has to be conductive. So it has to contain ions. There are three kinds of liquids, which fulfill these conditions, acid, lye or saline solution. I did experiments with each liquid, I used caustic soda (NaOH) for lye, sulfuric acid (H_2SO_4) for an acid and sodium sulfate (Na_2SO_4) and measured the efficiency and the stored energy which each of them.

Another thing to change was the voltage which was varied between 0,9V-3V.

4. Results

All in all, it became apparent that the battery worked best with sodium hydroxide. Using saline and acid wasn't successful. By variegating the test set-up I could reach a maximum efficiency of 13 %. By storing the battery in the lye, all materials got in very good contact, which helped to improve the results. The battery can store 50 J or 20 mAh which is, taken the ratio of the size and the weight not really much, comparing it with conventional batteries. But after all, the costs are very low and if this technique would be developed further the results would definitely improve.

[1] A. Vezzini, "Elektrofahrzeuge" Physik in unserer Zeit 1/2010(41.), 31-42

Sweet water contamination

Stefan Futterknecht, Sonja Futterknecht, Carina Lämmle

Students Research Center, Germany, stefan.fu@gmx.net

1 Introduction

Sweet - sweeter - sweetener. In view of the increasing popularity of the substitute sweetener stevia, we made our thoughts on the use of synthetic sweeteners. Some of them are discussed controversially. In many countries cyclamate for example is approved as food additive, other countries, including the USA, did not approve cyclamate due to safety concerns. In addition, we learned from literature that several sweeteners escape the waste water treatment and are even detectable in our purified drinking water. Therefore, we intended to develop a method to separate the sweetener from the drinking water.

2 Preparatory work

First, we gave our thoughts to the selection of a suitable sweetener. An important criterion for the selection was a high chemical stability, because we wanted to examine a sweetener that occurs in the drinking water. Finally, we came upon the sweetener cyclamate. It is 35 times sweeter than table sugar and cyclamate is often used to replace sugar in beverages and foods. In addition, this sweetener is heat resistant and chemically stable. The fact that the degradation product of cyclamate is toxic motivated us even more to develop a method by which we can remove the sweetener from drinking water.

2.1 Demonstrating cyclamate

Before doing experiments to isolate cyclamate from drinking water, we first had to find a method to detect cyclamate. First we tried TLC to detect cyclamate; however, we failed with several different attempts to derivatize cyclamate. With the mass spectrometer, we detected cyclamate using single ion recording scan (SIR):

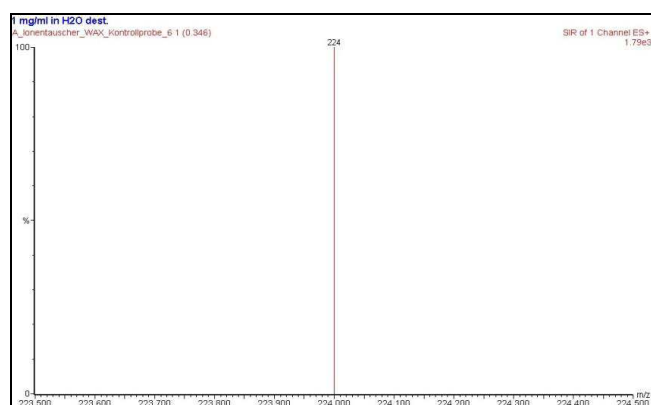


Fig.1 SIR of cyclamate

3 Bacterial degradation tests

When we demonstrated cyclamate, we initially decided to do bacterial degradation tests since we have chosen the artificial sweetener cyclamate which can be reduced in part by the bacteria of few people to cyclohexylamine which is toxic. We opted for a mixture of bacteria that we had isolated from soil to determine whether the cyclamate is degraded in nature. Before we were able to analyze our gained samples, we first had to prepare the samples for the mass spectrometer.

3.1 Preparation of the samples

From literature [1] we knew that cyclamate can be extracted by a weak anion exchanger, so we prepared the samples using this ion exchanger. The ion exchanger binds the strongly acidic cyclamate, which then can be eluted into methanol resp. ammonia.

4 Using the ion exchanger to isolate cyclamate from drinking water

Having used the ion exchanger during the preparation of the samples to transfer cyclamate into other liquids, we saw the possibility to use the ion exchanger to remove cyclamate from drinking water. In our experiments we tried to clear drinking water from cyclamate using a weak anion exchanger.

5 Conclusion

All in all we can say that cyclamate is chemically stable. It is difficult to detect cyclamate and we failed with a method for cyclamate using TLC. With the mass spectrometry, we were able to detect cyclamate. Using a weak anion exchanger, we found a method to extract cyclamate from the drinking water.

References

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The effect of environmental stress on Tetrahymena pyriformis

Yuanzhe Deng, yuanzhe_deng@yahoo.de

***In den Gärtlesäckern 44
70771 Leinfelden - Echterdingen
Germany***

Motivation:

In today's world environmental problems become a big issue. Due to the gigantic human consumption of synthetic substances, the environment is affected by many stresses, e.g. radioactive waste, greenhouse gases, toxic chemicals... If we want to know how we can save our environment, we first have to realize how the stresses affect the environment.

Problem statement:

Surplus fertilizer gets into the water because of leaching. This leads to eutrophication and it will cause a negative impact on the aquatic animals.

But how do fertilizers affect organisms directly, i.e. when they come in contact with each other?

Another issue is the rising CO₂ level caused by burning fossil fuels. Because of the rising CO₂ level in the atmosphere, the CO₂ level in the water will rise, too. So how does the rising CO₂ level in the water affect organisms?

Method:

The free living freshwater ciliate protozoan *Tetrahymena pyriformis* serves as model organism.

The advantage of *Tetrahymena pyriformis* is that we can easily see the damage on their mobility and appearance under an optical microscope [1].

So the *Tetrahymena pyriformis* were brought into contact with a solution of ammonium nitrate, ammonium chloride, potassium nitrate or a solution with a high level of CO₂ and we observed them under an optical microscope.

Results:

The experiments with ammonium nitrate, ammonium chloride and potassium nitrate has shown that fertilizer do affect the protozoon negatively. The rate of damage of the *Tetrahymena pyriformis* depends on the concentration of the solution. If the concentrations rise, the damage will rise, too.

The experiments with CO₂ have shown that CO₂ – at least in a short period of time - do not affect the protozoon. There was no noticeable damage at all. But although we haven't seen any influences we can not exclude damage after a longer period of time.

References:

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What effects does the red sludge have on rivers?

Csaba Kirckeszner

Vak Bottyán Secondary Grammar School, Paks, vizvizsgalat@citromail.hu

1 Introduction

The Hungarian Prime Minister reported on 4th October 2010 that a million cubic metres of the red sludge spilled from a reservoir at an alumina plant in Ajka. The researchers described the spill as one of the top three environmental disasters in Europe in the last 30 years. Tests were carried out for two potential hazards: a powerful alkaline solution and heavy metals (e.g. iron-oxide, titanium-oxide, silicon-dioxide).

Aluminium is produced in two steps in Hungary: Bayer's manufacture of the alumina and the Hall-Heroult's electrolysis. The red sludge and the NaAlO₂-solution are formed at the alkaline digestion of bauxite. The red sludge is treated as the byproduct of the procedure. The prepared alumina is electrolysed between two indifferent graphite-electrodes.

2 The purpose of the investigation

I have specialized in researching water quality and environmental analytics since 2006. I have already analysed the water quality of the River Danube. I have also investigated how the Nuclear Power Plant influences the water quality. In 2008 I set up a new type of water analytical monitoring system. This red sludge catastrophe provided an opportunity for me to try out my monitoring system in the case of important water pollution. I have been looking for the answers to the following questions:

- i. How can the trophic intensity of surface waters be determined quickly and accurately?
- ii. How does the red sludge have an effect on the rivers?
- iii. How can heavy metals be separated with the thin-layer chromatography out of surface waters?

3 Method of the investigation

I have pointed out eleven points of sampling. I have taken the sample with manual methods. I have made the on-sight examinations, so that I have got an advance diagnosis about the water quality. I have measured the pH-level, the dissolved oxygen, the oxygen saturation, the conductivity and the total dissolved salt. I have analyzed

the concentration of the total iron with a portable photometer on the spot.

In the lab I have analyzed the concentration of chemical oxygen demand, free ammonia, ammonium-, nitrite-, nitrate- and ortho-phosphate-ion. I have measured most of the chemical parameters with a UV/VIS (ultraviolet – visible) photometer. The principle of photometry is described by Lambert – Beer – law:

$$A = -\lg \frac{I_r}{I_0} = -\lg T = a \cdot l \cdot c = \varepsilon \cdot l \cdot c$$

Some of the heavy metals were separated with the thin layer chromatography out of the samples. These examinations were made possible by MOL (it is the Hungarian Oil and Gas Company).

4 Results of the experiment

The following table demonstrates the results and the values of water quality. (IV.A. is very polluted water, III.B is bearable and II.A is good water quality).

Code	Name of the River	Average water quality index	Water quality
M01	Marcal	5.2	IV.A.
K02	Marcal	6.4	III.B.
R04	Rába	8.2	II.B.
GY04	Danube	7.7	III.A.
GO05	Danube	8.3	II.B.
NY06	Danube	8.5	II.A.
BP07	Danube	8.6	II.A.
E07	Danube	8.6	II.A.
D08	Danube	8.7	II.A.
DF09	Danube	8.4	II.B.
P10	Danube	8.9	II.A.

I set up an advance system. This system can determine the trophic intensity of surface waters quickly, accurately and very simply.

5 References

- [1] Deborah V. Chapman. "Water Quality Assessments", Taylor & Francis Publisher, 1996.
- [2] Jamie Bertran, Richard Balance. "Water Quality Monitoring", Taylor & Francis Publisher, 1996.
- [3] Nelu Grinberg. "Modern Thin-Layer Chromatography", CRC Press, 1990.

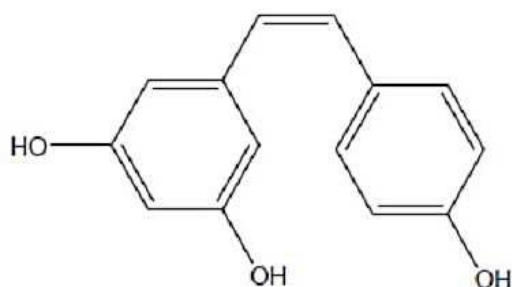
The Mystery of the French paradox

Réka Dobi

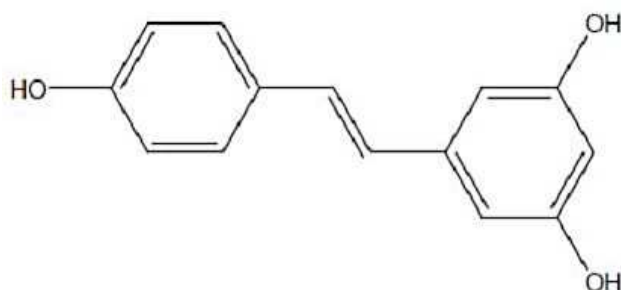
Dobó István Secondary School, Hungary, d.rekus@gmail.com

1 Introduction

The French people who live in wine producing lands and eat a lot of fatty and heavy meals rarely suffer from cardiovascular diseases. The solution of this French paradox is attributed to the beneficial physiological effects of the red wine they drink abundantly. Regarding this unusual phenomenon, the ingredients of wine, namely polyphenols and particularly resveratrol, are worth considering.



Cis-resveratrol



Trans-resveratrol

2 The purpose of the investigation

As I live in Eger, a town in Hungary, which is famous for its excellent wines, I decided to check the changes in resveratrol content of various grape products from grapes to the quality wines that can be found on the shelves of shops. My decision was encouraged by a well-known wine producer too, as he was glad to compare his wine making knowledge with my analytical evidences.

My objective is to discover how the resveratrol content changes in grapes, musts and wines during the wine making process.

3 Method of the investigation

The applied method which I want to refine is only one of the several ones that have already been published. The samples were prepared by solid phase extraction (SPE) the components of the eluent were separated by high performance liquid chromatography (HPLC). The quantitative and the qualitative analyses were performed by mass spectrometry (MS). Sample preparation is one of the crucial points of the whole method. It was my personal research task to find the way to avoid the disturbing influence of the particular matrices of the investigated vegetal fluids on the binding efficacy of resveratrol on SPE sorbent.

4 Results of the experiment

Resveratrol concentration increases during the fermentation process. The ratio of isomers shifts toward the cis isomer within the technological process. In my research it can be clearly seen that due to the wine making technology, red wines contain significantly more resveratrol than white wines.

5 Conclusion

My research work has not been finished yet. It is still going on and I think it is worth continuing it. It can have an additional benefit as well, i.e. it may help revealing frauds. Since resveratrol is a natural product, it cannot be detected in adulterated wines. Fast and cheap analytical procedures may contribute to the revealing of the frauds. My work may be a step in this direction.

Acknowledgment

Many thanks to Dr Károly Vékey for providing the technical environment as well as equipment for my work and to my mentor, Kálmán Újszászy, for his generous help.

Effect of Single Cell Protein Induced Media on the Growth of Abnormal Cells

Hana Ishikawa, Florencia Vanya Vaniara and *Christy Hong*

Santa Laurensia Senior Highschool, Indonesia. www.santa-laurensia.com.

1 Introduction

Stem cell plays a prominent role in improving human's health quality with its ability to regenerate any types of cells, making it a potential for a cure in healing degenerative diseases. On the other hand, stem cells have a low availability and life span due to the need to be cultivated in the highly specialized environment.

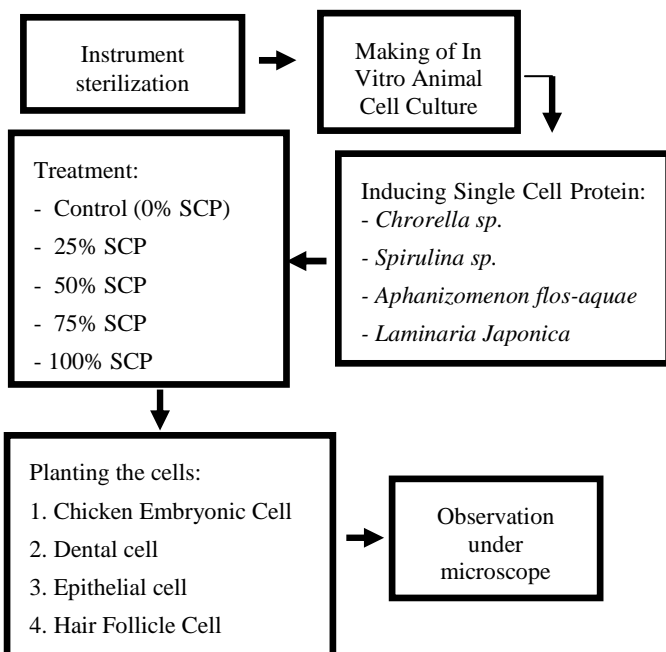
Single Cell Protein (SCP), commonly found in algae, fungi, bacteria, is one of the possible alternatives in providing the nutrients required by all cells in order to continue its growth and multiplication of its numbers. By inducing SCP to the media, the quality and quantity of stem cells will reach the level where it's available for medical treatments, especially in curing degenerative diseases.

Content

1.1 The purpose of the investigation

The objectives of this research are to investigate the effectiveness of SCP as the catalyst to increase the growth of cells and to determine which of the following SCP works best to enhance the growth of cells.

1.2 Method of the investigation



1.3 Results of the experiment

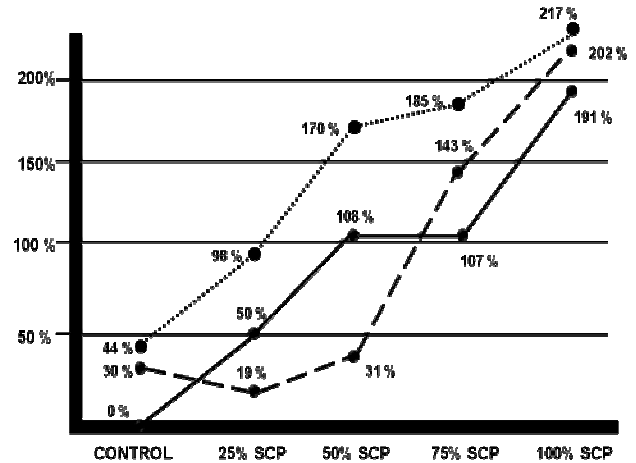


Fig. 1 Percentage increase in 3 types of cells from initial to the final period

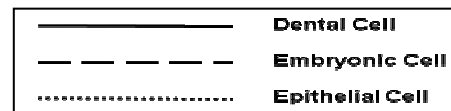


Fig. 2 Information of graph line

This graph represents the percentage increase of cells from initial period to the final. The graph lines for dental cell and embryonic cell represent the actual percentage, however the graph line for epithelial cell is made into 1:5 scale. (ex: 44% = 220%)

3 Conclusion

The conclusion drawn from this research is that adding mixture of SCP in media can increase the growth of cell.

References

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Eco Friendly Paper

Fialdy Josua Pattiradjawane

Chandra Kusuma Junior Highschool, Indonesia. bubble.fialdy@gmail.com

All those people using the paper. Students, workers, and ordinary people, all using paper. These papers are used for various needs, from writing, drawing, reading, and folded, all using paper.

We have chosen to use a banana stem. Because so far, paper is made of pine trees. Because our paper needs increase, many pine trees are felled. Felling pine tree will continue to cause global warming due to deforestation. Banana stem was also thrown away or burned after harvest because of the banana fruit only once. Banana stem are treated like garbage.

We use the banana stems that are old and already fruiting banana fruit. We took the banana tree from our school garden.

This research took time from September to October. We conducted our research at the Chemistry Laboratory of Chandra Kusuma School, Cemara Asri residence.

Thus has been shown that the banana trunks can also be used as material for making paper and to reduce deforestation.

The Making of Banana Hump-based Plastic

Jessica Lo, Seraphine Alarice Mulya

Cita Hati Christian High School

1 Introduction

Along with the development of human civilization, containerization technology has also amended rapidly. Although natural ones are still used, modern containers are preferred because of their variety in shapes, colors, purposes, and most of all in their durability. Among existing container materials, plastic is the most popular one because it is flexible, transparent, less fragile, not corrosive, and relatively cheap. Besides its superiority, it also has some shortcomings, which are not resistant to heat, contaminating (especially to food), and non-biodegradable. The latter seems to make a quite serious problem come to the surface, not only the accumulating plastic waste but also the decreasing of petroleum oil as the primary material to produce conventional plastic.

This research aims to find an alternative to plastic wrappers, one that is biodegradable and non-toxic. Therefore, we use a common biopolymer to make biodegradable plastic, starch, that is much found in tropical vegetation. One of the starch sources that are still rarely used is banana hump. However, the use of 100% starch is not recommended because the plastic acquired will have a low mechanic property because of the fragile film formed. Hence, the utilization of starch should be complemented by animal biopolymer, for instance chitosan. Chitosan can be obtained by deacetylating chitin which is found in several wasted seafood shells. It's expected that its hydrophobic characteristic will increase the quality of the bioplastic obtained. The optimum composition of starch and chitosan was also determined through this research.

2 Content

2.1 The purpose of the investigation

This research aims to find an alternative to plastic wrappers, one that is biodegradable and non-toxic using waste. We use one of the starch sources which is banana hump starch. In Indonesia there are so many banana trees which its hump can be used as starch.

2.2 Method of the investigation

Banana hump was sliced then processed in a juicer in order to obtain the starch-contained juice. The juice was left out

for one night to get the residue which is the starch. The mixture was decanted and the residue was dried under sunlight. The dried residue was then sieved to obtain the homogenous starch powder.

Both the chitosan and the banana hump starch were dissolved in 1% acetic acid, and the solutions were mixed, followed with the addition of glycerol while heating and stirring for about 30 minutes with several variations as shown in table 1.

Chitosan	Banana hump starch
100%	0%
80%	20%
60%	40%
40%	60%
20%	80%
0%	100%

Table 1. The percent composition of chitosan and banana hump starch in the biodegradable plastic.

For every 6 g dry weight of chitosan-starch, 5 ml glycerol was added. The plastic was then made by pouring the blended mixture onto a plastic tray, and was dried on a heater at 80 °C for 4 hours. The plastic formed was then tested for its tensile strength.

2.3 Result of the experiment

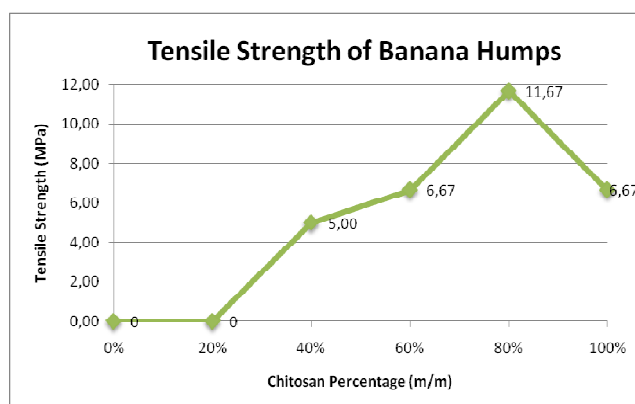


Figure 1 The tensile strength (MPa) of various chitosan-banana hump starch compositions.

Figure 1 indicates that the biodegradable plastic made from composition of chitosan-banana hump starch of 80%-20%

has the highest tensile strength. The water resistancy test reveals that water seeps through the bioplastic film at the rate 0.12 ml/hr since the very beggining. The rate of water loss does not depend on the thickness of the film.

3 Conclusion

From this research, it is obtained that the strongest plastic is reached when it is made from 80% chitosan whose tensile strength is 11.67 MPa. This shows that the optimum tensile strength obtained was not so different from, even higher than the LDPE's, which is 10 MPa, so it's presumed that this bio-plastic may be able to be used as plastic container/tray by making it thicker. The water resistancy test reveals that water seeps through the bioplastic film at the rate 0.12 ml/hr since the very beggining. The rate of water loss does not depend on the thickness of the film.

Although the optimum condition was reached when using 80% chitosan, but this composition is not really recommended because the plastic produced will be very expensive, considering that the production cost of chitosan is very high as well. So, it's concluded that the best solution is to strain the banana hump starch with a larger mesh sieve and also combine it with good quality of chitosan. For any similar research, it is suggested to do the biodegradability testing, for example using *Aspergillus niger*. While for future research, it's suggested to research about the making of edible bio-plastic for wrapping sausages or the making of food cling wrapper.

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Tea Waste : A Novel Metal Muncher

Laksmi Satria, Intan Satria

SMA Negeri 1 Singaraja, Indonesia, info@smansasingaraja.com

1. INTRODUCTION

The mortality case related to the contamination of heavy metal is very hazardous and it does not only affect today's life, but also our great grand children's life in the future, because the effects can't be healed just in time. Actually, there are many ways which have been done by any related institutions, related to this problem, like the use of charcoal flying ashes and activated carbon to vanish the heavy metal. However, this adsorbent has a very expensive cost and it is really hard to be obtained. Related to this and remembering the big potential of Indonesian nature in supporting humanity, there is tea waste, which actually has a high latent potential to reduce the amount of the heavy metal which has contaminated this environment.

2. CONTENT

2.1 Purpose of the Investigation

Heavy metal pollution is not a simple matter. It may affect the whole things in related humanity and its remedy is not as simple as that. If it occurs well, it may save thousands people's life. But if not, those thousands people's life would be in vain, killed by the badly contamination of heavy metal, and so would their generation. The aim of this research is to make sure that this project is compatible enough both to the environment and humanity, assessing the way of its work, and analyzing the procedure and prospect of this project to the real application.

2.2 Method of the Investigation

Experimental and literature study methods are used in this research. A 3x5 matrix is used to determine the experiment sample in each heavy metal solution. There are three heavy metal solutions which are being examined to find the adsorption efficiency, which are $Pb(NO_3)_2$, $Ni(NO_3)_2$, and $Cd(NO_3)_2$. So, there are 15 samples for each heavy metal solution, or in the other word, 45 samples are used in one period of experimenting. The adsorption efficiency for each condition will be expressed by this table.

2.3 Result of the Experiment

The equilibrium state can be determined through experiment. There are different equilibrium states in every conditioned sample, see figure 1. The highest adsorption efficiency has shown by lead, which is being adsorbed by tea waste in powder in 2 hours contact time with 92.85% adsorption efficiency. In nickel, the highest adsorption efficiency has shown by tea powder in 3 hours contact time with 62.85% adsorption efficiency. And the lowest one has shown by cadmium in 3 hours contact time with 49.8%

adsorption efficiency. The adsorption efficiency is determined by contact area, which shown by higher adsorption efficiency by powder tea waste and also determined by the kind of heavy metal which is being reduced.

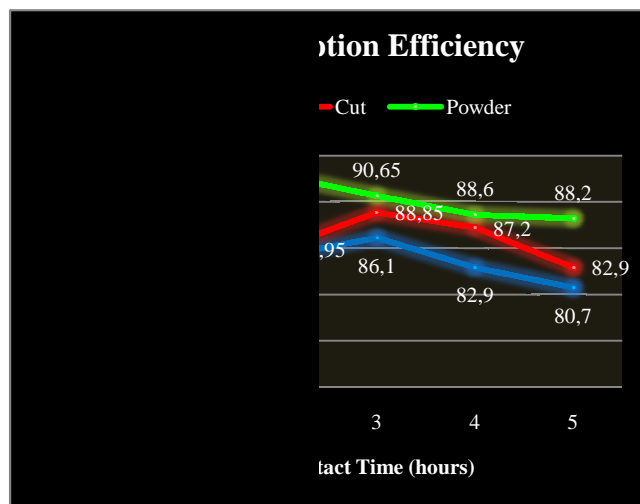


Figure 1 Lead Adsorption Efficiency

3. CONCLUSION

There always be an equilibrium state of everything, included the right combination of the form of the tea waste with the contact time used. This equilibrium state should be given attention related to the application of this project in the future to get the most effective and efficient work. The low obtaining cost, its characteristic of being friendly to the environment and very easy to be obtained in a huge scale also become good prospects to the future to be implemented in the real big case related to the hazardous contamination of heavy metal.

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Tea Leaves as a Natural Preservative

Luthfi Mu'awan, Agung Budi Tri Prasetyo

State Senior High School of Purwareja Klampok, Indonesia, potter.awan@yahoo.com

1 Introduction

Indonesia is an archipelago, and has an abundant production of marine fish. Marine fish is a kind of high nutritious food. But there is a problem on its preservative. Many Indonesian fishermen use formalin as marine fish preservative; however it's really dangerous for human being if it is consumed. So there must be a natural preservative. Tea leaves contain secondary metabolite which can inhibit the growth of several microorganism, so that it can be used as a marine fish natural preservative.

2 Content

2.1 The purpose of the investigation

The main causes of spoilage in fish are the presence of microbial growth, enzyme activity, chemical reactions, and physical degradation. In general, microorganisms take advantage of free amino acids, dipeptide, lactic acid and sugar to grow, and then produces a smaller fraction of compounds such as cadaverine, putreacine, and organic acids. On the other hand, a secondary metabolic compounds produced by plants has been shown to inhibit the growth of microorganisms.

2.2 Method of the investigation

Research method used is experimental method. The experiment is the comparison of tea leaves extract volume and sterile distilled water: A1= 1:2, A2= 1:1, A3= 3:2, A4= 1:0. Each treatment was repeated twice in order to get eight experimental units.

2.3 Results of the experiment

Experimental data show that secondary metabolic compounds that found in tea leaves extract can inhibit the growth of microorganisms, so the fish do not rot. This can be seen from the morphology of the fish that still remain as before treated, and the fish does not smell. The best concentration for preservation of marine fish is 75%. This is because the extract is not too thick, so easily to be absorbed. The mechanism of preservation of marine fish by tea leaves extract is by disrupt the permeability of cell walls and cell membranes of microorganisms, and inhibit the synthesis of nucleic acids.

5 Conclusion

Based on the results of this experiment concluded that tea leaves extract is potentially as a natural preservative, with the best concentration of tea leaves extract for preservation is A3 treatment (concentration 0,534 gram/ml)

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The research of the general chemical toxicity of the environment by the biotesting method of snow.

Kaminskaja Violeta , Marija Drozd
School of a name of F. Skoriny of the City of Vilnius

1. Introduction

2. Content

2.1. The purpose of the investigation

In our project we have made the aim to research the air pollution on the area of our school. The problem of "polluted snow" is very actual not only for the district of the city.

2.2 Method of the investigation

The methods of the parts: the first one – research of the chemical stuff and admixtures in melted snow; the second part – research on the general chemical toxicity by the method of biotesting.

The research of the chemical stuff and admixtures in melted snow. The process of the work. Firstly we melted the taken tries-out of the snow. For this research we took the same quantity of melted waters – 200ml.

1. We filtered the fall-out , we examined it through the microscope. 2. We did the test of the acid-alkaline surrounding with the keep of indicators, universal litmus paper. The result is: the surroundings in all the tries-out are neutral. 3. Then we examined the taken tries-out with the help of AgNO_3 on the presence of ions: chloride, ortophosphorus, and bromides. The result is that there are chloride ions in all the tries-out (except the woods).

The research of snow on the general chemical toxicity by biotesting method.

For this purpose we took cucumber seeds of the same harvest and kind. We put 10 seeds in each sterilized in advance Petry cups and pored melted water on the bottom of each of them. We defined the snow toxicity according to the number of the sprouted seeds and the speed of the development of the root system of the sprouts. During our work we defined: the dates of the sprouting of seeds; measured the length of the main root and defined the

average idex; we noted the time of the appearance of the side roots, the first leaves. This experiment took us 10 days.

3. Conclusion

On the basic of the obtained data of biotesting it is possible to form an opinion about the influence of the environment on the growth and development of sprouts:

1. The most polluted and toxic snow is the one taken on the highway (try-out №2) it can be connected with a great number of vehicles on the given area and the usage of anti iced stuff.
2. The less toxic snow is in try-out №4. It can be explained by the fact that there are less transport and anti iced stuff are practically not used.
3. It is possible to suppose that there is much less toxicity of the snow in try-out №5, because this area is far away from the roads with intensive transport movement and on the fact that cars are forbidden on the school territory.
4. The snow taken from the depth of the woods is the cleanest. The reason of it is that trees cover the snow covering in the woods from the harmful toxic substances from the atmosphere as well as the woods are far away from the roads and harmful substances are not thrown on the roads.
5. The most beneficial conditions in the purified water for the sprouts can be explained by the fact that the nature of cucumbers took care about their descendants and provided them with all the necessary things for the first the depression of other sprouts in other examined of their sprouts in other examined surroundings can signify about the high level of pollution of the environment caused by the industrial waste in the city area.

The tick and Lyme's disease.

The tick and Lyme's disease are more and more in the news. Increasingly, people are confronted with the consequences of the bite of a tick.

A growing number of people contract Lyme's disease. This development increases the need to carry out research into the cause of this disease: the Borrelia bacteria.

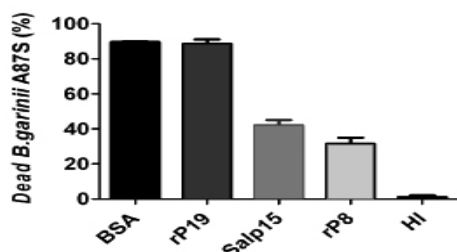
In order to get a complete picture of the current state of affairs and today's knowledge, four studies have been made. These studies are:

- a biological study of the tick;
- a study of the tick's habitat;
- a medical study of the Borrelia;
- a survey conducted at our school.

In our research, we made connections between the Borrelia bacteria, the tick, its habitat and the current medical treatment.

The studies themselves:

At our school, we have conducted a survey to test the existing knowledge about the danger of contamination with Lyme's disease. We have also studied the tick's habitat and linked it to changes in its environment and the tick's temperature. In addition, we have studied the tick's defence mechanisms against the host's immune system and the way the Borrelia bacteria benefits from this. The complement system consists of some twenty proteins protecting the human body. Certain proteins in the tick's saliva 'dismantle' some of these proteins, thus invalidating the immune system around a tick bite. We were given an opportunity to test the effectiveness of these proteins. In order to do this, we combine several proteins in combination with the Borrelia bacteria's immune system and study the result under a microscope. These proteins are BSA (a negative check), P19 (a protein peculiar to the tick, of which we know that it does not affect the



immune system, a negative check) Salp 15 and P8 (these are proteins that we suspect to dismantle the immune system, and, finally, inactivated blood serum. After making combinations we will count the number of dead bacteria.

Research institutes:

We carried out our research at three different leading Dutch institutes:

- Agricultural Institute Wageningen (Landbouw Instituut Wageningen) (WUR);
- The Amsterdam Medical Centre, which belongs to the University Of Amsterdam (AMC);
- The PWN, an institute that controls the Noord-Holland dune reserve.

Our main research questions were:

- Does the introduction of Scottish Highlanders have a positive effect on the tick population?
- What is the relation between the tick and the Borrelia bacteria?
- What kind of specific defence mechanisms does the tick use on its host, of which the Borrelia bacteria also makes use?

The results:

Contrary to what we expected, the Scottish Highlanders prove to have a negative effect on the tick population. This is because they chase away the mice, and it is the mice that prove to play a major role in spreading Borrelia and the feeding of a healthy tick population. The tick makes use of specific proteins, such as P8 (which we have studied) to protect itself against the host's immune system. No contamination is possible without these proteins. These proteins make it possible for Borrelia to contaminate the host without let or hindrance. We have gained an insight into the diagnostics of Borrelia and into the way the disease can be contracted. In the future, we will probably see the development of a vaccine. The number of tick bites has proved to be on the increase, and along with it the number of Lyme's disease patients. Contaminated ticks are more active than non-contaminated ones. We have acquired a better insight into the relation between the tick and the Borrelia bacteria causing the disease.

S.P van Doornik & C. Kriek

Photo Thermo and Photo Acoustic sensors in monitoring environment

Adrian Jarczyk

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

Introduction

In my labor I have made all information about study performed by me on a photo-thermal and photo-acoustic sensors in my hometown.

I have developed my labor in the following areas:

- Understanding the nature of light
- Ecological importance of using solar energy
- The use of photo-thermal sensors and photo-acoustic in monitoring environment
- Monthly measurement of sunshine in Katowice
- Pollution in Katowice
- A study of solar-heating project
- Economic analysis and evaluation of profitability
- Knowing how to deal with pollution

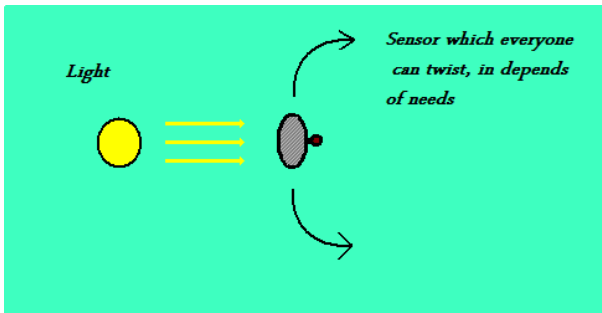
My research

The test voltage and photovoltaic cells, depending on the angle of the sun.

These test shows us what great importance in getting light energy is no angle to the sun. The study was conducted in our school physics lab and was repeated at home. The study was designed to test the dependence angle of the sun on the current and voltage in the photo cell..

Below is a chart of the study:

We conclude from it that the most efficient collection of sunlight is possible when they fall vertically on photo element.



Measurement of sunshine in Katowice

The inter-school project "Partners in Science" in which our school participates done specific research on the sunshine city of Katowice in the month of October.

Measurements and tests were performed in the lab to our school facilities, while the solar panel was placed in the open roof of the school building. Below is a intensity diagrams energy consumed directly from the sun between the hours of 8:00 and 18:00each day considered by us a month.

Every Day we made 120 measurements, it makes 3720 measurements per month. Here are a few graphs of my results, which show us a Day amount of sunlight.

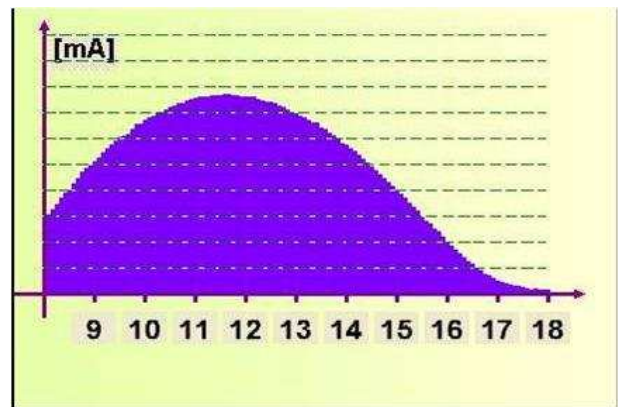


Fig.1 Sun exposure of 04-10-2010

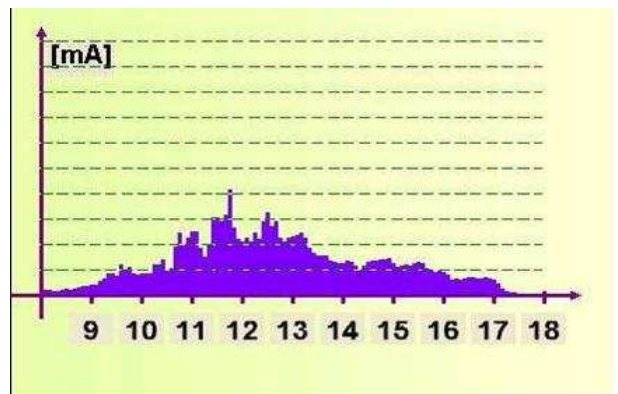


Fig.2 Sun exposure of 09-10-2010

Ocotober	31 days x 120 measurements	3720 measurements
All year	365 days x 120 measurements	43800 measurements

Fig.3 Number of measurements

Heat recovery and thermoinsulation A method of economizing on heat in buildings

Ilona Grzyb

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

Climate changes force us to save energy. The priority in domain of global climate is to decrease CO₂ emission and propagate peoples’ awareness of energy – saving, as well as in civil engineering range.

High costs of energy force us to save it. The heating waste in winter is caused to a large extent by ventilation because with removed air we lose heat. With using the thermomodernization elements, for example: replacement of windows, doors, insulating of the roof to gain less heating waste through partitions, but bigger ventilation waste in the whole energy balance: from 35% for non-insulated house to 57% for an insulated house, hence, we have to find and use the best technical solutions.

The appropriate humidity in flats, offices etc. is a prerequisite to make people feel the comfort of living and working. We should not ignore thinking of ventilation because the increase of humidity fosters fast course of illnesses, mold and yeasts. We can avoid this problem by using high recovery ventilation what enables to recycle heat from the removed air – the two air streams (exhaust and outdoor air) remain physically separate.

In the experimental part of my project I was concentrated on energy-saving improvements, modernization of heating and ventilation systems, energy balance results before and after the proposed thermomodernization improvements realization and economical analysis of final thermomodernization variant. For my experiment I used two houses made of hardwood: one of them was insulated with 2cm of polystyrene foam and the other one was not insulated at all, alcohol and tactile thermometers and Assmann psychrometer to show the method and the speed of heat migration. Having put in a source of warmth I checked the temperature by the roof and the walls, outside and inside, every two minutes both during ventilation and without ventilation. At the same time, I measured the humidity with Assmann psychrometer in partitions of the houses.

While heating non-ventilated houses the measured temperature was approximately 10°C higher than in the non-insulated. In insulated ventilated house the temperature inside the house was ca. 8°C lower than in the non-ventilated ones. Humidity in insulated house totals 50% and in the non-insulated 80% during ventilation.

Temperature measurements in the insulated houses by the external side of the roof with and without ventilation showed, that temperature differences were very small: 0,2 – 0,4°C and therefore the waste of energy was very small too. By means of calculations we can compare energy waste depended on heat transfer coefficient U. In an insulated house we need more energy to get appropriate humidity because the waste of energy in ventilated houses is bigger than in non – ventilated ones. The waste of energy in non-insulated house were from 3,5 to 4 times bigger than in insulated. I observed as well

considerable temperature differences in different parts of that little house – a convection.

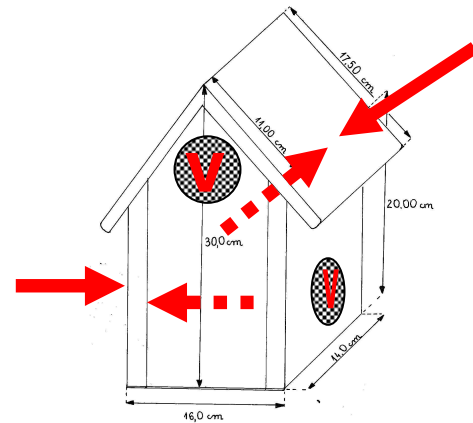


Fig. 1 Points for measurements and ventilation

To show, what thermomodernization in practice is, I used a ground-floor house covering the surface 88,1m², the volume 256m³ and for three household members before and after installation a few technical solutions: the heat pump to heat up in cold seasons, heat recovery ventilator to get heat salvage from ventilated air and solar collector for hot tap water.

When we take into consideration: efficiency of appliances, transmission, heat accumulation, the cost of investments and installation to prepare our ecological and economical balance, we can state, that we can refund investments within fewer than ten years.

When we use good, well-matched components of a passive building or low-energy house, we can obtain noticeable ecological and economical results. For our own good and, first of all, for the next generations we should intensify our activities in the nearest milieu, because we can protect our environment thanks to insulation and ventilation.

Natural radioactivity of soil

Paweł Mleczko

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 The purpose of the investigation

The aim of our study was to find out if in our environment, in places where we live, are radioactive isotopes. We also tried to answer, what the radioactivity of soil may cause in human body.

2 Method of the investigation

The samples were examined for the presence of gamma radiation isotopes. The device used for this purpose is called spectrometer. It is able to determine the amount of particular radioactive isotopes in soil. The research has been conducted at the Department of Nuclear Physics and Its Application of the University of Silesia in Katowice. The result of the analysis of a sample is a spectrum, that is the distribution of radiation energy, which demonstrates the number of records within particular channels of different energy levels. Analysing the location of particular peaks on an energetic scale we may, with the use of proper tables, determine the type as well as the amount of isotopes contained in a given sample. The results are given in Bequerels per kilogram. They determine the concentration of radionuclides, that is the activity of radionuclides in a unit of mass or volume. Apart from this test, we have performed several others. We used a school radiation dosimeter – the Geiger counter. It is used to determine the doses of radiation caused by the emission of alpha and beta particles, as well as gamma radiation. The device provides the results in mSv/h (microsieverts per hour)- it is a dosis effective within a unit of time.

3 Results of the experiment

Sample	²²⁶ Ra	²³² Th
	Bq/kg	Bq/kg
1–National Road 1	57.6± 1.7	54.7 ± 1.7
2-Garden	21.4 ± 1.5	29.5 ± 1.5
3-Housing estate	27.9 ± 1.7	36.9 ± 3.5
4-Silesia Coal Mine	61.4 ± 3.1	56.5 ± 3.1

Table 1 Intensity of activity

The highest concentration of radioactive radium-226 and thorium-232 isotopes have been found in soil taken from the Silesia mine and the vicinity of the National Road 1. The largest amount of potassium has been found in soil from the road and the Pólnoc housing estate.

Sample	⁴⁰ K	¹³⁷ Cs
	Bq/kg	Bq/kg
1–National Road 1	478 ± 16	6.3 ± 0.8
2-Garden	401 ± 15	12.2 ± 0.3
3-Housing estate	439 ± 16	24.5 ± 0.5
4-Silesia Coal Mine	389 ± 22	< 3.5

Table 2 Intensity of activity

The highest concentration of caesium-137 has been found in the soil from the housing estate. It is of human-produced origin and its amount depends on where a given sample has been taken. We expected a larger amount of radionuclides within the mine. However, the soil from this area showed no signs of increased radioactivity. The average amount for radium-226 and thorium-232 for Poland amounts to 26 and 21 Bq/kg, respectively. As can be easily perceived, the concentration of radium in the soil from the garden and the housing estate fits this norm perfectly. A slightly higher concentration of this element is present within the mine and the vicinity of the national road. Yet, it does not exceed the acceptable level. The concentration of thorium does not exceed the general national average as well. The average concentration of potassium-40 in soil equals 414 Bq/kg. The results of our study show the concentration range between 400-500 Bq/kg, which also fits the Polish average. The amount of caesium-137 isotope does not exceed the norms as well. We also have examined the sites from which the samples have been taken. The counter did not show increased radioactivity in any of these sites. The radiation level equaled about 0,05 (zero point zero five) – 0,15 mSv/h. Apart from this, we managed to measure the radiation level of the pipe used to carry mine water. The results were surprising. Next to the pipe, the Geiger counter showed the radiation at the level of 10,91 mSv/h. This is about 100 times higher than the background radiation in our town. Following the pipe, we reached a spot where it was disconnected, the opening not sealed. During the first measurement, the counter showed the radiation of 26,15 mSv/h. When we put the device a little deeper in, it showed the radiation of 32,64 mSv/h. It is 300 times more than the average level of background radiation! Yet, even such levels of radiation do not constitute any threat to human health, as one-time absorption of a dose needs to exceed 250 mSv in order to result in nausea and a slight fall of the amount of white blood cells.

Conclusion

Summing up, the results of our study are not alarming. The concentrations of radionuclides stay within the country's average range, and the radiation level exceeds the average levels only in the vicinity of the pipe carrying mine water. Still, the radiation level is not harmful to humans. Apart from that, the area is usually not frequented.

Deforestation and ecological imbalances in Cluj county, Romania

Fazacas Andreea Octavia - student

Catuna Alina Maria - student

Barbu Leonora - teacher of Biology and Ecology

Szenkovits Mariana - engineer of Chemistry

Technical College „Ana Aslan” Cluj Napoca, Romania, colegiul_anaaslan@yahoo.com

The Purpose of the investigation

The “Deforestation and Ecological Imbalances in Cluj County” project aims at researching and monitoring the level of degradation of woodlands in the county of Cluj in the last years, highlighting the serious ecological imbalances as direct consequences of the abusive and illegal deforestations.

Research methods

1) Investigation of the forest areas of Cluj county using Google Maps and Google Earth web applications.

2) Physical and chemical analysis of soil samples collected from deforested areas, according to the age of the deforestation:

-the determination of soil permeability for water (Wolff tube method)

-the determination of organic matter

3) The experimental research of the vegetal biomass and the plant growth in the samples of soil collected from forested and deforested areas.

Google Earth allowed us to observe the anthropogenic impact over the investigated forested areas. Soil samples have been taken from different areas of Cluj county and analyzed over a period of several years. We aimed to compare the soils of the forested areas with those of the deforested ones from the same research area. The analyses were made in our school’s labs and those of the University of Agricultural Sciences from Cluj-Napoca.

Results of the experiment

Soil’s permeability for water decreases in the deforested areas in comparison with the forested areas in the neighborhood.

The vegetal biomass and the plant growth are lower in the soil samples collected from deforested areas.



Fig. 1 The plant growth in the soil samples collected from the forested and from the deforested areas.

The organic matter decreases, directly proportional with the period of deforestation, as shown in the following graphic.

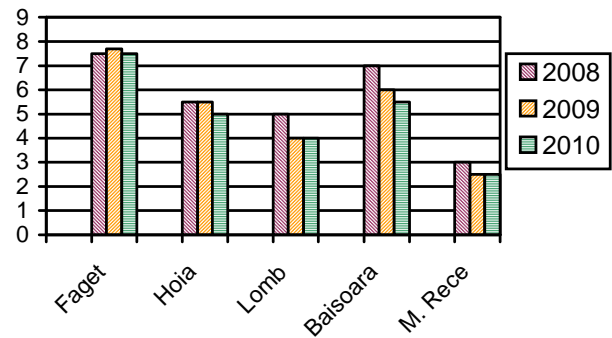


Fig. 2 The variation of organic matter content (%)

Conclusions

The organic matter stock is directly proportional to the annual input of plant material.

More vegetal biomass mean more carbon stored in plants and less in the atmosphere.

The fertility of the soil has decreased after deforestation.

We need to grow the vegetal biomass in the soil, to stop the increase of the carbon in the atmosphere.

The anthropogenic activities, such as deforestation, determine soil degradation namely the loss of organic matter and the decrease of permeability for the water.

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Recycling durian's pericarp to be a valuable package instead of foam using

***Parewa Sophark** , Khwankamon Lexmaad , Pasin Assawatreeerattanakul

PSU.Wittayanusorn School,Hatyai ,Songkhla,Thailand 90110

1. The purpose of the investigation

1.1 To study humidity of durian's pericarps; inner durian's pericarp and outer durian's pericarp.

1.2 To study an optimum ratio between maize flour and durian's fiber for producing a package.

1.3 To study an appropriate quantity of wax to coat a package.

1.4 To produce the most effective package.

2. Method of the investigation

2.1 Preparing raw materials

2.2 Study humidity of durian's pericarp in 2 parts that is inner durian's pericarp and outer durian's pericarp.

2.3 Preparing fiber from durian's bark

The 200 grams of dehydrated inner durian's pericarp was boiled for 15 minutes. The water was drained out and put the 15% w/v of NaOH into the pericarp in the ratio 1:10 between inner durian's pericarp and NaOH. Afterwards, it was boiled at 70°C for 2 hours. The fiber was washed until pH is equal to 7 and dehydrated. Later put 35% v/v of H₂O₂ in the volume 25% of the dry weight and boil the pericarp at 70°C in 30 minutes. The fiber was washed again until pH was equal to 7 and leaved it at 100 °C for 5 hours. Finally the fiber was spin. The same instruction with outer durian's pericarp was carried out.

2.4 Studying a suitable ratio between maize flour and durian's fiber to produce a package.

The maize flour glue and maize flour were mixed in the ratio of 15 : 85 while the inner durian's fiber was mixed with the prepared flour in the ratio of 1%, 2% and 3% by weight. Then the mixer was poured in a block and build up into the bowl shape at 150°C within 10 minutes. The package was bring out of the block and decreased the temperature to 25°C before testing a mechanical properties. The same manners were done for the outer durian's pericarp.

2.5 Studying an optimum quantity of chitosan for coating the packages.

The packages which have the best mechanical property were chosen. The packages were weighed before coating with chitosan. The packages were coated with chitosan of

5 grams, 7 grams and 9 grams, respectively. The packages were dried up at 50°C in 24 hours. Then the packages were weighed after coated. Finally the resistance of water absorption properties were tested.

3. Results of the experiment

3.1 Analysis of package's humidity

From the experiments, the humidity of inner durian's pericarp is 12.16% that is higher than outer durian's pericarp that has the humidity 12.07%

3.2 Studying of an appropriate ratio between maize flour and durian fiber for producing a package

The result is shown that the package that made from 2% mixed of inner durian's pericarp has the highest puncture value and the package that made from 1% mixed of outer durian's pericarp has the highest compression value.

3.3 Studying of a suitable quantity of wax to coat a package

From the experiments, the packages that coated with 5 grams of chitosan adsorb water the least.

4. Conclusion

The humidity of inner durian's pericarp is higher than outer durian's pericarp. The package of using the fiber from outer durian's pericarp combined with maize flour in the ratio 3:97 gives the best mechanical quality than any other experiments. The package with 5 grams of chitosan coating exhibits the best water absorption resistance.

In summary, the package which made from outer durian's fiber and maize flour in a ratio of 3:97 and coating with 5 grams of chitosan is the best package.

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Development of Improved Thermal Insulation Properties of Ceramics by the contribution of the paper waste

Aslınur Özdemir, Umit Karaca

Izmir Private Fatih Science High School, ukaraca2006@gmail.com

Purpose

Today, the damaged natural balance and global warming have made people more conscious about the environment [2]. The recycling application, which is one of the ways to reduce the environmental pollution, came into the prominence substantially. For example, paper recycling is quite common. But the secondary waste which is produced at the end of the recycling process can not be utilized [1,2].

The aim of this project is to produce a novel brick with increased heat insulation capacity by the addition of Paper Processing Residue (PPR) to the brick raw material. Depending on this goal;

- To hinder the wastage of the quite expensive cellulose that is in paper processing residue (PPR),
- To bring commercial and industrial value in calcite (CaCO_3) that has a little value and finite industrial usage in paper processing residue (PPR),
- To increase the added value of the secondary residue that is produced at the end of the waste paper recycling,
- To determine the applicability of the production of these novel products in large-scale,
- To produce bricks that have decreased thermal conductivity coefficient,
- To produce lighter bricks than the bricks that are produced now,
- To compose anorthite crystallization phase at the end of the reaction of CaCO_3 and clay were aimed.

Method

3 types of bricks were produced in this study. These are; PPR doped refractory bricks, PPR doped insulation bricks, non PPR doped insulation bricks.

The first part of the project, the mixture that prepared by mixer is poured into plaster mold for forming phase. After drying in the oven, it is cooked 1 hour in 1300°C degree by 10' increments. Samples were taken, that descending back to room temperature by 10' decline. Some parts of samples were used for Archimedes and the heat transfer coefficient measurement tests, XRD, SEM analysis.

The second part of the project, prepared materials was extruders. By this way, mixture preparation and forming operations has been completed. Samples are cooked 1 hour in 900°C degree by 10' increments after drying in the oven. Samples were taken, that descending back to room temperature by 10' decline. Some parts of samples were used for Archimedes and the heat transfer coefficient measurement tests, XRD, SEM analysis.

The same procedures were applied to the 2nd part also performed in the 3rd part. The only difference was not benefit from PPR.

Results

All the theoretical and experimental stages of the project is completed. Paper processing residue (PPR), which normally does not have economic value and hence carried to dumps with special vehicles, is turned into an economically useful product. In addition, putting this work into practice means substantial savings of the transportation cost. Because 58% moist PPR is transported to dump sites from the paper mill. Each truck carries 58% water which is extremely inefficient for the industry.

Physical properties		Sintering temp. (°C)	Percent paper residues additions by weight		
			0%	10%	20%
Loss on ignition (%)		1000	7.5	13.0	17.4
		1100	7.5	12.3	17.0
by Archimedes method	Apparent porosity (%)	1000	31.7	40.7	46.7
		1100	30.8	38.9	46.2
	Water absorption (%)	1000	17.2	25.6	32.8
		1100	16.7	23.9	31.9
	Bulk density (g/cm^3)	1000	1.85	1.59	1.42
		1100	1.85	1.62	1.45
	Apparent density (g/cm^3)	1000	2.70	2.68	2.67
		1100	2.68	2.65	2.69

Table 1: Density, porosity and water absorption results of the sintered bricks.

Conclusion

The heat transfer coefficient of the produced bricks is 50% less than the heat transfer coefficient of the bricks produced in factories. So walls of buildings made from these new bricks will benefit from reduction in thermal conductivities.

- As a result of the burning of the organic materials in the paper processing residue (PPR), which was added to the mixture at the raw material preparation process, microporous bricks were produced. The heat transfer coefficient of new bricks has 50% lower than normal bricks.
- Finally, an economically feasible and environmentally friendly construction material can be produced using an unprofitable paper waste. Materials science and engineering principles helped achieve these objectives.

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The Chemical Analysis of Coal and Ash Samples from Turkey's Coal-Fired Thermal Power Plants

Bilge Kaan Anutgan, Umit Karaca

Izmir Private Fatih Science High School, ukaraca2006@gmail.com

Purpose

Today, both the world population increases, the growth rate of technology is increasing too [1]. The growth of the world population and the growth of the technology increase the need of energy, so using of fossil fuels is increasing [2]. One of this fossil fuels is coals and it is using for produce energy. 29,2 % of fossil fuels using for produce energy is coals and coals are one of the most using fossil fuel.

Heavy metals and radioactive metals are harmful to human health and the environment [3]. The aim of this project is analyzing the coal and ash samples from Turkey -West Anatolian Region, coal-fired power plants and interpreting analysis results of coal and ash samples.

In this project aims;

- To determinate thermal power plants to provide coal and ash samples,
- To determinate the content of coal and ash samples,
- To analyze coal and ash samples in ICP-OES device and determinate of heavy metals in these samples,
- To analyze coal and ash samples in XRD device and determinate minerals in these samples,
- To analyze coal and ash samples in Scintillation detector and determinate radioactive elements in samples,
- To interpret the data of heavy metals and radioactive elements in coal and ash samples,
- To inform people, harm of coal burned in thermal power plants and ashes to the environment.

Method

ICP-OES analysis of some heavy metals (Hg, Cd, As, Pb, Zn), determination of minerals with XRD device, radiation measurement with scintillometer, and determination of radioactive elements with scintillation detector have done in coal and coal fly ash samples of Turkey's thermal power plants.

First, coal and coal ash samples brought from Turkey's thermal power plants were broken in jaw crusher and grinded in vibratory cup mill. First, I've provided 6 coal and 6 ash samples from 5 different thermal power plants. Then break the samples in jaw crusher and grain in ring mill. I tried many different methods on ground samples to determine the elements, particularly mercury and cadmium. I've researched method by experiments that coal and ash samples dissolve completely. This samples were abstracted with HCl (hydrochloric acid), HNO₃ (Nitric acid), HF (Hydrofluoric

acid), H₃BO₃ (Boric acid) in microwave. Then, samples were analysed in ICP-OES device. Not only mercury and cadmium, It is determined the contents of other heavy metals by this method.

After grounded the samples, I did mineral analyses by XRD device and radioactive element analyses by scintillation detector. In addition, I conducted the radiation count in certain areas of thermal power plant.

Results

Theoretical and experimental phases of the project have ended. Thallium (Th) elements were not directly detected in samples. Radioactive potassium (K-40) and radium (Ra) activity level was not detrimental to human health.

According to the results of XRD mineral analysis, it was determined the amount of graphite and pyrite in coal and ash samples. I was founded that the amount of graphite in ash samples was higher than coal samples. Accordingly, It was detected that the carbon atoms in coal mixed into the air as CO and CO₂.

The amount of pyrite in coal samples was found more than ash samples. The reason for more than the amount of pyrite in coals more than the ashes was sulphur in pyrite the result of combustion involved in the air as SO₂.

Conclusion

Coal Fly ash that has heavy metal amounts over limit value is dangerous. The analysis results showed that cadmium, lead and arsenic levels in coals in coal fly ashes were higher than the standards. For this reason, to leave the coals burned in thermal power plants and the fly ashes without control is dangerous for human health and the environment

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Country: Ukraine

Team: Kharkiv Educational Centre for Youth Gifts Development

Name: Datsenko Illya, Bratkovskiy Oleksandr

Section: Environmental Science

Supervisor: Iryna Malysheva

Title of the presentation: **Hands-On experiments of producing recycled paper as a motivation factor of environment protection.**

One of the most global environmental problems is a problem of pollution when the industries produce paper. During last decades people in Europe have separated paper litter from the other rubbish. In this case people help to protect their environment. The problem of our country is that people still can't understand the importance of separation paper litter and paper recycling

Our research is devoted to one of the most important and complicated topic: bringing-up process of the ecological thinking for Ukrainian primary and secondary school students. The process of recycled paper creation has been realised and demonstrated as a hands-on activity. Some simple household materials like juice cans, bolter, shaker have been used to demonstrate the process of producing recycled paper in industry. All those simple experiments were presented at secondary school № 118 and Lyceum of Kharkiv National University for pupils aged from 8 to 12 to show them the importance of separating paper litter, to persuade them taking care about our environment and to form a habit to assort paper garbage.

The special questionnaire forms have been devised and used to estimate the impact of our research. The results of positive feedback demonstrated the urgency and importance of our research. All the experiments in our investigation were constructed in Kharkiv Educational Centre for Youth Gifts Development in premises of Karasin Kharkiv National University.

Олександр Братковський та Даценко Ілля

Одна з найбільш глобальних екологічних проблем по захисту довкілля є проблема забруднення при виробництві паперу. У передових країнах Європи вже йде активне відокремлення паперу серед іншого сміття, тим самим люди допомагають рятувати навколишнє середовище від забруднення. Проблемою нашої країни є те, що люди не розуміють важливість перероблення паперу, адже в Європі вже давно запроваджено використання промислових виробів, що зроблені з вторинно-переробленого паперу.

У нашому дослідженні ми використали велику кількість інформації з інтернету та з книжок.

Використавши спеціальні анкети для дітей віком 7-12 років, ми виявили рівень їх обізнаності в цій галузі. Ми розробили експеримент з виробництва вторинного паперу власноруч, який може бути легко повторений кожною дитиною. Експериментальним способом ми донесли до дітей як у наш час важливо відокремлювати паперове сміття від іншого, щоб зробити подальшу промислову переробку легшою.

Influence electromagnetic waves of DATA center on grows plant and bacterium cells

(Ecology)

Julia Kamkova

Lyceum # 145

Kiev, Ukraine

We live in era of technical progress. Everyone uses personal computer, mobile telephone, Internet. DATA centers are ensures regular work of Internet. DATA centers are rooms, were retrieve servers. But servers radiate low waves frequency.

Theoretical part. According to literature low waves frequency are more dangerous than high waves frequency. It is known that low waves frequency have influence from structure of molecular of water in live organism, these waves destroy cell membranes, caused appearance free radicals. But it is unknown influence low waves frequency of DATA centers on organisms. In this time DATA centers built in housing region.

That's why the aim of this investigation is to study influence low waves frequency of DATA center on live organism in particular plants and bacterias.

Experimental part. Seeds of cucumber (*Cucumis sativus* L.) and bacterias *Sarcina flava* and *Serrantia marcescens* were choosed test-object. Cells of roots cucumber are very quickly growth and lateral roots put in lower layer of generating tissue, that's why quantity of lateral roots and length of main root are indicated to intensity of cell division and growth. *Sarcina flava* and *Serrantia marcescens* have pigments and there intensity of growth we identified to intensity of pigments with spectrophotometer CF 2000. 10 cups Petry with 10 seeds of cucumber and 10 test-tubes with bacteria we had placed in room with servers (25 servers on 1 m²) and control cups and test-tubes we had placed in room without servers. In both rooms temperature, pressure, humidity, regime of lighting was identity. Experiments with bacterias had continued 3 days, with seeds of cucumber – 7 days. The results of experiments are leads in tables.

Results.

Table 1. Influence electromagnetic waves of DATA center on growth of seeds of cucumer.

Variant	Length of main roots (sm)	Quantity of lateral roots	Length of shoot (sm)
Control	18.9±0.2	25±2	7.5±0.1
Experiment	13.86±0.3	21±1	7.0±0.2

Table 2. Influence electromagnetic waves of DATA center on growth of seeds on bacterias.

Variant	Optical density	
	<i>Sarcina flava</i>	<i>Serrantia marcescens</i>
Control	2.778±0.01	2.582±0.02
Experiment	2.666±0.02	2.449±0.01

Discussion

According to our experiments low waves frequency decreased length of main roots on 27%, quantity of lateral roots on 16%, optical density of germ culture of *Sarcina flava* on 4%, *Serrantia marcescens* on 5%. These dates was suggested that low waves frequency of DATA center have negative effect from cell division and growth especially eycariots. Since mechanisms of mitoses in all eycariots are similar we recommend to no build DATA centers near dwelling houses and workers of DATA centers to use antioxidant.

Literature

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**LIFE
SCIENCES**

The role of printed media in dealing with the sexual abuse of children and teenagers

Júlia Lima de Lucena

Santa Teresinha School, Imperatriz-Brazil

1. The purpose of Investigation

The purpose of this work is to analyze the role of printed media in dealing with sexual abuse of children and teenagers. During the project development, other purposes came about: to identify the frequency the theme is reported by “Estado do Maranhão”, “O Progresso” and “Folha de São Paulo” newspapers; To identify the readers and the net protection to childhood and teenagers perception about the problem and make it a social debate.

Author's purpose	“O Estado do Maranhão”	“O Progresso”	“Folha de São Paulo”	Total/ %
Informative	15	18	6	48%
Mobilizing	-	11	4	18,5%
Sensationalist	16	4	7	33,5%

2. Method of Investigation

The project is composed by 2 focuses: Qualitative and quantitative methods whereas it's a mixed method (quantitatively).

[1] “[...] The investigative procedure is based on inductive and deductive researches which requires an enormous dynamism of the searcher during the process.[...]”.

The study was developed in two phases: Documental and Field research, with “Estado do Maranhão”, “O Progresso” and “Folha de São Paulo” distributed within 80 questionnaires, followed by consensus term; 7 semi-structured reports with net protection perception.

3. Results

3.1. Analysis of the report

Central idea	“O Estado do Maranhão”	“O Progresso”	“Folha de São Paulo”	Total/ %
Cases of sexual abuse	29	21	12	76,5%
Events about the theme	-	12	5	21%
Death related to abuse	2	-	-	2,5%

3.2. Protection net

Institution	The role of Printed Media in dealing with sexual abuse
CREAS	Does not reach the objectives. Does not inform society properly.
Childhood and Youth Prosecution	Informs and mobilize society, contributing to the increase of complaints.
CAOPij	Contribute to the increase of denounces in the State, mainly when providing necessary information.
Civil police	Does not interfere in the number of denounces.
Childhood and Youth Organization	It is important to inform families.
Tutelary Council-Area I	Does not interfere.
Tutelary Council-Area II	Media is still very omissible. It is so far away from the reality which we face.

The role of printed media in dealing with the sexual abuse of children and teenagers

Júlia Lima de Lucena

Santa Teresinha School, Imperatriz-Brazil

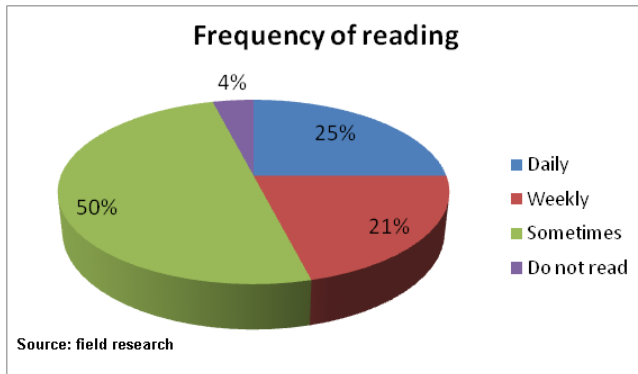
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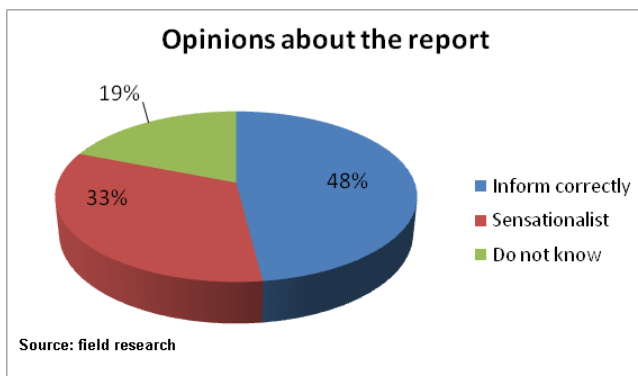
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3.3. Readers' perception



Base: 80 questionnaires



Base: 80 questionnaires

4. Conclusion

Frequency of reports about the problem: 8,4%; 9%; 4,5% “Estado do Maranhão”, “O Progresso” and “Folha de São Paulo” newspapers, respectively.

Reader's perception: low daily reading; valorizes the report about the problematic situation; newspapers inform correctly.

Protection net: Informs society correctly but does not generate confrontation action;

Debate Amplification: The making of the first Seminary about the theme; Development of a documentary; Development of lectures for the public.

5. References

The role of printed media in dealing with the sexual abuse of children and teenagers

Júlia Lima de Lucena

Santa Teresinha School, Imperatriz-Brazil

EDUCATIONAL ROBOTICS - INNOVATION IN THE METHODOLOGY OF THE CALCULATION COURSES

ABSTRACT

The use of robotics as a teaching tool allows students to develop hypotheses, investigate solutions, establish relationships and draw conclusions. The aim of our project is to make the student question, think and seek solutions, leading from theory to practice by using the lessons learned in the classroom and everyday life. For the development of this research, there were six workshops, divided into three stages: 1) Imitation, where the students deconstruct and then rebuild a model 2) Step by step construction, where the students no longer have the real image of what they will build, know what they must do, but do not yet know how or what the final outcome is; 3) Programming the robot-which lasted 20 hours, involving the participation of 25 first and second year students (aged between 15 and 16 years old) of the Liceu de Maracanaú High School - Ceará. The workshops made it possible to observe the use of the robot as a mediator in the teaching-learning process in subjects involving calculations. The workshops aimed to encourage interdisciplinary knowledge, promoting the integration of concepts from other fields, such as Mathematics, Physics, Portuguese, etc and showed how it is possible to develop high technology prototypes at low cost. As a result, the students who participated in the robotic workshops attained an average grade of 68% in Mathematics and an average grade of 87% in Physics at the end the second semester of 2010 (with workshops), compared to the same semester in 2009 (without workshops). The project also generates an environmental, social and economical awareness within the students.

Proteins in the lens of the eye

Filip Bzik

XI. Gymnasium, Zagreb, Croatia, fillip.bzik@gmail.com

1. Introduction

My project is focused on a membrane protein called Cadm1, which is highly expressed in the lens of the eye [1]. In my paper I will explain the methods I used to determine the location of this protein within the cells of the lens. I have chosen to study the Cadm1 protein because of its possible role in cataract formation. The lens expresses many hundreds of proteins which together contribute to the transparency of the healthy tissue [3]. A small change in the structure or location of an abundant protein such as Cadm1 could lead to alterations in lens composition [2]. In fact, my data indicate that the absence of Cadm1 causes changes in the structure of the lens fibers that may contribute to cataract formation. My research was done in the summer of 2009 at Washington University School of Medicine in St. Louis, USA. I volunteered to work in the Laboratory of Professor Steven Bassnett in the Department of Ophthalmology and Visual Sciences.

2. Methods and materials

The mouse lens was used as a model system in the experiments. Lenses were prepared using a microtome, stained using the immunofluorescence technique and analyzed by confocal microscopy. My experiments compared lenses from wild-type mice and those in which the gene for Cadm1 had been deleted.

3. Results

Protein Cadm1 is present in the lens of the eye. Its highest concentration is in the epithelium found at the anterior surface of the lens. These are the cells that undergo mitosis. Cadm1 was also found in the membranes of lens fiber cells, the most abundant cell type in the lens [3]. In wild-type mice, lens fiber cells are arranged regularly. However, in mice lacking Cadm1 protein, the fiber cells are very irregular in shape (Fig. 1)

4. Conclusions

Protein Cadm1 is found in both lens epithelial and lens fiber cells. Cadm1 is best known as an adhesion protein but in lens fiber cells it may have a critical role in the

maintenance of cell morphology because cells lacking this protein are irregular in shape. Future studies, perhaps in older animals, will be necessary to determine whether alterations in Cadm1 function contribute to cataract formation in mice (or humans)

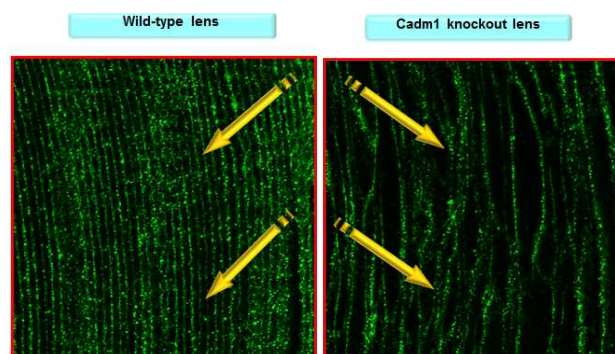


Fig. 1 Absence of Cadm1 in the lens causes changes in structure of the lens fibers

Acknowledgments

I would like to thank to Dr. Steven Bassnett for giving me the opportunity to volunteer in his laboratory and providing guidance thought my scientific work and to my biology teacher Mirjna Kežman for her help and support. Dr. Ksenija Kos helped me with English language and translations.

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The Structure and Number of Red Blood Cells in Connection with Physical Fitness in Adolescents

Ines Kovačić

Vladimir Prelog Science School, Zagreb, Croatia, ineskovacic@hotmail.com

1 Introduction

Red blood cells are also referred to as erythrocytes. Hemoglobin is the main component of red blood cells. The primary function of hemoglobin is to transport oxygen. MCH is the average mass of hemoglobin per red blood cell in a sample of blood. There are four basic blood types: A, B, AB and O. Blood pressure is the pressure exerted by circulating blood upon the walls of blood vessels. Pulse is the number of times our heart beats in one minute.

2 The purpose of the investigation

The purpose of blood typing was to determine whether the results for all examinees correspond to statistical results regarding the distribution of ABO blood types in Croatia. The purpose of blood pressure and pulse measurement was to determine how their values change after physical activity. I used the obtained results as reference range for establishing the examinees' physical fitness. I also performed counts on all examinees, including the red blood cell count and the measure of concentration of hemoglobin per liter of blood so that I could compare them with the obtained BP and pulse measurements. My intention was to establish the connection between the physical fitness of the examinees and the red cell count as well as the amount of hemoglobin per liter of blood.

3 Methods of the investigation

My research involved 22 adolescents at the age of 16 or 17. I drew blood of the examinees using a lancet and I mixed it with A and B antibodies. I used the agglutination reactions to determine the blood type. I measured changes in blood pressure and pulse rate of all the examinees before and after running. I used Bürker-Türk counting chambers to determine the number of red blood cells per liter of blood. The blood sample of 0.01 ml was mixed with 9.99 ml of 0.05 M water-soluble solid EDTA which served as an anticoagulant and a blood thinner. I counted red blood cells on a central grid, in five different squares at high magnification (*400 times*). The determination of the hemoglobin concentration was performed by using the spectrophotometric method. I added the blood samples of 0.02 ml in test tubes which contained 5.0 ml of 0.02 M chromogenic reagent. I also prepared one tube for blank determination. Thus, by using a spectrophotometer to determine the absorbance of light by a solution, I determined the hemoglobin concentration. The MCH was calculated by dividing the concentration of hemoglobin by the number of red blood cells in a volume of blood.

4 Results of the experiment

The most widespread blood type is O and only one examinee has AB blood type.

The examinees with the smallest changes in systolic blood pressure and pulse mostly had higher MCH. Among the six examinees with higher levels of MCH, three of them, examinees 7, 8 and 20, have better physical fitness than the rest of the examinees. From what I heard from them, they practice some kind of sport (Fig.1).

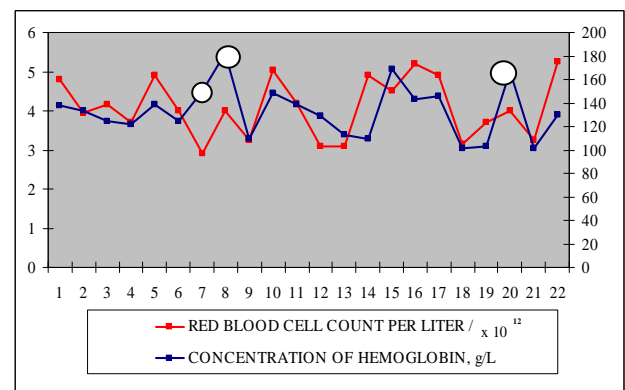


Fig.1 Comparison chart: red blood cell count in comparison with concentration of hemoglobin per liter of blood. Numbers 1 to 22 indicate the number of examinees. White circles indicate the examinees having higher MCH and, at the same time, a higher level of physical fitness.

5 Conclusion

The distribution of ABO blood types among the examinees shows partial overlapping with the distribution of ABO blood types in Croatia.

The red cell count and the concentration of hemoglobin per liter of blood are higher in male than in female examinees.

The examinees whose BP and pulse measurements after physical activity changed in smaller degree have higher concentration of hemoglobin per red blood cell, that is higher MCH.

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Does the Moon affect human sleep?

Eva Viková, Lucie Kropáčková

First Private Language Grammar School, Hradec Králové, the Czech Republi, vikova.eva@psjg.cz, kropackova.lucie@psjg.cz

1 The Aim:

The aim of this project is to find out whether or not the Moon, especially the full Moon and new Moon, affects the quality of human sleep.

2 The Method of the Experiment:

We used qualitative research. We asked 13 people of different ages and work background to observe their sleep for one month and to make notes about their findings to a table in MS Excel.

They make notes about time going to bed and time waking up, duration of sleep, quality of sleep, number of waking during the night, their tiredness and mood, etc.

date	day	time going to bed	time waking up
1.11	po	1:30:00	6:30:00
2.11	út	0:30:00	6:30:00
3.11	st	1:00:00	6:30:00
4.11	čt	23:30:00	6:30:00
5.11	pá	0:30:00	8:00:00
6.11	so	1:30:00	7:30:00
7.11	ne	1:00:00	6:30:00
8.11	po	1:00:00	6:30:00
9.11	út	0:30:00	6:30:00
10.11	st	1:15:00	6:30:00
11.11	čt	23:00:00	6:30:00
12.11	pá	3:30:00	10:00:00
13.11	so	5:30:00	11:00:00
14.11	ne	1:45:00	6:30:00
15.11	po	4:00:00	8:00:00
16.11	út	5:30:00	12:00:00
17.11	st	3:00:00	7:30:00
18.11	čt	1:00:00	6:30:00
19.11	pá	19:30:00	10:30:00
20.11	so	3:30:00	12:00:00
21.11	ne	4:30:00	11:00:00
22.11	po	4:30:00	8:30:00
23.11	út	3:30:00	9:00:00
24.11	st	5:30:00	10:00:00
25.11	čt	6:00:00	11:00:00
26.11	pá	x	x
27.11	so	6:00:00	12:30:00
28.11	ne	0:45:00	12:45:00
29.11	po	4:00:00	11:00:00

Fig. 1 Example of complete table – A part of table from Man A

During this month we were focusing on the theory about the Moon's influence on the human sleep, organism, brain, nature and so on.

We also determined our hypothesis this way: *Moon, especially the full Moon and new Moon, affects the quality of human sleep.*

After we had compiled all the data, we evaluated the obtained information.

2.2 The Compiled Data:

We have obtained the information about sleep from 13 people for the period of one month. We calculated the Average Sleep for each person.

After that we compared this result with the sleep in various phases of the Moon. Then we looked into the changes and the irregularities in comparison with the Average Sleep.

2.3 The Result of the Experiment:

From the physical and the biochemical point of view, the Moon has a relatively small affect on the sleep in human beings, as according to our findings, the compiled data shows minimal changes in values.

On the other hand, it is more the psychological factor which appears to be more important because most insomnia depends on the psychological mood of a human being.

3 The Conclusion:

As a follow up to the results of the experiment, the hypothesis was not confirmed as the issue may differ individually.

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Ecological and economical prevention of *Phytophthora infestans*

Phytophthora infestans is a fungal pathogen which affects plants from the family *Solanaceae* (nightshade family). Important for agriculture are two plants of this family, the tomato and the potato. These two plants take an important place in our agriculture, especially the potato plant as an important supplier of amyllum. But since 1840 the pathogen *Phytophthora infestans*, which causes the “Brown Mark Illness” or blight, has taken place in Europe.

P. infestans has caused the Irish Potato Famine or Great Famine in 1845-1852.

In the 1980t’s a new type of *P. infestans* was imported from Mexico. This new type is able to do sexual and asexual recombination. It can also produce a high number of offspring with a big variation, what could be a reason for the fast adaption to new environments and fungicides. Another reason for the fast adaption to new conditions could be transposons, because over 40% of the genome is conserved and the other part of the genome includes a high number of repetitive sequences and transposons, which cause a high variability.

The infections are even effective because often more than 25% of the potatoes and up to 100% of the tomatoes harvest could be damaged.

As a result of the high risk of infection and fast adaption of *P. infestans*, the farmers have to use high quantities of fungicides to prevent infections, what causes economical and ecological damage. The financial damage of *P. infestans* is, only in developing countries, approximately 2.7 billion Dollars.

During my project I looked for alternative fungicides which should be environmentally friendly and cheap in production. The first approach was allicine. This substance is a product of an enzymatic reaction which appeared after cutting garlic. By damaging the cells the enzyme alliinase which is located in the vacuoles begun to transform alliin which is located in the cytoplasm. The product of this reaction is the cytotoxic alliin, which is even used in former medicine against fungal infections. We have synthesized alliin in the lab and tested the alliin solution on agar plates of *P. infestans*. The growth of *P. infestans* was, depending of the concentration, reduced from 25% up to a complete prevention of *P. infestans*. However alliin is very instable and dissociate into other substances (which are responsible for the garlic-smell). Therefore a long time prevention with allicine is not possible but we can use it to treat plants for prevention of infection after bad climate conditions. Tests with plants in combination with classical fungicides show good results. Another possible “fungicide” is *Bacillus subtilis*. The liquid culture of this bacterium can prevent the growth of *P. infestans* under laboratory conditions on agar plates.

Bacillus subtilis has not negative effects for the environment because in nature, *Bacillus subtilis* is omnipresent and can be isolated from soil or from hay.

These two kinds of alternative fungicides are able to reduce the use of normal fungicides and environmental problems, especially the contamination of soil. Both are cheap to produce with biotechnological methods but only if big quantities are needed. It is very important to find cheap solutions for environmental problems because if they are too expensive no one will use the alternatives.

POSSIBILITIES OF SELENIUM SUPPLEMENTATION

Zsófia Baji

Kossuth Lajos Grammar School of University of Debrecen, 11th grade
Debrecen, Hungary

zsofi.baji@gmail.com

1. The purpose of my investigation

Selenium is an **essential antioxidant, anticarcinogenic microelement**, the supplementation of which is absolutely necessary in order to reduce cancer risk as selenium deficient organisms are comprehensively typical of the Hungarian population. To justify that the most effective way of supplementation is the use of **biologically produced red elemental nanoselenium presupposed to be the least toxic form of selenium**, I performed a comparative acute oral toxicity test of this new, **hardly investigated species** and three other, organic/inorganic species (SeCys/SeMet, NaHSeO₃, NaHSeO₄) widely used in supplementation.

*Licence Number of animal testing: 1/2009/DEMAB
(Committee of Animal Research, University of Debrecen)*

2. Materials and methods

I produced selenium nanoparticles for the enrichment of mouse forage by the application of a lactic acid fermentation-based technology, during which the reduction of plus four oxidation state ionic selenium into elemental molecular form takes place inside bacterium cells.

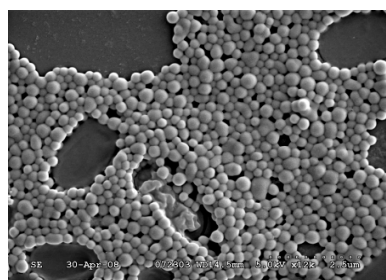


Fig.1. Transmission electronmicroscopic image of intracellular rNano-Se

To justify the **toxicity screen effect of the bacterium cells** (which means that they overshadow the influence of the selenium nanoparticles

consequently having lower toxicity), I enriched the forage of one six-individual group of mice with desiccated and then

grinded yoghurt consisting of perished bacteria intracellularly accumulated selenium nanoparticles and another's with high purity colloidal solution of the nano-sized spherules of red elemental selenium.

In both five cases the same kind of selenium-enriched forage was given to the mice in three different concentrations ($c_{\text{Control}}=0,0$; $c_1=0,5$; $c_2=5$; $c_3=50$. $\text{/[c]}=\text{ppm}$) of which the lowest was specified so it would correspond with the maximum selenium content of livestock forage dry matter licensed by the European Union, then the ten- and hundredfold of it was taken.

3. Results

As a result of the acute oral toxicity test, mortality was experienced only by the groups getting the selenium species in the highest concentration. In the case of NaHSeO₃ the mortality rate is 6/4 – 66,7%, 6/3 – 50,0% where NaHSeO₄ was used, while 6/1 – 16,7% at the group treated with purified Nano-Se. **There were no perished individuals at the groups getting organic selenium- and unpurified Nano-Se-enriched forage.**

The selenium levels – which refer to the activity of selenoenzymes, mainly glutathione peroxidase and thioredoxin reductase – measured in the liver with atomic absorption method after the procedures of autopsy and digestion **increase contrary to the mortality rate and are the highest in the case of unpurified Nano-Se.**

4. Conclusion

In my experiment the inorganic selenium species are proved to be the most toxic, while the organic selenium and the unpurified red elemental nanoselenium are described as ideal forms to supplement the element.

The mortality rates justify the toxicity screen effect of bacterium cells on biologically produced red elemental nanoselenium, which brings the fact that these nanoparticles are less toxic than chemosynthesized ones with the same parameters and physical-chemical properties.

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Lichens – environment bioindicators

Vincukeviciute Greta, Muravskaja Violeta
School of a name of F. Skoriny of the City of Vilnius

selected part and determined the area occupied by lichens.

1. Introduction

The survey was carried out in the area of Vilnius Skorina School and in the nearby forest. The school is in the western part of Vilnius in the Karolinishkiu district. There is a road at the west side of the school, which average traffic intensity increases at the peak hours. There is a grove with installation of garages on the other side of the road.

2. Content

2.1. The purpose of the investigation

- ▶ Research of atmospheric pollution using the method of bio indication in the area of Skorina High School

Research tasks:

- ▶ to investigate the structure of lichen;
- ▶ to get acquainted with variety of lichen species within the school area;
- ▶ to assess the level of air pollution in the territory of Vilnius Skorina High School according to abundance of different morphological lichen groups.

Hypothesis: if we identify a sufficient amount of lichens, we can draw conclusions about the favorable ecological environment of the researched area.

2.2 Method of the investigation

- ▶ We created a map of the investigated area.
- ▶ We divided selected area into squares (10x10)m.
- ▶ We chose 5 trees in each square.
- ▶ We counted the amount of lichen species on each tree.
- ▶ All found species were divided into three groups: flat, leafy, branched.
- ▶ We assessed the tree trunk coverage with lichens. We put the strain of the measuring grid of 10x10 cm on a

2.3. Equations

The overall envelope counted by the formula :

$$H=(100a+50b)/c$$

Relative index of atmosphere pollution

$$(ARU) = \frac{1F+2L+3B}{30}$$

The higher index (ASU), the cleaner lichens growth area.

2.4. Results of the experiment

“Repression zone” – poor lichens flora № 1, 2,3.(ASU: 0.2)

“Normal living zone”; points № 4, 5.(ASU: 0.36-0.46)

3. Conclusion

After revising graphs we can emphasize high indexes in the research facilities such as No 4, and No 5 School area. These items are mostly covered. Slightly lower indexes are in objects **№ 1 A Park Near School and № 2 Roadside**. In these objects lichens are in depressed state. The atmosphere is moderately polluted.

Indexes of object **№ 3 Grove** threaten more. Branched lichens are not found here. There are some species of leafy and flat lichens. The biggest number of atmospheric pollutants are found in this object.

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Honey and other bee products as healthy and natural foods and natural remedies in home

Eleonora Lazarova, Ana Mari Chimeva

SOU. „Vancho Prke”, Vinica, Macedonia eleonoral26@yahoo.com anacimeva@yahoo.com

Introduction

Beekeeping is an important industry known long ago. Beekeeping dates from the 19th century. In our country there are favorable conditions for beekeeping, because mild climate allows the bees to be active 7 -8 months of the year.

The purpose of the investigation

My research on types of bees was a little harder feasible for reasons that included a relatively large number of organisms. According to these studies I came to some conclusions about the organisms that are good to know because their importance to man as well as a number of plants is invaluable.

Method of the investigation (in comparison with known methods)

For this research in nature I visited several places with bees in my immediate surroundings and conversation with several beekeepers who had more years of experience. I watched the bees and their members using special protective suits. Mainly it was my method of work.

Results of the experiment

According to information collected by beekeepers in my area and competent experts in this field I have come to the realization that the territory of the Republic meet four subspecies of honey bees (purebreeds):

- Apis mellifica macedonica (Macedonian bee)
- Apis mellifica carnica (Gray subspecies)
- Apis mellifica ligustica (Italian subspecies)
- Apis mellifica mellifica (Dark subspecies)

These 4 subspecies are represented with 50% of the whole number of the honey-bees, while the other 50% are hybrids, i.e mixed.

Conclusion

We can conclude that bees and their products are very important for human health because the honey has to be one of the most important products in the diet of man. The use of honey prolongs life and prevents.

Nature is our protector, the spring awakens sleepy, love ripple our heart and honey sweetend our soul.



Pic.1 Eleonora the beekeeper.

References

www.pcela.mk

Juice from different fruits contain different amounts of vitamin C, and boiling in a microwave does not kill more vitamin C than boiling on stove

Ana Mancevska, Aleksandra Filipova

SOU. „Vancho Prke”, Vinica, Macedonia a.mancevska@yahoo.com aleksandra.filipova@hotmail.com

Introduction

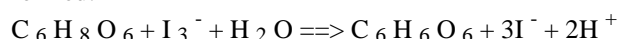
Vitamin C (ascorbic acid) is an antioxidant that is essential for human nutrition. Vitamin C deficiency can lead to a disease called scurvy, which is characterized by abnormalities in bones and teeth. Many fruits and vegetables contain vitamin C.

The purpose of the investigation

To determine whether freshly prepared juice from different fruits contain different amounts of vitamin C and whether the boiling of freshly prepared lemon juice in a microwave oven will kill large amounts of vitamin C than boiling it on the hotplate electric stove.

Method of the investigation (in comparison with known methods)

One way to determine the amount of vitamin C in foods is to use a redox titration. Redox titration is better than the acid-base titration, because there are more acid in the juice, but few of them interfere with the oxidation of ascorbic acid with iodine. Triiodide oxidizes vitamin C and dehydroascorbic acid is formed:



As long as vitamin C is present in solution, triiodide is converted into iodine ions very quickly. However, when all vitamin C is oxidized, iodine and triiodide will be present, which react with starch to form a blue-black complex. Blue-black color is the endpoint of titration.

This titration procedure is appropriate for testing the amount of vitamin C in fruit juices.

By applying this method we established the amount of vitamin C in 1ml freshly prepared juices of kiwi, apple, orange and lemon. Then a certain volume of boiling lemon juice, 15min and 30 min in a microwave oven and hotplate of electric cooker, then in all 6 samples we determinate the amount of vitamin C.

Results of the experiment

mg / ml vitamini C in different fruits:

1ml freshly squeezed juice	mg/ml Vitamin C
kiwi	1,105mg/ml
apple	0,108mg/ml
orange	0.49mg/ml
lemon	0,458mg/ml

mg / ml vitamin C in lemon juice (boiling):

Lemon juice	mg/ml Vitamin C
Boiling (stove)	0,44
Boiled 15min (stove)	0,41
Boiled 30min (stove)	0,37
Boiling (microwave)	0,43
Boiled 15min (microwave)	0,4
Boiled 30min (microwave)	0,36

Conclusion

Equal volume of freshly squeezed juice from different fruits contain different amounts of vitamin C. Boiling kills vitamin C, but boiling in microwave ovens kills more vitamin C than boiling on fire.

References

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EFFECTIVNESS OF GARLIC IN FIGHTING BACTERIA

Mihail Trajkov, Daniel Pesov

SOU. „ Vancho Prke”, Vinica, Macedonia trajkov.miki@gmail.com , d.pesov@gmail.com

1. Introduction

It is well known that garlic has the ability to fight against bacteria and viruses. Antimicrobial substance in garlic is called allicin.

2.1 The purpose of the investigation

To prove whether garlic really is effective in killing: pathogenic bacteria and a strain of the fungi *Candida* spp, (isolated by tongue).

2.2 Method of the investigation

We have selected 11 strains of pathogenic bacteria isolated from different sites (urine, swabs from throat, nose, skin and a layer of the fungus *Candida*, isolated by tongue). They are planted on appropriate bacteriological base, such as: -the gram positive bacteria of the genus *Streptococi* are planted on a Columbia Blood Agar Base; - the gram negative bacteria on a Mueller Hinton Agar base, which serves to make the antibiogram. - Fungus *Candida* is planted on a high selective base for fungi – Sabouraud agar.

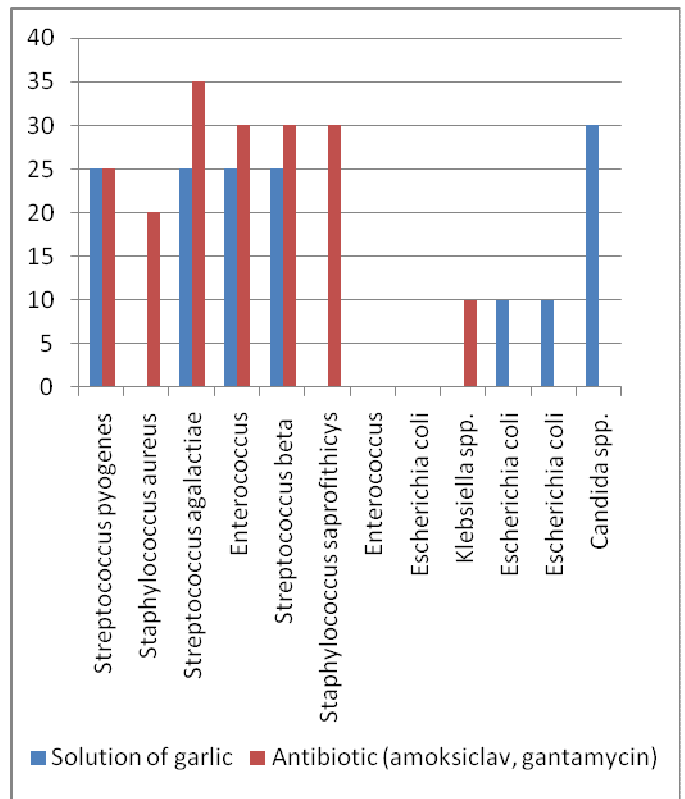
A hole is made on the planted surface with a hole diameter of 2mm, 30 µl of the solution of garlic is added through the hole. At the same time, as control, we made a disc with antibiotic, such as: - amoxiclav (for gram positive) and - gentamycin (for gram negative strains) After this, an incubation is done on all the plates at a temperature of 37 C , in a period of 24 hours, in conditions with reduced oxygen in a container with a candle (for bacteria that require such conditions to grow better).

2.3 Results of the experiment

After the incubation, the reviewed material has given the following results measured as zones of inhibition. The zones of inhibition are measured with ruler and compared with the disk with the antibiotic. The results are shown into the graphic.



Pic.1. Results from the effect of garlic on *Escherichia coli*



Pic. 2. Effect of garlic and antibiotics against pathogenic bacteria and fungi *Candida* spp.

3. Conclusion

The presence of garlic will kill some species of bacteria and prevent their growth

- Acts well on gram positive cocci from the group *Streptococcus*;
- No effect on *Staphylococcus*;
- On some *Escherichias* acts better than the antibiotics
- Excellent effect on the fungi *Candida*.

Candida which is often a result of too much given antibiotic. Perhaps eating garlic when you take antibiotic would prevent development of infections with this fungus, and at the same time would increase the effect of the antibiotic.

References

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A heat stable oxytocin injection

Esther Hazelhoff & Ilvy van der Hoeven

Maartenscollege Haren, the Netherlands

1 Introduction

The University of Groningen is currently investigating methods for stabilizing the hormone oxytocin. Oxytocin causes the contraction of the uterine wall during and after childbirth. It is used in the treatment of postpartum haemorrhages, when injected during or immediately after childbirth. We were given the opportunity to participate in this study and to write our final project on our activities. We have completed this study under the supervision of Prof. Dr. H.W. Frijlink, Dr. W.L.J. Hinrichs and, Ms. C. Avanti M.Sc. They are working on a project to stabilize oxytocin, so oxytocin will not degrade under conditions that are not optimal for oxytocin, like temperatures above eight degrees Celsius. When that goal is achieved it will be possible to use oxytocin also in third- world countries to decrease maternal mortality caused by postpartum haemorrhages.

2 Main question

How do we turn the oxytocin injection into a heat stable product?

3 Theory

Oxytocin is a hormone the body itself is able to produce, but it is also possible to produce Oxytocin via a synthetical route. One of the main properties of the hormone lies in stimulating the contraction of the uterine wall. When oxytocin is injected during or after childbirth it will prevent or decrease postnatal haemorrhages. However, solutions of oxytocin show degradation under circumstances that are too warm. This leads to an unusable medicine in third-world countries.

In our research we formulated oxytocin in a solid state, starting from the liquid state. We did this by using a freeze dryer and including the hormone in sugar. The freeze drying process ensures the molecules are immobilized during the process. The molecules will therefore not clash with one another that much anymore. After oxytocin has been dried it will not degrade as fast as in the liquid state. A complication occurring sometimes during freeze-drying is formation of ice crystals near the molecules. This damages the medicine causing it to lose its effect. To prevent this from happening we used different sugars to coat the medicine. The sugars we used are able to form a perfect layer around the molecules, thus protecting the molecules against ice crystals. To check if this will work in practice, we used HPLC analysis to measure the quantity of active substances and degradation products. HPLC (High Performance Liquid Chromatography) is a separation method based on chromatography.

We used four different sugars in our research: dextran, inulin, trehalose, and a combination of inulin and dextran. The three different test groups we focused our research on, are (figure 1):

Group 1: The liquid oxytocin with each of the dissolved sugars. This group was not put in the freeze dryer (figure 1 liquid unstressed).

Group 2: Oxytocin with a coating of each of the sugars measured immediately after having been in the freeze dryer (figure 1 unstressed).

Group 3: Oxytocin with a coating of each of the sugars freeze-dried, measured after a month in a climate cabinet of 55°C (figure 1 stressed).

4 Results

Freeze drying oxytocin in a sugar coating is an effective way to stabilize oxytocin. As one can see in figure 1, the quantity of degradation products by all sugars is quite small after being a month at 55°C.

We compared the overlapping box plots between the stressed oxytocine and the liquid unstressed oxytocine. We concluded out of this comparison that the oxytocine included in either dextran or trehalose is degrading least.

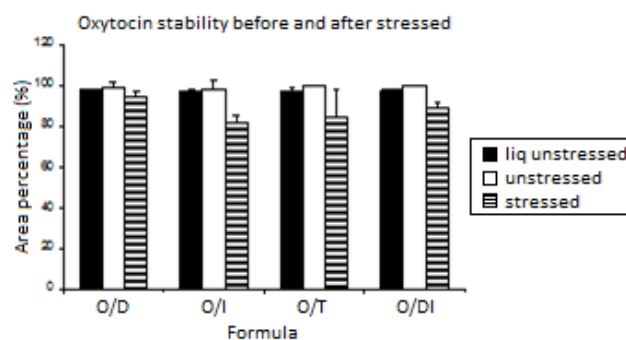


Figure 1: Results (HPLC)

5 Discussion

We achieved our goal finding a way to turn oxytocin into a heat stable product. The study at the University of Groningen aims at developing an oxytocin injection which is stable for three years. Our researchtime was too short to study the quality of oxytocin for this time period. The time during which we have examined is one month. It was a great experience to be given the opportunity in contributing to the decrease of maternal mortality over the entire world.

Ice cream diet

Tomasz Tokarski

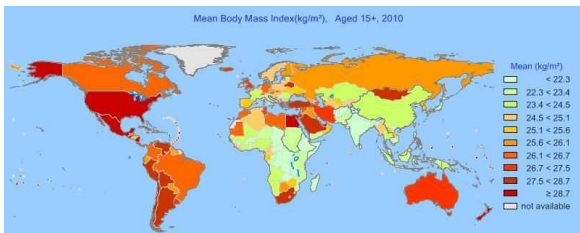
“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 Introduction

An ice cream diet is based on a fact that people are warm-blooded and each product consumed at a temperature lower than the temperature of a human body (36,6°C) needs to be warmed up. As a result, our body burns calories while consuming food at lower temperatures. The aim of my research is to verify experimentally whether it is possible to lose weight while eating ice cream and drinking cold beverages.

2 Obesity in the world

Nowadays, the problem of obesity has become very serious. Most of obese people live in North America, Europe and



Australia, but this problem also occurs in some countries of South America, Asia and even in Africa, as shown in Fig.1.

Fig.1 Obesity in the world

3 Research

3.1 Heating up ice cream

In the beginning of my research I determined the amount of energy needed to heat 100g of ice cream from the initial temperature of -8°C to the human body temperature. Using Eq.(1) I counted the energy our body would burn while heating ice cream.

$$Q = m \cdot c \cdot \Delta T \quad (1)$$

Subsequently, I determined that the amount of energy needed to heat up these ice cream was about 13,5kJ, which is very small as compared to the energy supplied by ice cream (approximately 540kJ).

3.2 Stomach as an isolator

There remains a question whether a human body is fast enough to heat food before it takes energy from the surrounding. Firstly, I determined the drop in the temperature of the water surrounding an ice cube. If we consumed ice instead of ice cream, we would not obtain

any calories while burning some. I noticed a drop of 12°C after only 12 minutes. However, our stomach is isolated. Hence, I made a model of a human stomach surrounded by meat and repeated the previous experiment.

Repeating the measurement, I got a drop in temperature of a 0.5°C after one hour. That shows that without the isolation the ice cream diet would be impossible, however, thanks to the natural insulating layer around the stomach, it is surprisingly efficient. Moreover, as shown in Eq.(2), the burned energy is inversely proportional to the thickness of the isolator.

$$Q = -\lambda \frac{S \cdot \Delta T \cdot t}{d} \quad (2)$$

3.3 Infrared camera

The University of Silesia provided me with an infrared camera, which I used to observe the change of the temperature of human body after drinking a glass of cold water. This experiment assured me that a human body is able to heat consumed food in time less than one hour.

3.4 Tasting temperature

The last part of my research was to check whether colder food is still tasty. Multiple tries showed that after decreasing the temperature the taste of juice was even better. However, too low temperature made the drink tasteless. Therefore, the optimal temperature for the juice to still taste good was determined to be 7°C.

5 Conclusion

Summing up, my experiment showed that a diet using colder food is possible and makes a human body burn more calories, thereby reducing obesity. Moreover, I showed that the human body is a great isolator and it is really fast at heating food.

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LICEUL TEORETIC BRASSAI SÁMUEL

B-dul 21 Decembrie nr.9, Cluj-Napoca, 400150, Tel/Fax (+004) 0264-596159
Email:brassaisamuel.cluj@gmail.com, Web: www.brassai.ro

Ischemic Time As a Key Factor In ST-Segment Elevation Myocardial Infarction

Name, Surname

Mátyás Jakab

Kerekes Stefánia

School, Grade

Brassai Sámuel High School, 11th grade

City, Country

Cluj-Napoca, Romania

Team Name

ROMANIA

E-mail

jakab_matyas@yahoo.com

stefy623@yahoo.com

Scientific advisor, academic degree

Vremir Magdolna, school teacher

vremirmagdolna@gmail.com

1. Background information

STEMI (ST-Segment Elevation Myocardial Infarction) is a medical emergency requiring urgent intervention as the loss of myocardial muscle is directly proportional with ischemic time [time from the onset of symptoms to reperfusion]. Thus, ischemic time is the most important predictor of outcome in STEMI.

2. Purpose

The aim of this study was to determine ischemic time intervals and, implicitly, propose ways of improving chances of survival in STEMI.

3. Method

The study cohort comprised 62 STEMI patients treated at the Niculae Stăncioiu Heart Institute, Cluj-Napoca, Romania. A questionnaire was used to collect data regarding ischemic time intervals, risk factors and unstable angina. The data were processed with Microsoft Excel 2003 and OpenOffice.org Calc.

4. Results

The average length of ischemic time was of 9 hours and 12 minutes, which fits into the 12-hour frame during which medical intervention can be carried out. Of these 9 hours and 12 minutes, an average of 2 hours and 56 minutes passed from the onset of chest pain to emergency service call.

The investigation of risk factors showed that most patients were either smokers or had high blood pressure while less than half of them suffered from diabetes or high cholesterol levels.

A key factor in predicting an imminent myocardial infarction (MI) is unstable angina (UA), which resembles the pain experienced during a MI, only it is less intense and fades away (as opposed to the intense and constant pain of a

MI). It must be noted that UA was present in nearly half the patients a few days prior to their infarction.

5. Conclusions

One of the most significant findings was the long time period elapsed between the onset of STEMI and the call to an emergency service. This time, during which nothing is done to treat the coronary event, is particularly important because it represents the first hours of the infarction, when most deaths occur. It also expands the total ischemia time, which is inversely proportional with the chances of survival. Patients should ideally call an ambulance immediately after having experienced chest pain for more than 20 minutes. The population must therefore be informed about the seriousness and symptoms of a MI.

The number of infarctions could also be reduced by avoiding the risk factors involved (smoking, high blood pressure, diabetes and high cholesterol levels). Changes in eating habits and adequate patient information are crucial in this respect.

Keywords

STEMI, ischemic time, risk factors, unstable angina

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Polymorphisms of the vitamin D receptor gene and alpha-1 chain of collagen type I gene in children with scoliosis.

Ivan Alvovsky

Laboratory for Continuous Mathematical Education, Saint-Petersburg State Pediatric Medical Academy

Background

The adolescent idiopathic scoliosis (AIS) is a spinal deformation that progresses in adolescence during the accelerated growth of the body. Congenital scoliosis includes spine distortion arising from abnormally developed spinal bones and is formed prenatally. Scoliosis is a multifactorial disease characterized by genetic predisposition and environmental influence.[1] Presently, several candidate genes have been known to involve in metabolism of the bone tissue, among them, vitamin D receptor gene and alpha-1 chain of collagen type I gene. It is known that the SpI (rs1800012) and PCOL2 (rs1107946) polymorphisms of the gene which encodes alpha-1 chain of collagen type I (*COL1A1*), and the TaqI (rs731236) and Cdx-2 (rs11568820) polymorphisms of the gene which encodes vitamin D receptor (*VDR*) are associated with spine bone mineral density (BMD) with process of bone remodeling. In addition, it is known that the TaqI polymorphism of the *VDR* and SpI polymorphism of *COL1A1* are in cooperation. [2,3]

Objective

We studied the distribution of alleles and genotypes of the SpI and PCOL2 polymorphic sites of the *COL1A1* and Tag1 and Cdx-2 polymorphic sites of the *VDR* genes in children with congenital and idiopathic scoliosis.

Design

193 children with congenital vertebral anomalies, 150 children with idiopathic scoliosis, and 85 children without spine deformation as a control group.

Materials and methods

Genomic DNA was isolated from the blood samples by phenol chloroform extraction. Then, polymerase chain reaction (PCR) and restriction analysis have been conducted. The restriction products were analyzed for sequence variations by gel electrophoresis. Statistic analysis included

Chi-square test and Fisher's exact test for confidence level $p < 0,05$.

Results

The allele and genotype frequencies of the studied genes did not differ significantly from the theoretically expected according to the law of Hardy-Weinberg equilibrium. The statistic analysis revealed the following variation of allele frequencies in the groups: A-allele frequency of the *VDR* Cdx-2 polymorphism in the idiopathic scoliosis group was 19%, in the congenital scoliosis group – 20%, and in the controls - 16% ($p = 0,545$); C-allele frequency of the *VDR* TaqI polymorphism in the idiopathic scoliosis group was 34%, in the congenital scoliosis group – 38%, and in the controls - 31% ($p = 0,265$); T-allele frequency of the *COL1A1* SpI polymorphism in the idiopathic scoliosis group was 14%, in the congenital scoliosis group – 19%, and in the controls - 12% ($p = 0,106$); T-allele frequency of the *COL1A1* PCOL2 polymorphism in the idiopathic scoliosis group was 19%, in the congenital scoliosis group - 15%, and in the controls – 22% ($p = 0,177$). The distribution of alleles and genotypes in the control group did not differ significantly from that in the groups of children with congenital and idiopathic scoliosis. The hypothesis of an association of the genetic polymorphism with scoliosis, both congenital and idiopathic, has not been confirmed.

Conclusion

There was no statistically significant difference in allele and genotype frequencies of the studied genes in the groups of children with scoliosis, compared to the controls.

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Genetic diversity of Sungyod rice in Phattalung province, Thailand

Nutchaya Sukon

Mahidol Wittayanusorn School, Thailand, nutchayasukon@gmail.com

1 Introduction

Sungyod rice is traditional rice widely planted in Phattalung province, Thailand. It has special traits compared to others: a) it is the red unpolished rice containing high vitamin B1 and niacin b) it is rather soft and sticky when it is cooked. Thus, it is prevalingly used for consumption. Though, Sungyod rice has different qualities among themselves. Therefore, the Rice Research Institute in Phattalung province has selected the Sungyod rice species from Bangkaew district, Phattaluang province with mass selection method; this species has been promoted to plant widely because of high productivity.

2 Objectives

The specific objective is as follows: a) to study the genetic relationship between Sungyod, Bangkaew district and Sungyod (GI: Geographical Indications) b) to study the genetic diversities of Sungyod compared to others: Chiang Phattalung, Lebnok Pattanee, Khaodokmali 105, and Suphanburi 1.

3 Methods

This study including two main parts: morphology part and genetic diversity part. For morphology part, the Sungyod rice that has been chosen from 5 different areas; Sungyod rice GI, Lebnok Pattanee, Chiang Phattalung, Khaodokmali 105 and Suphanburi 1, each was studied about four main characteristics including leaf collar color, leaf auricle color, clump and height.

For genetic diversity part, Plant Direct PCR (Polymerase Chain Reaction) kit was used in dilution protocol; take five pieces of 2 mm x 2mm size green leaf tissue and place it in 20 µl of Dilution Buffer. Crush the leaf sample with a 100 µl pipette tip by pressing it briefly against the tube wall. After crushing the leaf, the solution will be greenish in colour. Spin the plant material down, and use the supernatant as a template for a 10 µl PCR reaction [1].

A total of 10 µl /sample of the PCR reaction mixture was prepared by adding 4 µl of distilled deionized water, 5 µl 2 x buffer, 1.6 µl dNTPs, 0.4 µl primer (forward), 0.4 µl primer (reverse), 0.25 µl template DNA, and 0.2 µl Hot Start DNA polymerase in a 0.5 ml PCR tube. Twenty four microsatellite markers, RM1, RM11, RM44, RM55, RM105, RM118, RM125, RM161, RM133, RM152, RM162, RM178, RM215, RM259, RM271, RM307, RM338, RM408, RM413, RM452, RM474, RM489, RM495, RM510 were used. Forty cycles of PCR were performed with 5 sec denaturation at 98°C, 5 sec annealing

at 55°C, and 5 sec polymerization at 72°C. Aliquots of 1 µl of reaction mixture containing the PCR products were loaded for each sample in a 6.0% polyacrylamide gel in 0.5 TBE buffer. Amplified DNA products and 10 bp DNA ladder were run in electrophoresis for 1 hr at 80 watt, 45 degree Celsius and then stained with Silver nitrate. The DNA banding patterns were photographed and translated to be code for creating dendrogram.

4 Results

For morphology part, green leaf collar, green leaf auricle and V-shape clump is prominent in all group. Moreover, Suphanburi 1 (improved rice) has the shortest when compare with others (traditional rice).

For genetic diversity part, after analyzing the information from DNA banding patterns by TFPGA program, the diagrams below show the result of the process.

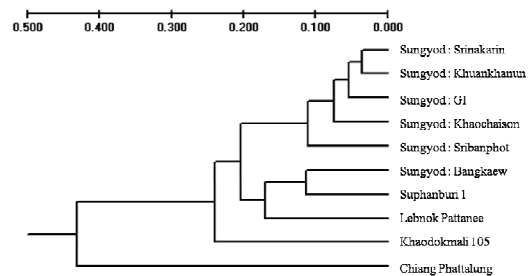


Diagram 1 Dendrogram of rice in all groups

5 Conclusion

After conducting the morphology analysis with SSLP technique, the study reveals that Sungyod rice from Phattalung, both GI and non-GI, are classified in the same group whilst Sungyod rice from Bangkaew district is found to have similar characteristics to Lebnok Pattanee rice and Suphanburi 1 rice. This study suggests that Sungyod rice from Bangkaew would be classified in the same group as Sungyod rice that has been genetically reengineered, whereas the Suphanburi 1 rice could not be grouped with other typical rice species.

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Antioxidant Activity from Local Plants

Yosapol Harnvanichvech

Sriboonyanon School, Thailand, ping_red_x@hotmail.com

1. Introduction

Free radical is an unstable atom or group of atoms unstable molecules that are highly chemically reactive within our body's cells. These can cause cellular damage, impairing the immune system and leading to degenerative diseases such as cancer and rheumatic disease^[1]. Thus, this investigation will focus on the free radical properties of five local medicinal plants, that have been accepted by the Thai Alternative Physician. The five local medicinal plant species are namely: *Alchornea rugosa* (Khang poi), *Ageratina adenophora* (Sap ma), *Ruellia tuberosa* (Toi ting), *Mimosa pudica* (Maiyarap) and *Cyperus rotundus* (Yaa hao muu).

2. Paper submission

2.1 Free radicals are atoms or molecules or ions with unpaired electrons cause them to be high-energy particles and unstable molecules. This reaction causes them to be highly reactive with biological molecules.

2.2 Determination of medicinal plants efficiency by using effective of concentration at 50% (EC₅₀)

3. Basic formatting instructions

3.1 Crude Extract Preparation

1) The five samples of medicinal local plants are cleaned by soaking water, sliced into pieces, dried in oven at 50°C for 3 days, and pulverised into powder.

2) Weighed 100 g of each sample powder and macerated with ethanol 80% for 7 days.

3) To filtrate the samples from number.2) and evaporated under pressure using rotary evaporator.

4) Calculation % yield by dried weight powered drug.

$$\% \text{ Yield} = \frac{\text{Weight of dried extract}}{\text{Weight of powered drug}} \times 100$$

3.2 Testing Antioxidative activity

1) Preparation the samples solution of 1.56, 3.125, 6.25, 12.5, 25, 50, 100 and 200 ug/ml

2) Preparation of DPPH at the concentration of 60×10^{-4} M

3) To pipette 0.5 ml of DPPH into each sample and measures the value of light absorbance by UV – Visible Spectrophotometer

4) Calculation for % Inhibition

$$\% \text{ Inhibition} = [(A_B - A_A) / A_B] \times 100$$

A_A = Absorbance of sample with DPPH

A_B = Absorbance of Control

5) To formulate the linear function from the derived % Inhibition and Effective of concentration at 50% as below :

$$EC_{50} = 50 - c/m$$

where

c = constant value

m = slope of linear equation

3.3 Testing for Chemical compounds

Determination of chemical compounds by chemical screening of alkaloids, anthraquinone, cardiac glycoside, flavonoid, lactone glycoside, saponin and tannin.

3.4 Chromatographic Finger prints by TLC

1) To dissolve each 0.5 mg of crude extracted samples with ethanol 80% 1 ml

2) To pipette the sample from number 1) and spot on Silica gel 60 F₂₅₄ (Stationary phase)

3) To prepare mobile phase with the volume of 100 ml of dichloromethane : methanol (90 : 10)

4) To put the TLC plate into the tank with mobile phase, wait until the mobile phase move to the end of the plate. Taking out the plate and examined under ultraviolet wave length of 254 and 366 nm.

4. Content

4.1 The purpose of the investigation

1) To investigate the percentage of medicinal plant dried extract (% Yield)

2) To compare the properties of free radical extract from medicinal plant samples with the standard reference of butylated hydroxytoluene (BHT) by using DPPH radical scavenging method

3) To investigate the chemical compounds of the plants by using Professor Farnsworth's Phytochemical screening

4) To investigate chemical compounds by using Thin Layer Chromatographic Finger print

4.2 Method of the investigation (in comparison with known methods)

DPPH Radical Scavenging Assay (Yamasaki *et al.*, 1994) is a testing of antioxidation by using the sample compound reacts with the violet colour of the stable free radical DPPH (1,1-diphenyl-2-picrylhydrazyl). When the DPPH was obtained by electron or free radical, the hydrogen will change to DPPH : H.

Professor Farnsworth's phytochemical screening (Farnsworth, 1966)

is a testing for chemical compounds in the plants based on reactive colour or suspended sediment. It is a testing chemical compounds of alkaloids, anthraquinone, cardiac glycoside, flavonoid, lactone glycoside, saponin and tannin.

Thin layer chromatography (TLC) is a chromatographic technique for qualitative and quantitative analysis. Thin layer chromatography is performed on a sheet of glass, plastic or aluminum foil, which is coated with a thin layer of absorbent materials, usually silica gel, aluminium oxide, or cellulose. This layer of adsorbent is known as the stationary phase.

4.3 Results of the experiment

The experiment results of %Yield of dried extracts, free radical antioxidant properties and chemical compounds of the five medicinal plants species are shown in Table 1. The TLC finger print is also shown in Figure 1

Sample	Result		
	% Yield	EC ₅₀ (µg/ml)	Chemical Compound
<i>Alchornea rugosa</i>	2.65	4.85	Hydrolysable tannin, Flavonoid
<i>Cyperus rotundus</i>	1.97	9.26	Hydrolysable tannin, Condensed tannin, Flavonoid
<i>Mimosa pudica</i>	1.24	12.32	Condensed tannin
<i>Ageratina adenophora</i>	8.4	12.77	Polyphenolic compound
<i>Ruellia tuberosa</i>	1.66	72.30	Lactone glycoside
Standard (BTH)	-	13.58	-

Table 1 The experiment results of %Yield of dried extracts, free radical antioxidant properties and chemical compounds of the five medicinal plants

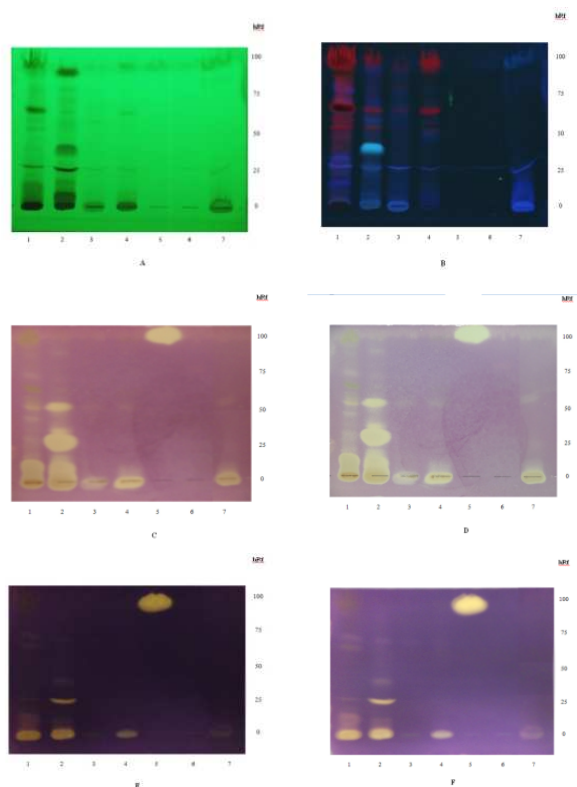


Fig. 1 TLC finger print of medicinal local plants.

5. Conclusion

By the comparison of extracted medicinal plants and reference standard, BHT it was found that the corresponding EC₅₀ values of extracted *Alchornea rugosa*, *Cyperus rotundus*, *Mimosa pudica*, and *Ageratina adenophora* were 4.20, 9.26, 12.39, and 12.77 µg/ml, respectively. These antioxidative properties were better than the reference standard, BHT (EC₅₀ = 13.58 µg/ml). *Alchornea rugosa* is the highest antioxidant which greater than 2.8 folds of the standard BHT. The chemical compounds of *Alchornea ragosa* are hydrolysable tannin and flavonoid. The research finding materials had been also reported by several Journal and Theses both in and other countries which said that it is an effective antioxidative agent.

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Development of A New Product That Abate Bleeding Time

Beste Dönmez, Umit Karaca

Izmir Private Fatih Science High School, ukaraca2006@gmail.com

Purpose

Bleeding is one of the most important problems of humanity for years [1]. Even deaths occur due to excessive blood loss [2,3]. In this study;

-Developing a new product that can be used to reduce the bleeding time and can be prepared easily.

-Obtaining a new biotechnological product and submitting to the scientific world.

-Developing a new product that has a faster, cheaper and applicable preparation technique were intended.

In this respect;

-Determining the enzyme that will be used in the product,

-Determining the biocompatible substance that will be used in product,

-Determining immobilization method,

-Determining immobilization variables on immobilization of enzyme with compatible substance,

-Determining optimum conditions for immobilization were aimed.

Method

2% sodium alginate and 3% CaCl₂ solution are prepared for beads. 2% sodium alginate solved at room temperature and waited at +4°C. After degassing at vacuum, 10ml sodium alginate was added drop by drop into 100ml CaCl₂ solution. Optimization of thrombin immobilization was investigated on calcium alginate. For determine the effect of pH on immobilization, pH 3, 4, 5, 6, 7 and 8 buffers were created and immobilization procedures was made with each swab. To determine the effect of immobilization time on immobilization process, enzyme was incubated with beads at 0,25-0,50-1-2 and 4 hours. Immobilization was made 4-15-25-37 and 45°C to determine optimum temperature. 2, 5, 10 and 25 beads were used to determine the ideal number. In order to determine the effect of initial enzyme activity, 5 different enzyme activity between 0.075 and 0.9 U were studied. Lastly, recalssification testing on normal blood and the blood by adding immobilized calcium alginate was performed.

Results

It is aimed to develop a new product that reduces the duration of bleeding, easy to prepare and low cost with this project. These study optimum conditions were determined for immobilization. Isoelectric point of thrombin is between 6.35 to 7.6 pH. thrombin activity was

measured, immobilized at different pH values, and determined optimum pH value 5.

Enzymes bioactive compounds and have the specific activities. Over time, they lose enzymatic activities by denatured and enzymes that lost their activities can not serve their purpose. Beads were immobilized with enzymes on 0.25-0.5-1-2-4 hours. When the activity measurement was made the optimum time was determined as 2 hours.

When the temperature increases, chemical reaction rate increases too. So enzymes loose their activity. In 5 different temperatures were studied between 4-45°C and the optimum temperature was determined +4°C.

While the number of beads increase, the surface area of interacted the enzyme is increase too. Immobilization was performed by working 2-5-10-25 number of beads and the optimum number of beads were determined as 5.

Enzyme preparation has very low protein content. Because of not determination the amount of protein through the connecting, I have expressed over the activity of thrombin. To determine the optimal thrombin 0,075-0,15-0,3-0,6 U initial activity of the enzymes were studied and the optimum initial activity was determined as 0.6 U.

Conclusion

When looking at the effect of the duration of recalssification on beads that immobilized in optimum conditions, reduce the duration of bleeding was detected on 50% on the same blood.

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INVESTIGATION OF THE IMMUNE RESPONSE OF HUMAN PERIPHERAL BLOOD MONOCYTES AGAINST BACTERIAL RECOMBINANT GROEL PROTEIN

Defne Angin, Umit Karaca

Izmir Private Fatih Science High School, ukaraca2006@gmail.com

process had been repeated twice, 500 μ l 1x PBS was added.

Purpose

Immune system is a defense mechanism that protects the organism against pathogenic microorganisms and toxic substances^[1]. The response to the pathogens and toxic substances changes according to the type of organic molecules of which the pathogen carried or produced. *A. actinomycetemcomitans* (*A.a*), is a bacteria which lives in oral cavity and shows its pathogenic activity with different types proteins^{[2][4]}. One of these proteins is GroEL protein which is bacterial homologue of human heat shock protein (HSP) 60^[3]. The aim of this project is to investigate the effects of bacterial recombinant GroEL (rAaGroEL) on the IL-12 and IFN- γ amounts which expressed by monocytes isolated from human peripheral blood and to determine the time-dependent change in these cytokines amounts when GroEL amount is stable.

Method

Mononuclear cells of 50 cc blood which has been taken from a healthy donor was isolated by Ficoll peripheral blood mononuclear cell (PBMC) isolation method. Briefly, first the blood was centrifuged at 1500 rpm for 5 minutes to separate the serum and blood from each other. After the serum had taken, blood was diluted with 1x PBS. Diluted blood was spread on 10 mL Ficoll-Paque in falcons. Falcons were centrifuged at 2500 rpm for 25 minutes. After, the mononuclear cells were taken to 50 mL tubes and 45 mL RPMI was added on for washing step. Tubes were centrifuged at 2500 rpm for 5 minutes. Supernatant was removed, washing and centrifuge steps were repeated as same. 15 mL RPMI + 10% FBS (complete medium) added on tube and homogenized with pipette. After cells were counted and total cell amount was calculated, 2×10^6 cell / mL were put in culture tubes with required chemicals (RPMI on negative control, 20 μ g/mL rAaGroEL on test group, 20 ng/mL and 1 μ g/mL PMA/I on positive control). 4 hours before the end of culture times (6,12,24,48,72,96 hrs), 10 μ g/mL GolgiStopTM had been added into tubes and tubes were homogenized with vortex. After, tubes incubated for 4 hours. 4 hours later, tubes were centrifuged at 1500 rpm for 6 minutes in +4°C. After supernatant had been taken by vacuuming, 500 μ l 1x PBS was added into each tube, centrifuge process was repeated as same and cell surface labeling markers were added into tubes. Cells had been incubated in dark for 20 minutes and after, washing process (500 μ l 1x PBS, 1500 rpm centrifuge and vacuum) was repeated. 200 μ l fix buffer was added, tubes were homogenized with vortex and incubated for 10 minutes in dark. Washing process was repeated twice as same, 250 μ l perm buffer was added into tubes and tubes homogenized with vortex. After cells had been incubated for 20 minutes in dark, intracellular staining was done after supernatant had been removed and cells incubated for 30 minutes in dark. After washing

Results

After cells had been labeled with cytokine antibodies, they were analyzed with BD FACSAArray flow cytometer. Intracellular cytokine staining process was done to determine IFN- γ and IL-12 cytokine expression. The results of highest IFN- γ and IL-12 amounts were measured at 72th and 16th hours (Figure 1 and 2). When monocytes stimulated with rAaGroEL at 16th hour, IL-12 amount increased 228% according to negative control group. According to time-dependent IFN- γ graphic (Figure 3), IFN- γ amount was reached to highest amount at 48th and 72th hours. At 72th hour, IFN- γ expression of monocytes increased 236% according to negative control group.

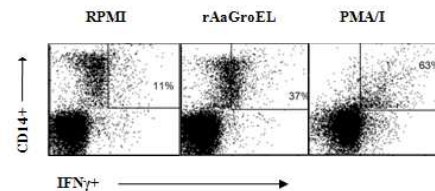


Figure 1: IFN- γ expression of monocytes at 72th hour

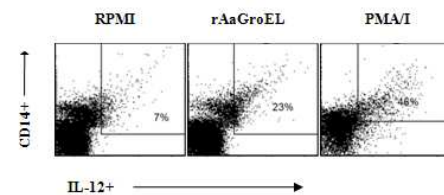


Figure 2: IL-12 expression of monocytes in 16th hour

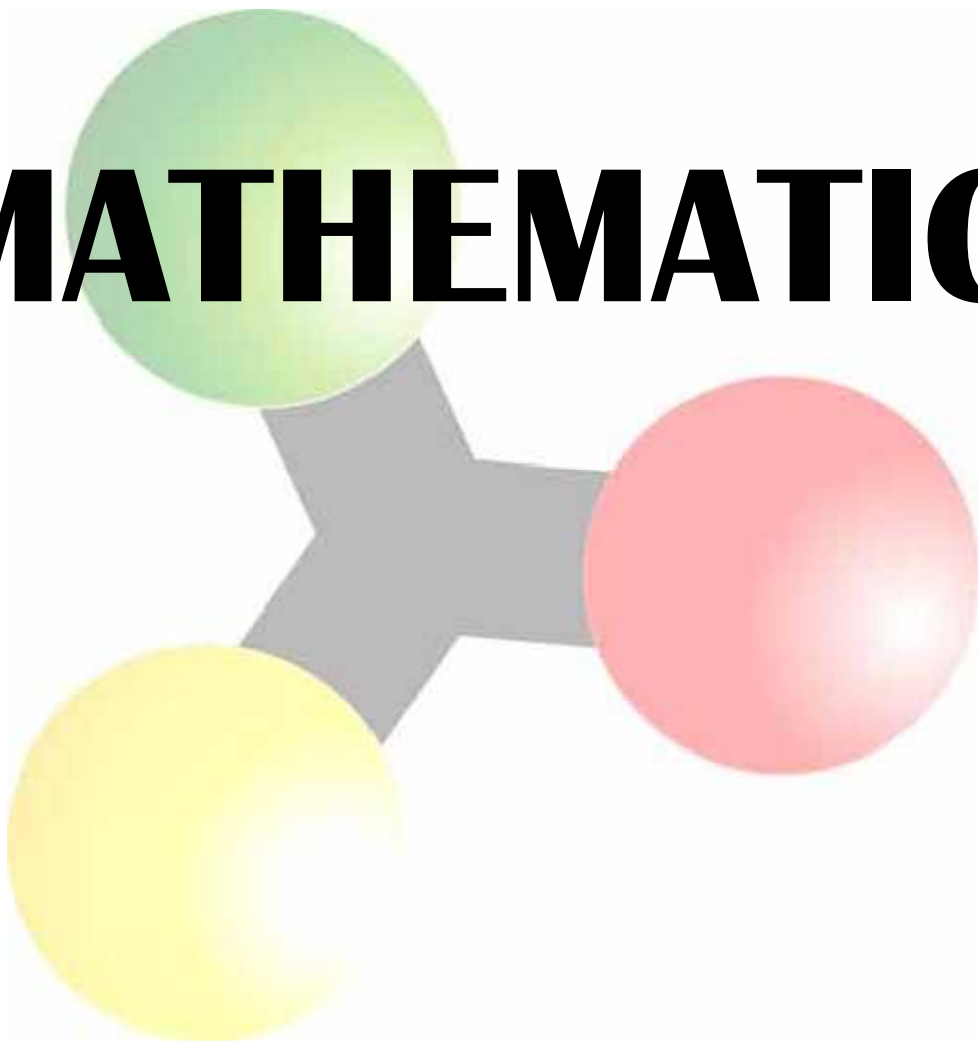
Conclusion

As a conclusion, it has been determined that after monocytes had been stimulated with bacterial recombinant GroEL protein (rAaGroEL), they increased IFN- γ and IL-12 expression. In this study, depending on CD4+ T cell differentiation to T_H1 phenotype by these cytokines which activated monocytes express, the important role of bacterial recombinant GroEL in immune response manipulation has shown.

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MATHEMATICS



Property the graph of a linear operator

Aliaksei Ivanin

Secondary school № 41, Minsk, Belarus

Currently, great attention is paid to the numerical estimates of graphs of the operators. In particular, these characteristics are used to assess the quality and reliability of cryptosystems.

Consider the set $Z_p^n = \{(\alpha_1, \alpha_2, \dots, \alpha_n) \mid \alpha_i \in Z_p, i = \overline{1, n}\}$ and a linear operator over the field Z_p $\psi : Z_p^n \rightarrow Z_p^n$.
 $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n) \xrightarrow{\psi} \beta = (\beta_1, \beta_2, \dots, \beta_n), \forall \alpha \in Z_p^n$

We consider the state graph G_ψ , with $V(G_\psi) = Z_p^n, E(G_\psi) = \{(i, \psi(i)) \mid i \in Z_p^n\}$. We concentrate on the study of the structure of the graph G_ψ .

Theorem 1

Each connectivity component of the graph G_ψ is a cycle whose vectors are attracts the tree.

Theorem 2

«Null» tree – p -nary tree accurate within a loop at the root $(0, 0, \dots, 0)$ if $\text{def}(\psi)=1$.

Theorem 3

Each tree, attracted by each vertex of each cycle of the graph G_ψ , isomorphic to the "null" tree.

Theorem 4

If ψ describes functionality of ACS-automaton* then:

if $p=2$ and $n = p^k(2l-1)-1$ where $l \in \mathbb{N}$ $k \in \mathbb{N}_0$ then tree's height equals: $p^k - 1$;

if $p \neq 2$ and $n = p^k(2l)-1$ where $l \in \mathbb{N}$ $k \in \mathbb{N}_0$ then tree's height equals: p^k .

Theorem 5

If ψ describes functionality of operator of a taking of a difference** and $n = p^k l$ where $l \in \mathbb{N}$ $k \in \mathbb{N}_0$, $(p, l) = 1$ then tree's height equals: p^k .

We give algorithms, for constructing graph with $\dim(\ker(\psi))=1$ and $\dim(\ker(\psi)) \neq 1$, series of statements and estimates lengths were proposed. We also investigated the properties of integer-valued polynomials.

The results can be used for the study the properties of various operations [2], and for research of the systems, which operating by a linear rules (diffusion, combustion processes, etc.).

In this study, the proofs are mainly based on combinatorial methods. Some of the results were investigated and proved in [1] using linear algebra (Theorem 1, Theorem 2). Theorem 5 was formulated in [1] and proved in the case $p=2$. In this paper, study of the trees over the field Z_p has been completed.

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* $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n) \xrightarrow{\varphi} \beta = (\alpha_2, \alpha_1 + \alpha_3, \alpha_2 + \alpha_4, \dots, \alpha_{n-2} + \alpha_n, \alpha_{n-1}), \forall \alpha \in Z_p^n$, where $\forall i = \overline{1, n}$

** $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n) \xrightarrow{\omega} \beta = (\alpha_2 - \alpha_1, \alpha_3 - \alpha_2, \dots, \alpha_n - \alpha_{n-1}, \alpha_1 - \alpha_n), \forall \alpha \in Z_p^n$, where $\forall i = \overline{1, n}$

The Diophantine Well

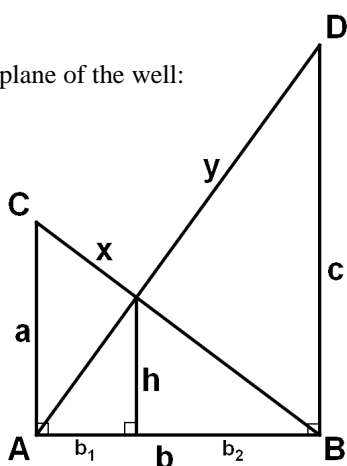
Felix Dörre, Dean Hrle, Randolph Scholz

Student Research Centers Baden-Württemberg, Randolf.Scholz@host4post.de

1 Introduction

Imagine a man throws two sticks of the lengths x and y into a well of the width b , so that they lie parallel to each other, cross themselves in the height h and touch the opposite wall of the well in the heights a and c (see drawing).

Slice plane of the well:



The original problem associated with the above figure was to calculate the width of the well for given values of x , y and h which is not possible by elementary constructions. In an article of the German edition of the *Scientific American* it was asked for a certain configuration in which all variables have integer values. We became interested in these wells and our work deals with them. To have a short notation we call them “*Diophantine Wells*”.

Especially we calculate the flattest (i.e. minimal value of a and c) and the narrowest (i.e. minimal value of b) Diophantine Well with integer values.

2 Our solution

We found a procedure to construct any existing *Diophantine Well*. It consists of 4 steps:

1. Construct 2 right angle triangles $\triangle ABC$ and $\triangle ABD$ in which all sides are of integer lengths.
2. Dilate both triangles with an integer factor so that they get a common cathetus (which is going to be the width of the well).
3. Expand both triangles so that the height h becomes integer.
4. Simplify all variables (this step is optional if there is taken care of keeping the variables simple in step 1-3)

Now the single steps are going to be explained in more detail. In the first step we use Euclid's formula^[1], which

basically says that for every primitive Pythagorean triple^[2] $\{a,b,c\}$ there exists a pair of integer numbers $\{s,t\}$ so that $a=st$, $b=s^2-t^2$ and $c=s^2+t^2$, in order to create 2 right angle triangles with integer side lengths.

In the second step we generate the least common multiple of any 2 catheti of the triangles $\triangle ABC$ and $\triangle ABD$. Then we dilate both triangles with the corresponding factor so that in the end they have a common cathetus.

In the third step we express h in dependence of the other variables and dilate the well sensibly, so that h becomes integer as well.

And finally in the last step, as all the variables are integer, we can simplify the solution 6-tuple $\{a,b,c,x,y,h\}$ by dividing all the variables with the greatest common divisor of the variables.

3 Conclusion

It is possible to construct every Diophantine Well using the given procedure which we also implemented in a Java program with which's help we constructed all wells with $\{s,t\}$ of step 1 being smaller or equal to 50. Under all these configurations we found the narrowest and flattest wells^[3], due to the fact that if $\{s,t\}$ were greater than 50 the starting triangle would be already bigger than what we found.

[1] Euclid's Elements: Book X, Proposition XXIX

[2] A primitive Pythagorean triple consists of 3 integer numbers $\{a,b,c\}$ which fit the Pythagorean Theorem $a^2+b^2=c^2$ and in which the greatest common divisor of $\{a,b,c\}$ equals 1.

[3] Narrowest well: $\{399,40,42,401,58,38\}$
There are actually 2 flattest wells:
 $\{84,80,60,116,100,35\}$ and $\{63,60,84,87,105,35\}$
(The values are listed in the order of the variables $\{a,b,c,x,y,h\}$, see the figure above)

JavaNim: Traditional Game Perfects Mathematic Game

Christa Lorenzia Soesanto

Santa Laurensia Senior Highschool, Indonesia, christa.lorenzia@yahoo.com

1 Introduction

Technologies enable people to play any kinds of modern games for hours; however there is a tendency that people nowadays leave all the traditional games which are supposed to be the national heritage. One of which is “Damdas 16 Batu”, one of Indonesian traditional games that is originated from Central of Java. The fact that most people might not know about the traditional game inspired the reseachers to synthesize “Damdas 16 Batu’ and ‘NIM’ - a simple well-known Mathematics game- into a single game which is more interesting, attractive and twisting.

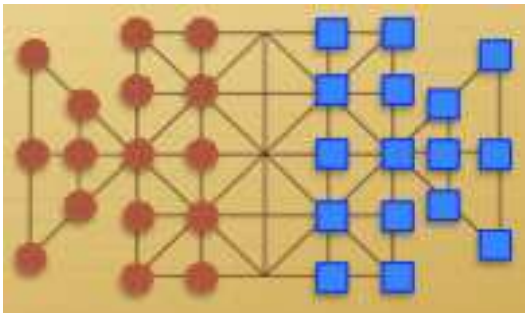


Fig 1. Damdas 16 Batu

2 Content

2.1 The purpose of the investigation

Preserving Indonesian traditional game by synthesizing and modifying the games with NIM into a new fair game as well as covering NIM’s weakness. This project also investigates the new representation of best strategy to win the NIM game.

2.2 Method of the investigation

Elaborating on literatures about the NIM, especially the winning strategy known as NIM Sum. A thorough observation on a more efficient method to pose the strategy of NIM game. After synthesizing the games and designing the new rules, the difficulty and complexity are tested to know the fairness of the game.

2.3 Results of the experiment

The best strategy of NIM presented in 3-dimensional Cartesian graph succesfully lead people in winning the NIM game with up to 3 piles in the configuration along with spotting the weakness of NIM. The game results in a much fairer match between the first and the second player

as Damdas 16 Batu successfully deal with NIM’s deficiency.

3 Conclusion

The simple yet brilliant traditional game will be a phenomenal brain teaser which develops the players’ critical and logical thinking. Graph is applicable and effectual to represent the best and systematic strategy of NIM. The combination of Damdas 16 Batu and NIM constructs a much more twisted match that results to a fair game.

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Fibonacci Mathemagics

Michael Sunarto

Indonesia, Chandra Kusuma School Medan (Cemara Asri residence, Deli Serdang, North Sumatra)

Most of the students always dislike math because they think that math is hard and difficult to be understood. The author want to introduce another ways to learn math fun and easier. For these purpose there are some magic tricks that make math fun and some formula make it easier.

Fibonacci was the name of an Italian mathematician, considered by some people as the most talented western mathematician of the middle age. In mathematics, the Fibonacci numbers is a number sequence which is defined recursively as follows: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946 ... etc.

Comparison between the two consecutive numbers is almost always the same and began to certain values

of numbers, this ratio value is fixed. The comparison is called the Golden Ratio which is close to 1.618.

This research uses the basic principle of algebraic equation. The algebraic equation is very helpful in to find the nth term of the Fibonacci sequence. And also used the principle of diophentine theory to find the first and the second term. Thus, the main objective of the author research is to find the sum of the Fibonacci sequence.

The author hopes this research will give benefits in the development of mathematics and science in the future studies and also to introduce this Fibonacci to the modern era.

The Ellipse

Rinse Liefferink

Jan Willem Passtraat 50, Nijmegen, Netherlands, rinseliefferink@gmail.com

When wanting to draw a bowl, a bit from the side, one often unconsciously is drawing an ellipse. Thus an ellipse is drawn as a depth image of a circle. Furthermore the ellipse is to be found as a planet orbit in astronomy.

So what exactly is an ellipse? With this question I started my research, which was then divided into four sub-questions.

1) How can an ellipse be constructed?

In my project I took up a number of simple construction methods. The most well-known and most frequently used construction is the pins-and-string method which can be carried out with a piece of string, two pins and a pencil.

In order to draw an ellipse even faster ellipsographs were designed in the 17th century. They are compasses for an ellipse. Stevin, a Flemish scientist, and Van Schooten and Huygens, two Dutch scientists, designed such ellipsographs.

However, the ellipsographs have been made superfluous by the computer. The computer is able to construct an ellipse with the help of methods which are too time-consuming and complex when executed by hand.

2) What is the history of the ellipse?

Ancient Greeks investigated the various conic sections and assigned names to them: the parabola, the hyperbola, the circle and the ellipse. Many mathematical properties of the ellipse were already known to them.

Much later, in the 19th century, developments around the ellipse once more took a flight. After Copernicus had completely rejected the geocentric world view and came to realize that we live in a heliocentric world, Kepler discovered that the planets orbit the sun in ellipses. Newton extended the laws Kepler had stated and proved them on the basis of his own laws, after which a relation was established between a planet's orbital period, its distance to the sun, and the masses of the two celestial bodies.

3) How can an ellipse be defined?

For an ellipse five mathematical descriptions can be given. Each has its own appeal and each has its own appropriate application. From geometry the description of conic sections and the focus – focus description are known. With the formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ Descartes provided an algebraic definition. Furthermore there are two descriptions from analytical geometry: The focus – directrix description and

the circle – factor description. In my project, I showed that all five descriptions result in one and the same curve (e.g. as shown in Fig. 1).

4) What other properties does an ellipse have?

The ‘shadow ellipse’ and the ‘tangent property of an ellipse’ are the subjects I finished this project with.

‘The shadow ellipse’ deals with the ellipse occurring as the shadow of a circle. Evidence for certain cases is given, after which we are able to discuss the eccentricity of the shadow ellipse. The eccentricity of the shadow ellipse is mostly determined by the position of the sun, namely the angle of the light with the circle plane.

The tangent property describes that rays sent from one of the foci and reflected on the ellipse curve will always converge in the other focus of the ellipse.

Taj Mahal

The tangent property can be clearly observed in the ‘Hall of Whispers’ in the vast building of the Taj Mahal. This hall was formerly used to celebrate marriages. Bride and groom stood in special places in the hall, 15 metres apart and whispered their vows to each other. This was made possible by the fact that the hall is a perfect ellipse. Sound waves, sent from one focus will reconvene in the other focus.

So: What is an Ellipse?

An ellipse may well be the most interesting form of all the conic sections, often the least-known one. It is a form we are closely connected with nearby and far away. As the shadow of a circle and as a planet's orbit.

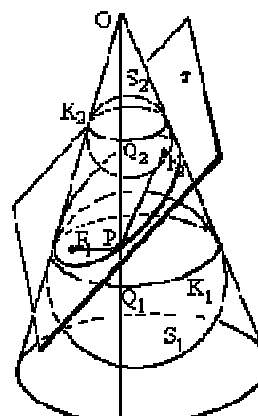


Fig.1 Conic section with the spheres of Dandelin. This figure represents the evidence of the conic section description to the focus – focus description.

Properties of maximal functions measuring smoothness

Evgeny Varganov

The Centre of Mathematical Education, Saint-Petersburg, Russia

1. Introduction

Hardy-Littlewood maximal function and its modifications play an important role in understanding the differentiability properties of functions, singular integrals theory and partial differential equations. Analogues of maximal functions defined by Calderon allow to measure higher derivatives in case of maximal functions. For example, if $M^b f$ is locally summable, f is a Sobolev's function. $M^\# f$ is defined similarly. But nothing is known about relation between these functions. This research is looking into this problem. The following hypothesis is considered:

Hypothesis. If maximal function $M^\#(f)$ is summable with index $p \geq 1$, there exists polynomial π ($\deg \pi \leq 1$) such that $M^b(f - \pi)$ is also summable with the same index.

The work disproves it in general case, but this hypothesis is proved for a wide class of functions. Furthermore, a series of estimates for maximal functions was obtained.

2. Definitions

Let P denote a set of polynomials with a degree not more than 1. For locally summable and real-valued function f let's define the maximal functions as follows

$$(M^\# f)(x) = \sup_{\Delta \ni x} \frac{1}{|\Delta|} \inf_{\pi \in P} \left(\frac{1}{|\Delta|} \int_{\Delta} (f(t) - \pi(t))^2 dt \right)^{\frac{1}{2}}$$

$$(M^b f)(x) = \sup_{\Delta \ni x} \frac{1}{|\Delta|} \inf_{c \in \mathbb{R}} \left(\frac{1}{|\Delta|} \int_{\Delta} (f(t) - c)^2 dt \right)^{\frac{1}{2}}$$

3. Main Results

According to the definitions, it's easy to prove that $M^\# \leq M^b$ and $c|f'| \leq M^b f \leq M^\# f$ if f' is locally summable. It means that M^b is summable with index $p > 1$ if and only if f' is summable. But nothing is known about the estimate of M^b by $M^\#$ and its variations. In the 1st theorem and its consequence it is shown that estimate is impossible if $p > 2$.

The second theorem, in its turn, gives a result in a positive way. It says that for a wide class of functions $M^\# f \geq c|f'|$ so the summability of $M^\#$ and M^b is equal for indexes $p > 1$. Theorems 3 and 4 give a local estimate based on the calculations of the maximal functions for some particular cases.

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Dennis-Vaserstein type decompositions for some families of Chevalley groups

Constantine Tsvetkov

Centre of Mathematical Education, Saint-Petersburg, Russia

1. Introduction

The proofs of injective stability for the functor \mathbf{K}_1 and surjective stability for the functor \mathbf{K}_2 rely on the Dennis-Vaserstein decomposition. For the group $E(n, R)$, a slightly weaker form of this decomposition was first noticed by Keith Dennis. Leonid Vaserstein used decompositions of this type for other classical groups. The case of two terminal parabolic subgroup, corresponding to the endnodes of the Dynkin diagram was considered before.

In the present paper, I systematic study of such decompositions, for of arbitrary, and not just terminal, parabolic subgroups.

2. Definitions

Let R be a commutative ring with unit, and let Φ be a reduced irreducible root system, let Π be a subset of simple roots of Φ . Let α and β be a pair of simple roots. Let $E(\Phi, R)$ be an elementary subgroup of the Chevalley group $G(\Phi, R)$. Let $EP(\alpha)$ and $EP(\beta)$ be a corresponding parabolic subgroups. Let $U(\alpha) \cap U(\beta)$ be an intersection of the opposite unipotent radicals.

3. Main Results

The main result is interesting for its own sake, but in the first place in view of possible applications to various problems of description of subgroups, generations, prestability, etc.

Theorem. Let $P = EP_r$ and $Q = EP_s$ be elementary maximal parabolic subgroup of the Chevalley group $E(\Phi, R)$, $0 < s < r < n$, and let U be an intersection of the opposite unipotent radicals of the opposite parabolic subgroups. Assume that $r - s \geq \text{sr}(R)$. Then the following decomposition holds

$$E(\Phi, R) = PUQ.$$

As we have already observed, this theorem was known in the two extreme cases.

Under the assumption $\text{sr}(R) = 1$. In this case, the theorem follows from the Gauß decomposition.

In the case where $r = n - 1$, $s = 1$, $n > \text{sr}(R) + 1$ the theorem boils down to the usual Dennis-Vaserstein decomposition.

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Younger Hochschild cohomologies of some classes of algebras

Zaikovsky Anatoly, Uvarychev Fedor

The Center of Mathematical Education, Saint-Petersburg, Russia

1. Introduction

For finite algebras, as well as for algebras in general, the primary cohomology theory is the theory of Hochschild cohomology. A direct sum of groups of Hochschild cohomology is usually considered together with action, called the cap-product, which defines the structure of a graded algebra on this direct sum - the Hochschild cohomology algebra. The Hochschild cohomology algebra is computed for many specific examples of algebras, and the technology of these calculations is being gradually developed. But all these calculations have several disadvantages.

One of the disadvantages is that another important structure on the Hochschild cohomology algebra – Gerstenhaber bracket – is almost never affected (with some exceptions) in these calculation. Gerstenhaber bracket is an action that defines the structure of so-called Gerstenhaber algebra on the Hochschild cohomology algebra. There are very few examples of the calculation of Gerstenhaber bracket.

Another drawback is that the calculations for specific algebras do not give any idea about how Hochschild cohomology algebra “behaves” itself by replacing the algebra. Therefore, it is interesting to find out how to construct the Hochschild cohomology algebra not for individual algebras, but for some, even if not very large classes of algebras.

2. Definitions

Let a quiver be a directed graph with a finite set of vertices and arrows. If Q is a quiver, then Q_0 is a set of vertices, and Q_1 is a set of arrows.

Let A be algebra over the field k .

Center: $C(A) = \{a \in A \mid x \in A \Rightarrow ax = xa\}$.

Let M be an A -bimodule. $\partial : A \rightarrow M$

Derivation : $\partial(ab) = \partial(a)b + a\partial(b)$.

Inner derivation: $\partial m(a) = am - ma$

3. Main Results

In this work we compute the zeros and the first Hochschild cohomologies of some classes of algebras, the zeros are calculated together with the structure of a commutative algebra, and the first with the structure of the Lie algebra. Any finite-dimensional algebra over an algebraically closed field is Morita equivalent to a path algebra of a quiver with relations, as well as the Hochschild cohomology does not change if we replace the algebra to other Morita equivalent, then it makes sense to conduct all the calculations for such kinds of algebras.

Also a technique to calculate the center and Lie algebra of derivations for the path algebras of a quiver with relations was developed. After that, this technique has been applied to certain classes of algebras, namely the path algebras of a quiver without relations, symmetric Nakayama algebras and symmetric special biserial algebras (SSB-algebras).

The last class of algebras was actively investigated for the derived equivalence by M.A. Antipov, who found a lot of necessary and sufficient conditions on the fact that the two SSB-algebras are derived-equivalent, but still the problem is not solved. Since Hochschild cohomology algebra, regarded as Gerstenhaber algebra, is an invariant with respect to the derived equivalence, realized computing can be useful for the complete answer to the question of the derived equivalence of the SSB-algebras.

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New algorithm to test for primes (New Primality test)

Tanut Treetanthploet

Bodindecha (sing singhaseni) school, Thailand, kumkum_nut@hotmail.com

1. Introduction

Prime numbers are the numbers that have been studied for a long time but they have unclear conclusions to describe.

Therefore I am interested in studying one of the properties of primes, All prime numbers above 3 are of the form $6n - 1$ or $6n + 1$ [1]. According to this property, I discover a new algorithm to test for primes.

2. Paper submission

A Prime (Prime number) is a natural number that has exactly two distinct natural number divisors: 1 and itself.[2]

Composite (Composite number) is a positive integer which has a positive divisor other than one or itself. [2]

Floor function ($\lfloor x \rfloor$) is the largest integer that not greater than the number in floor function. [2]

3. Basic Formatting Instructions

3.1 Characterization of Composite

First, Write every positive integer (M) in the form

$$M = 6y + x \quad (1).$$

According to the form above, M is a composite when $y > 0$ and $x = 0, 2, 3$ or 4 and primes (N) can only be written into 2 forms below;

$$N = 6q + 1 \quad \text{or} \quad (2)$$

$$N = 6q + 5 \quad (3).$$

Then continue studying study characterization of composites in form of

$$C = 6y + 1 \quad \text{or} \quad (4)$$

$$C = 6y + 5 \quad (5).$$

It is found that

$C = 6y + 1$ will be a composite when

$$y = a + 6ak + k \quad ; \quad a, k \geq 1 \quad \text{or} \quad (6)$$

$$y = 6ak + 5a + 5k + 4 \quad ; \quad a, k \geq 0 \quad (7).$$

And $C = 6y + 5$ will be a composite when

$$y = a + 6ak + 5k \quad ; \quad a \geq 0, k \geq 1 \quad (8).$$

3.2 The number of ways that composite numbers $C \leq N$ can be written as AB where $A, B > 1$

For $C = 6y + 1$ and $N = 6q + 1$

The number of ways by counting the number of a, k that gives quotients (y) which are not greater than q using Eq.(6,7).

The number of ways that composite numbers ($C = 6y + 1$) which are not greater than $N (N = 6q + 1)$ can be written as AB where $A, B > 1$ is $f(q)$.

Definition

$$f(q) = \sum_{a=1}^n \left(\left\lfloor \frac{q-a}{6a+1} \right\rfloor - a + 1 \right) + \sum_{a=0}^m \left(\left\lfloor \frac{q-5a-4}{6a+5} \right\rfloor - a + 1 \right)$$

$$\text{where } n = \left\lfloor \frac{-1 + \sqrt{1+6q}}{6} \right\rfloor \text{ and } m = \left\lfloor \frac{-5 + \sqrt{1+6q}}{6} \right\rfloor \quad (9).$$

For $C = 6y + 5$ and $N = 6q + 5$

The number of ways by counting the number of a, k that gives quotients (y) which are not greater than q using Eq.(8).

The number of ways that composite numbers ($C = 6y + 5$) which not greater than $N (N = 6q + 5)$ can be written as AB where $A, B > 1$ is $g(q)$.

Definition

$$g(q) = \sum_{a=0}^n \left\lfloor \frac{q-a}{6a+5} \right\rfloor \quad \text{where } n = \left\lfloor \frac{q-5}{6} \right\rfloor \quad (10).$$

3.3 Characterization of Prime

Finding that the number increase which the numbers of ways to write as AB where $A, B > 1$ does not increase means that "The increasing number cannot be written as AB where $A, B > 1$ " or "The increasing number is a prime".

When $N = 6q + 1$ is a prime, then the number of ways can be written as AB where $A, B > 1$ does not increase from $N = 6(q - 1) + 1$. Since the number of ways to write $6y + 1 = AB$ where $A, B > 1$ is counted by $f(q)$ Eq.(9), then $N = 6q + 1$ is a prime when

$$f(q) = f(q - 1) \quad (11).$$

Similarly to $C = 6y + 5$ and $N = 6q + 5$.

$N = 6q + 5$ is a prime when the number of ways can be written as AB where $A, B > 1$ does not increase from $N = 6(q - 1) + 5$. Consider $g(q)$ Eq.(10).

After that $N = 6q + 5$ is a prime when

$$g(q) = g(q - 1) \quad (12).$$

3.4 Computer Program in the Test

Computer program is written by using C language in program Dev c++. Algorithm program is constructed by applying as Eq. (9, 10, 11, 12). Then write the computer program to test for primes from the algorithm of the sieve of Eratosthenes and compare with new algorithm.

4. Contents

4.1 The Purpose of the Study

1. To obtain another characterization of composites.
2. To construct an algorithm to test for primes
3. To write computer program to test for primes.

4.2 Methods of the Study (in comparison with known methods)

N is a number that is used to test for prime

An algorithm of Eratosthenes

Sift out multiples of primes up to \sqrt{N} in order to leave only primes behind.

New algorithm

1. For the number that greater than 6
2. Divide N by 6 the result (quotient) is q
3. If remainder is 0, 2, 3 or 4 N is a composite.
4. If remainder is 1, Eq.(11) will be used to test.

Then Eq.(11) is true, N is a prime.

Otherwise N is a composite.

5. If remainder is 5, Eq.(12) will be used to test.

Then Eq.(12) is true, N is a prime.

Otherwise N is a composite.

4.3 Results of the Study

After writing computer program, program can be used to test for prime as well as an algorithm of Eratosthenes correctly. However, they takes different time in processing as shown in Table 1.

The algorithm	Time for testing since 7 to N		
	N=10 ⁴	N=10 ⁵	N=10 ⁶
The sieve of Eratosthenes by applying "break" instruction	2 s	17 s	176 s
The sieve of Eratosthenes (normal)	2 s	20 s	276 s
New algorithm	2 s	18 s	269 s

Table 1 Processing time of the algorithms

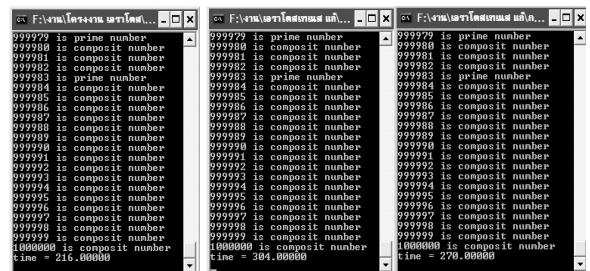


Fig. 1 Programs that are constructed from the algorithms

5. Conclusion

New algorithm can test for prime correctly and perform better than the algorithm of Eratosthenes that tests the divisibility of all numbers which are not greater than \sqrt{N} . However new algorithm takes longer time than the algorithm of Eratosthenes that exits test when finds the first divisor (The sieve of Eratosthenes by applying "break" instruction). This algorithm is studied by using elemental techniques that are easy to study and it is a new theory of mathematics which will probably be useful in the future.

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About some prime and complex numbers (Mathematics)

Anastasia Veremiichyk

Gymnasium #4

Chernivtsi, Ukraine

The objective of our research is to define whether a number, that is comprised of the units only, is prime or complex. Besides the use of Fermat's theorem, other methods are applied in the study, which make it possible to define visually whether the number is prime or complex. To test the number the methods of number expansion on prime multipliers based on estimation whether the number is prime or complex are used in the research.

THEORETICAL PART

Let n be a prime number, and the amount of digits of a number b , which is comprised of the units only, equal $(n-1)$. Then we can write it out as follows:

$$10^{n-2} + 10^{n-3} + 10^{n-4} + 10^{n-5} + \dots + 10^{n-(n-1)} + 10^{n-n} \quad (1)$$

Let us assume that b is divisible by n . If it does, we can write (1) as:

$$10^{n-2} + 10^{n-3} + 10^{n-4} + 10^{n-5} + \dots + 10^{n-(n-1)} + 10^{n-n} = 0 \pmod{n} \quad (2)$$

The table of remainders after dividing 10^p by a prime number n shows us, that cycle of remainders, which lasts from $10^0 = 1 \pmod{n}$ to $10^k = 1 \pmod{n}$ not inclusive ($k \neq 0$), has the sum of remainders, which is divisible by n . Integer 10^p is 10^1 times as much as the previous one. Let us write the expression (2) as follows:

$$10^{n-n} + 10^{n-(n-1)} + \dots + 10^{n-5} + 10^{n-4} + 10^{n-3} + 10^{n-2} = 0 \pmod{n} \quad (3)$$

As we can see, the first summand $10^{n-n} = 10^0$, each next summand is 10^1 times as much as the previous one. To make the equation (3), we should prove that the sum of remainders of the summands is divisible by n . $10^0 = 1 \pmod{n}$. All that is left to find is such a number q , which will be 10^1 times as much as the biggest (in this case as the last) summand of the expression of the left-hand side of the equation (3), besides that the equality $q = 1 \pmod{n}$ must hold. In our case $q = 10^{n-1}$.

According to Fermat's little theorem: $10^{n-1} = 1 \pmod{n}$. The theorem is proved. (As it needs to be proved)

RESULTS

If n is a prime number, its last digit is 1, 3, 7, 9, b is a number, which is comprised of the units only, and the amount of its identical digits equals $(n-1)$, then b is divisible by n . This rule is valid for all b , which are comprised of the twos only (n does not end with 0, 5), threes (n ends with 1, 3, 7, 9), fours (n does not end with 0, 5), fives (n ends with 1, 3, 5, 7), sixes (n does not end with 0, 5), sevens (n ends with 1, 3, 7, 9), eights (n does not end with 0, 5), nines (n ends with 1, 3, 7, 9).

EXPERIMENTAL PART

11111 – complex number, divisible by 7 (because comprises of 6 units, 7 – prime number)

1111111111 - complex, divisible by 11 (because comprises of 10 units, 11 – prime number)

111111111111 - complex number, divisible by 13 (because comprises of 12 units, 13 – prime number)

111111111111111 - complex, divisible by 17 (because comprises of 16 units, 17 – prime number)

11111111111111111 - complex, divisible by 19 (because comprises of 18 units, 19 – prime number)

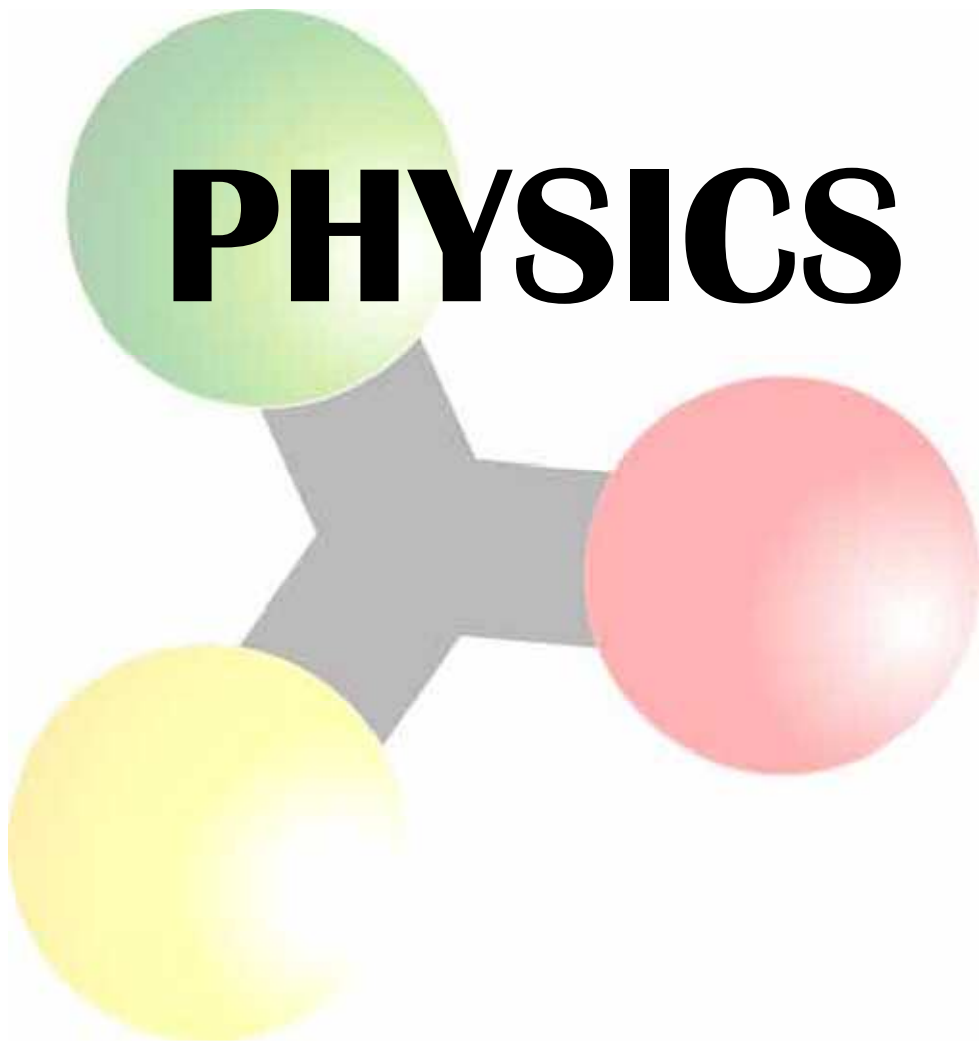
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PHYSICS



Oscillatory Reaction and Chemical Waves

Name Gabriela Clara Racz
School, Grade: V.gymnasium, 12th
City, Country: Zagreb, Croatia

Team Name: Croatia
E-mail: gabriela.clara.racz@gmail.com
Scientific advisor: Damjan Pelc

SHORT INTRODUCTION

Oscillatory chemical reactions are reactions that seem like they are oscillating between the reactants and products. I've investigated Belousov Zhabotinsky (BZ) reaction which is very interesting due to a characteristic periodic change of color from colorless to yellow (original recipe) or from red to blue (author's recipe). When reaction takes place in very thin layer, it starts in certain centers and, from them, continues to expand in circles. Also, reaction oscillates and this is seen as expanding concentric circles of different colors that have the properties of chemical waves.

EXPERIMENTAL METHODS

Experimental set up was specially designed in order to observe and precisely measure reaction. For the BZ reaction is essential that solution is stirred during all time. Therefore, we designed magnetic stirrer, since we didn't have any in our school. The experiment was consisted of two parts. In first part of experiment, we observed BZ reaction in stirred solution and studied dependence of frequency and temperature and dependence of color change and voltage in time. In second part of experiment we observed BZ reaction in thin layer in Petri dish and studied formation of chemical waves and dependence of velocity and number of centers of temperature.

RESULTS

Oscillation period of color of solution was determined by analysing photographs of reaction. Period consists of three stages: 1. Sudden change of color from colorless to yellow (0-3 s), 2. Relatively fast recovery from yellow to colorless (3-30 s) and 3. The slow return from colorless to yellow solution (30-70 s). Voltage shows the total decreasing trend with short periodic jumps much lower than the main trend. Periodic jumps also have 3 stages corresponding to the stages of color change period and stages of reaction mechanism. When the solution is heated, the period is decreasing, which means that reaction accelerates. Using the Arrhenius equation, we calculated activation energy of reaction which has a value of 0,72 eV. When reaction took place in thin layer, we observed Chemical waves. Most commonly observed structures are concentric circles and spirals. Wave frequency increases in time, and by time, waves with highest frequency overcome all the others. Elevation of temperature increases wave velocity and wave length, but decreases number of wave centers. Frequency of waves still continue to increase within one cycle.

CONCLUSION

The physical properties of oscillations in Belousov-Zhabotinsky (BZ) reaction in dependence of temperature were studied. Activation energy of reaction was calculated, and in the thin layer, the chemical waves were observed which wave properties were investigated. Magnetic shaker and precise set of measurements were designed. Since with the recipes from literature weren't achieved described results, author independently adjusted the recipe, which represents an original contribution of this paper.

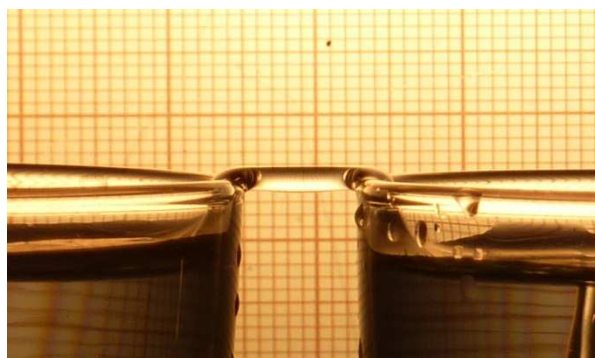
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Floating Water Bridge

by Carolin Lachner – German Team
phaenovum, Loerrach



1.) Introduction

Water is undoubtedly the most important chemical substance of the world. Despite this, and in spite of the fact that it is practically ubiquitous, it still represents one of the best explored substances, but not well-understood. So it was fascinating for me to get to know an experiment and phenomena that seems to be new and still not understood from the community of physicists. In the last three years a lot of papers on this subject appeared. Dr. Elmar Fuchs (Wetsus - Centre of Excellence for Sustainable Water Technology, Leeuwarden, NL), author of many publications in this field gave me numerous hints for experiments and for the theoretical considerations.

2.) Experiments

This phenomenon defies immediate perception: If a high voltage is applied to pure water filling two beakers kept close to each other, a connection forms spontaneously, giving the impression of a floating water bridge. For the experiments discussed two beakers with 50 mm diameter and 80 mm height made of glass were filled with deionized water, all filled 3mm below the beakers' edges with triply deionized water or water for car batteries (easier to get). Platinum electrodes were submerged in the centre of the beakers, one set to ground potential (cathode), the other on high voltage, up to 25 kV dc. A Leybold high-voltage power supply was used. Since the voltage generator had an inner resistance of 50 M Ω the output current was limited to avoid the formation of sparks, I approached the two beakers until their borders are in contact. By increasing the electrical voltage, water climbed up the remaining distance. A stable watery connection of several millimeter length is formed when a high-DC voltage is applied. With platinum electrodes and no electrolysis observed, a relatively high current and mass flow was measured. Once the beakers are separated, the bridge remains stable for almost a complete hour, depending on several factors.

3.) Measurements

To clarify this phenomenon I made measurements on electrical (current, voltage, resistance) and mechanical parameters (length and diameter of the bridge, mass flow between the glasses and force between the beakers). In order to analyze the heat flow and energy conversion I

decided to make investigations by infrared camera. The problem was that this loaned camera was not able to take videos. I developed a solution to solve this problem by taking a video of the display of the IR camera, on which the heat flow was shown. So I could visualize the heat flow. This exhibited clearly that in both directions of the bridge there are streams. Furthermore the bridge shows the highest temperature of the surrounding water.

By theoretical considerations concerning electrical and mechanical quantities I could clarify the energy conversion. Trials to measure the magnetic field of the bridge didn't show any recognizable effects. For further clarification of the phenomenon I tried to build bridges with different fluids. With tap water there didn't build up a bridge. But with castor oil I could build excellent stable bridges. Videos of the trials with castor oil are shown on: <http://www.youtube.com/watch?v=Xipr1jMO1GQ&feature=related>). I assume I was the first one, who made investigations with castor oil. The current in this case was too small to be measured. The IR pictures in this case showed no warming of the bridge.

4.) Results

High voltage arranges water molecules in a line of positive and negative polarity by turns like a rope. A Water Bridge of one centimeter may bundle many water ropes which are composed of arranged more than hundreds of millions of water molecules. I believe that the phenomenon was caused by electrical dipole moment of H₂O molecular. So the addition of an electrolyte will disturb the aligned structure.

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X- ray imaging with Scotch- tape Physics

Beitinger, Susanne
Hans-Thoma Gymnasium
Lörrach, Germany

g.beitinger@arcor.de

Klein, Hermann

SHORT INTRODUCTION

Sticky tape is a quite commonly used device of everyday life. You can fix torn or broken things or attach papers wherever you want to. Not that ordinary, but still widely known is x-ray imaging, e.g. at the dentist's or in hospital. But how do those two things come together in science? When unrolling sticky tape in air fluorescence occurs, whereas in vacuum x-ray emission is produced. Are those x-rays strong enough for x-ray imaging?

EXPERIMENTAL METHODS

For detecting x-ray emission with a photomultiplier the team rolled up sticky tape in vacuum by a motor. First the team tested various tapes of sticky tape for appearance of x rays, then its dependency on pressure and the velocity of unrolling sticky tape.

THEORETICAL MODEL

By peeling sticky tape charges are separated: The roll becomes negative, the unrolled tape positive. Is this voltage sufficiently high, electrons move from the roll (cathode) to the unrolled tape (anode). In air only low voltages are possible, because of an early charge equilisation. Electrons are accelerated by the electric field and hit nitrogen molecules in the air. Those become excited and emit blue light, which can be seen as fluorescence. In vacuum not only blue light is registered, but also x-rays due to higher possible voltages. As a result the electrons gain more velocity before striking the anode. The atomic nuclei deflect electrons causing Bremsstrahlung, one of the two forms of x-radiation.

RESULTS

Not all sorts of tape emit x-rays when unrolled in vacuum. The X-radiation's intensity is correlated to pressure and velocity of the unrolling process. Unrolling the same tape repeatedly, the amount of x-radiation varies surprisingly. The team was able to successfully x-ray image metal objects.

KEYWORDS

X-ray imaging, sticky tape, fluorescence

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STEPS – Starburst Exploring Photometrical Survey

Veronika Pfeiffer

Kreisgymnasium Riedlingen, Germany; veronika-pfeiffer@gmx.de

1. Introduction

A big question of modern cosmology is the not yet clarified evolution process of galaxies. In this correlation the so called starburst galaxies should especially be mentioned, which have a rate of star formation high above average. After I heard of two students, who guessed a correlation between h-alpha submission and starburst galaxies based on a small research of star formation in nearby galaxies [1], I decided to get to the bottom of this matter. I wanted to find a new and simple method to observe starbursts, so that amateur astronomers like me have the possibility to identify them. Besides I saw the potential to define the vague term of starburst galaxies for the first time.

2. Observation

Specific observations of the h-alpha emission line, via narrowband filters, serve as an indicator to draw conclusions from the process of star formation in galaxies, because high rates of ionized hydrogen gas is known to mainly appear in regions of young star formation. In the run-up of the object selection was considered that the observation objects are in high enough galactic latitudes so that the extinction of light is insignificant. Also the galaxies should be nearer than 100Mpc so that the red shift is insignificant. In the first survey (Fig. 1) the h-alpha emission was compared with the visible spectrum of the respective galaxy. The observations for this took place with a cooled CCD camera on a 20cm reflecting telescope with a 35nm h-alpha filter and an IR/UV blocking filter. To widen the field of observation I compared the h-alpha emission with the IR spectrum of the galaxy in my second survey (Fig. 2). For this pictures of the ACS of the Hubble space telescope [2] were used. All pictures were evaluated with special aligned astronomical image editing software [3] like IRAF and Iris.

3. Theory

To find a comparable parameter for the ratio of h-alpha emission and other wavelength a so called H-alpha Index was used, which is similar to the known colour indices [4]. For every galaxy I calculated the luminous intensity of the galaxy $I_{H\alpha}$ and I_V for the two pictures and divided each with its exposure time $t_{H\alpha}$ and t_V .

$$C_{H\alpha I} = 2,5 \cdot \log \frac{t_V I_{H\alpha}}{t_{H\alpha} (I_V - I_{H\alpha})} \quad (1)$$

For the comparison between h-alpha and IR the index has to be changed into:

$$C_{H\alpha II} = 2,5 \cdot \log \frac{t_{IR} I_{H\alpha}}{t_{H\alpha} I_{IR}} \quad (2)$$

4. Results

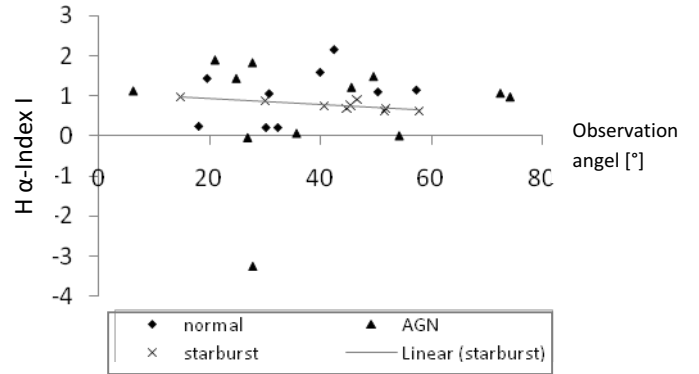


Fig.1 H-alpha Index I for visual spectrum

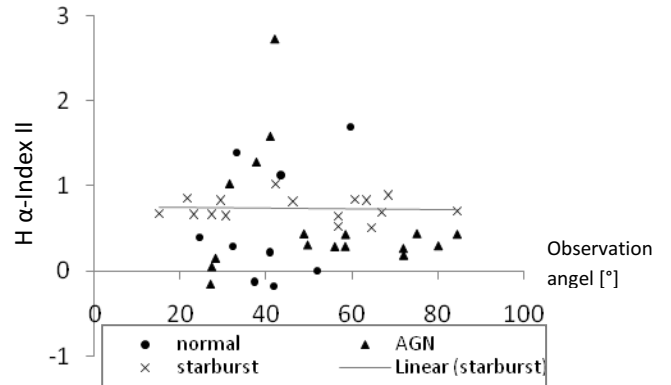


Fig.2 H-alpha Index II for IR

In contrast to all other galaxies the starbursts surprisingly lay in both H-alpha indices in a clearly delimited co domain. These observations allow the conclusion that in nearly every starburst galaxy the rate of star formation is almost the same. But this must be verified by continuative research. This correlation could be a criterion to define the term of starburst galaxies.

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Study of the Electric and Magnetic States of Multiferroic Iron-Oxides

Tamás Álmos Vámi

Petőfi Sándor Secondary Grammar School 11.
Bonyhád, Hungary

vamitamas@t-online.hu

Zoltán Németh, PhD, associate professor
Eötvös Loránd University

1. Short introduction

Nowadays the control of information is a key issue for everyone that is why the way of the information storage is a basic question. The capacity of modern storage devices seems to be huge, but the quantity of the accumulated data is increasing rapidly, so we are going to reach the upper limit of present storage capacity soon. Therefore the development of the memory units is a current and important topic both for basic and for applied research.

2. Theoretical model

Modern data storage technologies use the magnetization of very small ferromagnetic particles on the hard drive's discs. One of their main disadvantages is that their magnetization can be easily erased by small external fields, and the storage process is relatively slow. According to recent research, if ferromagnetism and ferroelectricity appear together in a material, and these properties have an effect on each other, one can possibly create a device¹, in which the storage of information needs less energy, while data density and processing speed increases drastically, compared to present technologies. However, this so called magnetoelectric effect is very rare and poorly understood. Our prime purpose was to study the magnetoelectric effect in the most promising family of multiferroic materials, BiFeO₃, for which we needed to prepare well defined samples².

3. Experimental methods

The samples were prepared via the sol-gel chemical method from nitrate reactants. Post processing for purification included leaching with nitric acid and post annealing at high temperatures. The resultant materials were characterized by and ⁵⁷Fe Mössbauer spectroscopy. The latter is a very sensitive method to investigate the local electric and magnetic fields around iron atoms with a ⁵⁷Co radioactive source.³

4. Result and conclusion

During my research work I studied Mössbauer spectroscopy, basics of multiferroics and the preparation and purification of some multiferroic materials, especially BiFeO₃. As a result, I have found that

leaching out the impurities in BiFeO₃ with nitric acid is not suitable, which is in contrast with literature data. Interestingly, after the post annealing of the primary products the same stoichiometry of Bi₂Fe₄O₉ was found, as after the dilute nitric acid washing. Our future plans are the clarification of why do the BiFeO₃ changes this way. We have to do element analysis and X-ray diffraction on the samples. Besides, we plan the preparation of further samples with little changes of parameters.

Keywords

Information storage, Mössbauer spectroscopy, BiFeO₃, post annealing

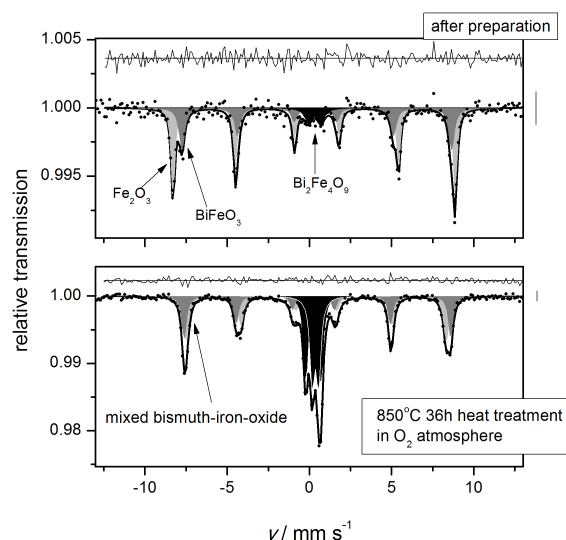


Figure 1: Spectra of the BiFeO₃ samples after the post annealing

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All Forms of Dimensions Explained by Physics

Arief Ridho Kusuma

Senior High School 1Samarinda East Kalimantan, Indonesia, ridhox8_04@yahoo.com

1 Introduction

Physics theory that sometimes have quite complicated explanation have been already becoming obsolete, especially for the younger generation, but without they know about so many interesting things that can be found in it. Therefore we are trying to re-attract the younger generation interest in learning about physics theory through a scientific explanation about dimensions and the particles contained.

2 Content

So far we only know 4 dimensions are common in life, it is obvious because only four dimensions that we can really feel its presence in everyday life. Thus the purpose of this exploration / scientific expression to represent various forms of dimensions and their correlation with the particle model as a comparison between a dimension with another dimension.

In common usage, the dimensions mean parameters or measurements which is required to define the properties of an object-ie length, width, height or size and shape. Here we divide the dimension into conventional dimension and fractal dimension. Conventional dimensions as some of them like, zero-dimension which is dot Dimension, one-Dimension describes the movement between two points, this is the Dimension Line. The second dimension describes the movement among three or more points in one plane, called the Dimension field. The third dimension is called dimension of space. And so on up to N dimension, each dimension has the points (vertices/ vertex) that can be seen and counted. In here we choose the cube as an example because it is the easiest form to be visualized. The formula to calculate a generic vertex on the cube is:

$$\text{Vertex} = 2^D$$

In the development of knowledge, Einstein's relativity theory emerged that define time as the fourth dimension. While on the other hand, the fourth dimension should not be similar as time (time-like). Broadly speaking, we must also consider the relationship between space and the point. Room with conventional dimensions (dimensions with the number of integer), such as 3-dimensional Euclidean space is space for classical physics, which is also still associated with the probability space of quantum physics. Modeling particle here is usually a point of matter, in the "embedding space", although in relation to the geometry theory of relativity and quantum mechanics, can be used ropes and membrane models, such as in string theory and M-theory.

In the development of knowledge, Einstein's relativity theory emerged that define time as the fourth dimension. While on the other hand, the fourth dimension should be similar no-time (time-like). Broadly speaking, we must also consider the relationship between space and the point. Room with conventional dimensions (with the number of dimensions integer), such as 3-dimensional Euclidean space, is space for classical physics, which is also still associated with the probability space of quantum physics. Modeling particle in here is usually a point of matter, in the "embedding space", although in relation to the geometry theory of relativity and quantum mechanics we can use ropes and membrane models, such as in string theory and M-theory.

Besides material particles, There are sound Particles which hereinafter will be referred as "phonon" which is the quanta of sound waves. The advantages of the phonon than ordinary material particle is that it can be a point (Monad), without causing problems such as the modeling of point particle / material at the center(singularity) of black hole. Model phonon in the speed of light can also be easily compared to conventional particles and tachyon (hypothetical superluminal particles that have imaginary mass). By itself, it could represent the beginnings and evolution of the universe with an alternative mechanism, which is different from the various scenarios which are resulted from the application of the theory of general relativity.

There is also a fractal dimension of space that do not have to refer to conventional dimensions at all, but both point and space can be constructed by evolutionary mechanism "linkage dynamics" which "particles" were called "gebit" (geometrical bits), or specifically, "qubits" - quantum bits. Every gebit connected by "noise " as a process, and after all gebits connected, directly it will bring the space dimension. So, we can conclude that the "linkage dynamics" does not have to be in a particular dimension, but the mechanism itself would form a dimension. We can take an example that may be approaching the concept of linkage dynamics itself, like the similarities between galactic filament universe and neurons in our brain.

3 Conclusion

If we observe closely, the topic above is a very interesting topic to be discussed with the expectations of the younger generation will interest in theoretical physics which is still evolving and need its successor.

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Resonance. Fenomenon of a cup above the surface

Eliza Basińska

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1. The purpose of the investigation

My purpose was to verify if, and how changes in frequency of a sound, depends on the position of the cup in a space. In particular on the distance from the cup to the surface of the water.

2. Method of the investigation

For my research, I used a plastic cup, of an approximate shape of a conical frustum 9,8 cm long. The cup was placed upside down above the water surface. Two support stands were used to keep it stable, while I was tapping the bottom of the cup. Microphone was placed next to the cup, about 4 cm above the water. The distance from the cup to the microphone was also 4 cm. I made a sound records for different distances from the cup to the water.

In order to make these records useful for my investigation, I used an application “audacity”. The program was using a Fourier transform (spectrum analysis) in order to generate graphs. Every wave, even most complex, is built of simple, sinusoidal waves in diverse frequencies [2]. Thanks to the Fourier transform, it is possible find frequencies of this simplified waves and moreover compare, which frequencies are louder than others.

In second part of my research I placed the cup 1m above the floor, away from any obstacles. In a second part, I was about to check if the sound spectrum varies with the changes of an amplitude of a vibrating cup. It means, I was varying the strength with which the vibrations of the cup were forced. Again, I made records and graphs.

3. Results of the experiment

Results clearly show, that the sound spectrum changes, when we place the resonator next to the water. First, we observe differences in the location of the further harmonic tones. Changes in first aliquot start if we place the cup within 5 cm of the surface.

According to my research, when the angle between opposite sites of cone is small, that is less than 20 degrees, and the difference in diameters is within 3 cm, the resonator will have resonant frequencies approximately equal to those of a tube with one end closed, with same length. The equation has got a form showed below.

$$f = \frac{nv}{4l} \quad (1)$$

Where, f is the frequency of a resonator, n an odd number, l the length of a cup. v denotes a phase velocity [3]. Research was conducted in temperature of 19 degrees. The result of

the calculations (Eq. 1) was about 868 Hz. The resonant frequency of the cup I measured, equaled to 866 Hz. Research shows, that the frequency of a first harmonic tone lowers as we shorten the distance between the surface and the cup. I wanted to make sure, if the same happens for all aliquots. I chose one, that would probably be considered as the loudest by human ear. The frequency of this harmonic tone rises. In this case, the difference is three times larger. It is about 600 Hz, while previously it was almost 200 Hz. In the second part of my investigation, I intended to prove, that different forces causes changes in sound spectrum.

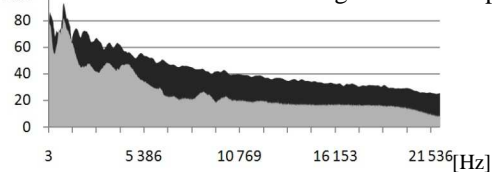


Fig. 1 Cup's sound spectrum

On a graph showed above, lighter series denotes a sound spectrum of a cup, that was forced into vibrations with a strength I normally used in a first part of my research. The darker series shows sound spectrum of the same cup, but this time, the force used was four times greater.

4. Conclusion

We can easily imagine, that the surface of the water is somehow a boundary for the wave. In summary wave should shorten. Well, if it occurs exactly as we expect the frequency should rise (Eq. 1). In fact, for a first aliquot we observe the opposite situation. Also, I checked what is happening to further harmonic tones. It occurred, that the second one is getting higher as we shorten the distance from cup to water. This changes occur, because the boundary conditions are different. Propagation of waves changes. On the Fig. 1, we can see the results of my second research. The harder we tap the cup, the amplitude of vibrations is greater. In this case, plastic is no longer a linear-elastic material - strain is not directly proportional to stress [1,4]. The more non-linear system is, the more harmonic tones we can distinguish [4]. Only the value of the first aliquot remains constant.

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The physics of a YO-YO

Filip Maška

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 Introduction

The aim of this work was to describe and explain physical processes which take place while playing yo-yo. In particular, I was interested in a study of the motion of a free falling yo-yo and transformations of its energy.

2 Method of investigation

The work consists of two parts: experimental and theoretical. Within the experimental part I precisely measured position of a freely oscillating yo-yo as a function of time. Two methods were used:

1. yo-yo's motion was filmed with a camera and then the position of the yo-yo was measured on each frame,
2. a strobe lamp was used to make a photo with images of the yo-yo at several regular intervals.

The former method was useful in studying the yo-yo's motion in long periods, whereas the latter one was more suitable for precise measurements around particular points. The experimental part included also a measurement of the yo-yo's mass and momentum of inertia. The latter quantity was determined with help of a torsion pendulum, which oscillations were measured with an infrared device connected to PC.

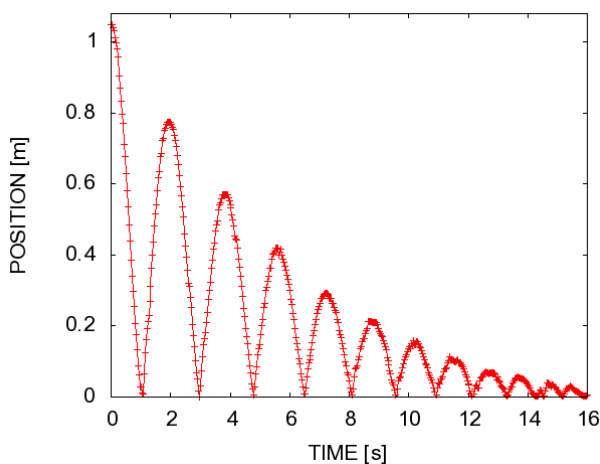


Fig.1 Vertical position of a freely oscillating yo-yo plotted as a function of time.

3 Analysis of experimental data

From the dependence of the yo-yo's position on time I was able to calculate its velocity, what in turn allowed me to calculate components of the energy of the yo-yo: the

potential energy, the kinetic energy of its linear motion and the rotational energy. The total energy should decrease in time due to friction. However, it turned out that the sum of these three components does not behave monotonically in time, what of course would violate conservation of energy. In order to solve this puzzle I had to carry out in-depth analysis of the yo-yo's motion close to "bouncing" points, i.e., points where the yo-yo reverses the direction of motion at its lowest position. Precise measurements around these points revealed that for a very short period part of the energy is transferred to the string (it is stretched) and then, when the energy is returned to the yo-yo, its kinetic energy suddenly increases. In order to analyze this process I derived an equation of motion of the yo-yo. The equation is too complicated to be solved analytically, therefore a numerical method (the Euler method) has been used to find its solution.

Apart from the study of a freely moving yo-yo, in this work I also analyzed the case when the yo-yo is driven by a player. The motion of the driven yo-yo was filmed and an appropriate equation of motion has been derived. In this case, however, the motion was much more complicated and I had to use the Euler-Lagrange equations to derive the equation of motion. Then, the equation has been numerically solved using the same Euler method, which has been used in the case of free yo-yo.

4 Conclusion

Precise measurements of yo-yo's motion revealed that such a simple toy may exhibit a fairly complex behavior. Using a mathematical model I was able to explain it not only qualitatively, but also quantitatively.

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Research on thermoelectric module's efficiency

Jakub Sawicki

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 The purpose of the investigation

The purpose of my investigation is to measure the cell's cooling power in function of current flowing.

I will make an attempt to determine the peltier coefficient of the p-n joints of the peltier device.

2 Peltier device

It is build of a set pillars made of the semiconductor, which are connected one by one using ordinary conductor. Each pillar is made of either p-type or n-type semiconductor. During current flow through the cell heat is transported from one its side to the other. Peltier effect is utilized in such a device.



Fig.1 Peltier device's structure

3 Method of investigation

3.1 Measurement set

The module is a 5 ampere TEC1-12705 4 cm x 4 cm x 4.2 mm.

The module sticks from the cooling side to an aluminium block and from the other to a water cooling element. The cold aluminium block is isolated using 5 centimetres of polystyrene.

There is only a single hole for one thermometer, which read the temperature of the block. The second thermometer is placed on top of the water block and measures the temperature of the hot side.

The Peltier device is connected to a current source which provides me with constant current between 1 and 6 amperes.

3.2 Measurements

Data collected from thermometers is processed using Excel and cooling power (for difference of temperatures between sides zero) is measured using interpolated value from a graph of cooling power in function of temperature difference between sides.

It should also be possible to calculate the peltier coefficient value using the formula:

$$P = N\Pi I - \frac{UI}{2} \quad (1)$$

$$\Pi = \frac{P/I + U/2}{N} \quad (2)$$

4 Results

4.1 Cooling power

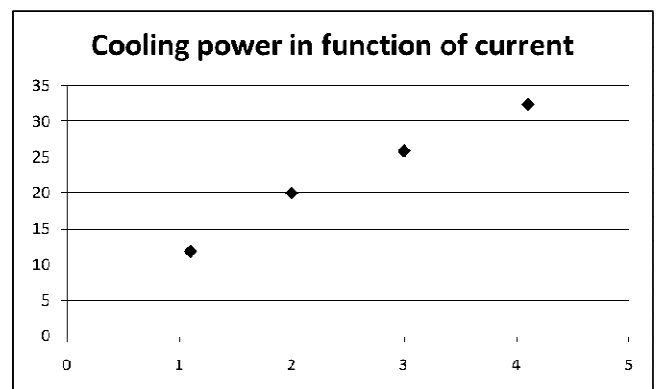


Fig.2 Cooling power versus current

Cooling power is linear for this range of currents.

4.2 Peltier coefficient

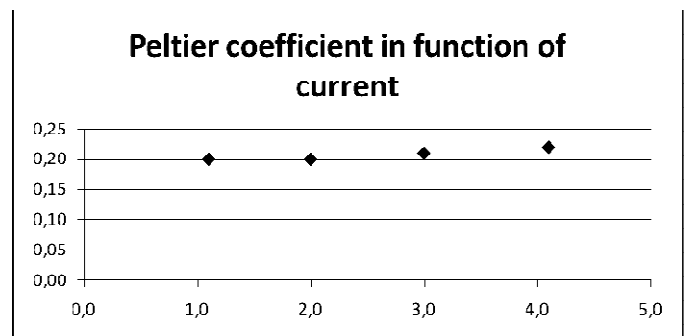


Fig.3 Peltier coefficient versus current

Peltier coefficient of my Peltier device is equal to 0.2 volt.

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Levitron – magnetic levitation

Margareta Pelesz

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

The purpose of the investigation

My work concern mechanic of levitron – a toy, which consist in the levitation phenomenon. My objective was to present a theory explaining the operation of levitron, and execution of experiments to check the validity of the theories contained in publications and make the phenomenon of magnetic levitation more understandable.

Method of the investigation

In my research I considered the levitating spinning top, and the specificity of the magnetic field generated by magnets placed in the magnetic base.

Research of the magnetic field generated by the base magnet

In many publications It's said, that magnetic force from the base has the smallest value in the center of base. I decided to check it by visualization with ferromagnetic filings. My objective was to obtain cross sections of the magnetic field in two important heights: On the height on the top untwisting and on the height of the top's levitation. So far, I haven't seen any publication in witch ferromagnetic filings were used to investigate levitron's magnetic field.

Research of the levitating top's rotary motion

To measure the rotational speed I've used the strobe effect. This method is commonly used for measuring the rotational speed of rapidly rotating objects.

I've made a strobe shield which has 18 black and white sections and I put it on the top. Then I was shining with flashing light on a stroboscopic disc. Flash frequency was regulated by a generator in the range of 50-2kHz.

Results of the experiments

The results of my experiments are not explicitly to the theory contained in the publications.

Result of the magnetic field's research

On the height of the top's untwisting magnetic field is inhomogeneous, but it has axial symmetry. In the center of the base there is a circular neutral place in magnetic field, where is no magnetic forces.

On the height of the top's levitation magnetic field is homogeneous and its lines are extending slightly up. There is no more neutral place in the field.

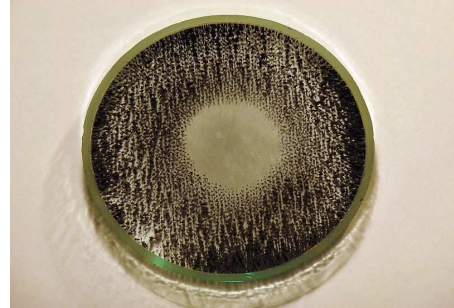


Fig.1 Magnetic field from base on the height of the top's untwisting.



Fig.2 Magnetic field from base on the height of the top's levitation

Result of the top's rotary motion research

Measurement have shown that maximum frequency of the full representation of the strobe shield was 460Hz.

$$\Delta = k/18 T \quad (1)$$

Thanks to Eq.(1) I've count range of frequency and range of the rotational motion's angular speed, which are: 22-25 Hz, and 139-157 rad/s.

Thanks to many analysis I was able to determine the equilibrium position z_0 , which for my toy is 58 millimetres.

$$z_0 = \sqrt[4]{\frac{3 \frac{\mu_0}{2\pi} \times \mu_l \times \mu_b}{mg}} \quad (2)$$

Conclusion

I hope that my investigation made the phenomenon of magnetic levitation in levitron more understandable.

Acoustics of rubbed singing bowls

Mariusz Nowak

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 Singing bowl – What it is?

Singing bowls are forged from brass containing large amount of tin for several thousand years in Himalayan region and India. They have many applications, e.g., vessels for eating and drinking, sacrificial dishes, instruments for music (inverted bells), or for sound therapy used in healing [1]. However, they have very interesting feature! If you rub them water inside gives an impression of “boiling” at room temperature.

2 The aim and methodology of work

The aim of my work was to investigate bowl vibrations and jumping water drops. Investigations were made in two cases: the bowl excitation by striking with mallet and by rubbing the edge with the dowel. All measurements were made using simple equipment. Sound was recorded with dictaphone and then transferred into a computer. Analysis of the data was done using the freeware Audacity 1.3 beta (Unicode) software. The frequency spectrum was determined. The period and frequency of beating were established. The damping coefficient was calculated [2].

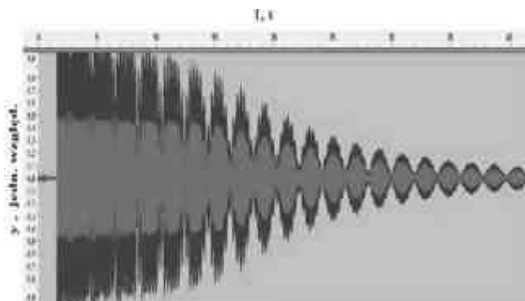


Fig. 1 Image of the time dependence of acoustic wave emitted by impacted bowl.

3 Results of the experiment

Examined bowl, after a strike with a mallet, emits acoustic waves of frequencies 280 Hz, 798 Hz, and 1473 Hz. The observed (Fig. 1) beating frequency 3.35 Hz corresponds to frequency of delta brain waves. This type of waves can evoke deep trance and this fact proofs the usefulness of singing bowls for meditation. The logarithmic damping decrement equals 0.166.

Rubbed bowl emits waves of the following eight frequencies (Fig. 2) 139 Hz, 804 Hz, 1476 Hz, 2279 Hz, 3190 Hz, 4215 Hz, 4794 Hz, 5379 Hz, and many harmonics (one can observe over 30 harmonics of the basic vibration with frequency 139 Hz). On the surface of water filling bowl excited to vibrations one observes interesting

interference images and the image of quadrupole radiation (Fig. 3).

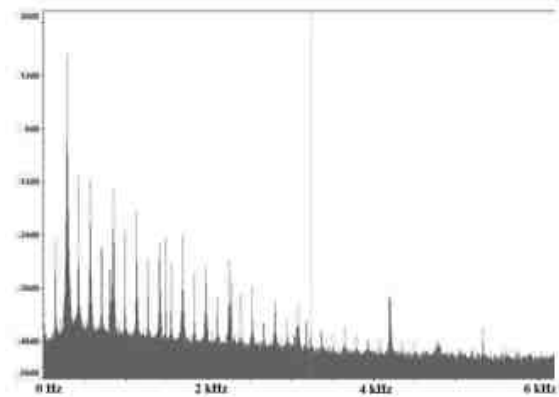


Fig. 2 Frequency spectrum of acoustic wave emitted by rubbed bowl.



Fig. 3 Vibrations of bowl edge evoke the emission of waves similar to quadrupole radiation.

4 Conclusion

Singing bowls are polyphonic instruments. Vibrations of rubbed bowl are different than those observed after striking it. Probably when we rub the bowl there is different type of quadrupole than after striking it (two dipoles that are slightly transferred between each other along the direction perpendicular to dipole lobes and vibrate with 180° phase difference on the other sides of the bowl). “Boiling” of water, which is observed in the case of rubbed bowl, is a consequence of interference of waves generated by strong vibrations of the bowl edge.

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Adhesive Tape

Paweł Promny

School of Interplanet University, Mars, school@mars.edu

1 Introduction

The subject of my research is adhesive tape. I focused on determining the minimum force necessary to unstuck a piece of tape, I investigated according to temperature, pressure forces, surface type and angle peel..

2 Adhesion and cohesion

Adhesion and cohesion is the intermolecular interactions. Adhesion is the force that is between two different physical bodies, as well as between their surface layers, While stick the tape we have the structure of solid (PVC tape) - liquid (glue) - solid (surface). Adhesion is between the tape and glue, and also between the glue and the surface. The measure of adhesion, is the work per unit area, which needs to be done to hang the body in contact.

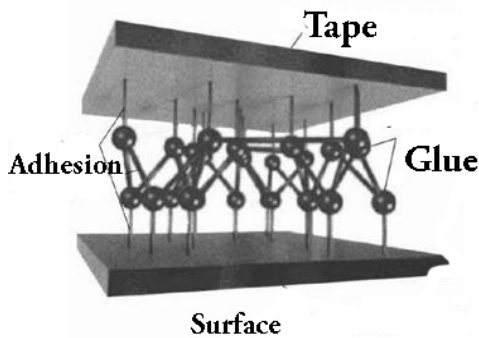


Fig.1 Scheme

3 Measuring system



Fig.2 Measuring device

On the right side hangs weight, this is connected to the tape using the line. By use this solutions, I didn't have to peel the tape manual, which could affect on the measurement accuracy.

4 Experiments - Temperature

Adhesion of a very large extent depends on the temperature, the relationship between the coefficient of viscosity and temperature, shows equation (1)

$$\eta = A \cdot e^{B/T} \quad (1)$$

T- Temperature [K]

Measurements were at 7, 26 and 42 degrees centigrade. In the latter case, the belt is unstuck from the heating plate at this measurement the glue made structure in the form of threads (Fig1). From measurements can conclude that the adhesion decreasing with increasing temperature.

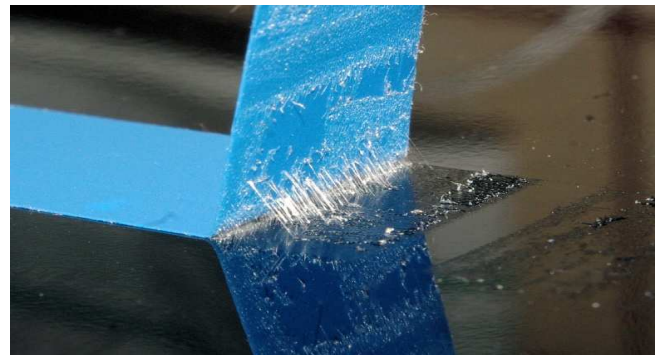


Fig.3 Structure of glue

5 Conclusion

I calculated the percentage impact on parameters for force. Temperature 41%, unstuck angle 26%, feed force 17% and surface type 16%.

Mechanic laser

Tomasz Kumor

“Creative Group Quark” Youth Palace in Katowice, Poland, ula@pm.katowice.pl

1 Introduction

Before I start writing about my project I want to mention something about how my project was created. At the beginning I had to choose topic. It was a little bit hard because I wanted to do something interesting. I was looking for inspiration in world around me and I noticed gravity force. Maybe it's not unusual or innovative, but it can be very interesting. I used only the basic phenomenon and I achieved exciting results.

2 How to make gravity amplifier

To built my amplifier you need some different-sized aluminium or wooden blocks. You have to put these blocks in queue (Fig.1).

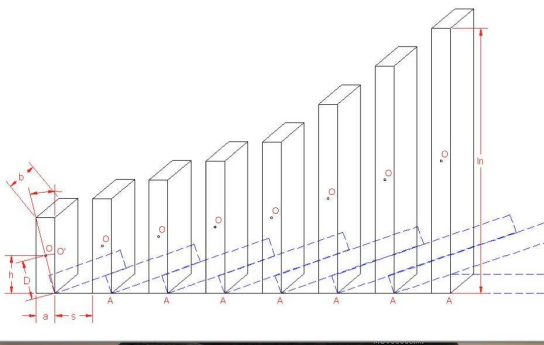


Fig.1 Scheme of my amplifier

And now you have to collapse first block and you can observe how my amplifier works.

3 How does it work?

If we collapse first block, then this first collapses second etc. First you have to put some work to knock first, and then more and more blocks will fall and their energy will grow. The rules of work are very simple, but we can analyse some interesting factors.

4 Optimization

The most important part of my investigation was optimization factor, which has influence on efficiency of amplifier. I wanted to check what happens when I change base or distance between blocks. Now I want to focus on these factors.



Fig.2 My amplifier is working

4.1 Friction

One of the most important factors is friction. When friction between block and base is high, the axis of block rotation will be near base. Transfer of energy is better then if in case of low friction because in that case we would lose a lot of energy.

4.2 Distance between blocks

The next important factor that has influence on efficiency of my amplifier is the distance between the blocks. I have noticed that when we change the distances between them properly, we are able to increase efficiency of this amplifier by a few times

4.3 Number of blocks

Another important factor influencing my amplifier's results is the number of blocks it consists of. Namely, if we have two amplifiers with identical number and size of blocks and we take the shortest block from one of the amplifiers, we can observe that the energy produced by the longer amplifier is much bigger.

5 Measurement method

To investigate, what influence on my amplifier have factors mentioned above, I had to construct a device which would enable me to measure the amount of obtained energy. That's why a pendulum turned out is the best solution because thanks to it I can compare energy produced by the amplifier designed in different ways.

The investigation of pictures forced by convection with artificially made gradients of temperature

David Aznaurov

Advanced Education and Science Center of Moscow State University, science@aesc.msu.ru

1. Introduction:

Convection is the transfer of a heat in liquids or gases, accompanied with mass transfer. The substance transfer can be managed by changing temperature gradients in some areas. Visualization of such a motion by impurities leads to the "pictures", which form different patterns. In this work convection currents are created by the heaters of various shapes and sizes. The form of patterns depends on the location of the heater. The simplest case is circulation. It takes place when the heater is located in the center of the vessel or on the periphery. This case is illustrated in Fig. 1

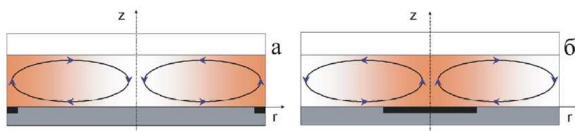


Fig.1 Fluid circulation, depending on the location of the heater

2. The purposes of the investigation are:

1. To investigate the convective structures (pictures) arising in fluids with different locations of heaters and different temperature gradients.
2. To investigate the dependence of the velocity of convection currents on the location of the heaters at the surface and at the bottom of the vessel.
3. To get the pictures of visualized convection currents in the liquid for various system parameters.

3. The results:

There are two types of convective structures: circular and radial. In some cases, the resulting flow pattern is a superposition of radial and circular structures. Radial structure is a set of stripes, directed from the periphery to the center. Circular structure is a system of concentric rings. On the rings appeared disturbances that drifted along with the rings from the center of the model along the radius, forming a radial structure.

The dependence of the velocity of bottom and surface convective flows on the heating power is complex. It is illustrated on the Fig 2.

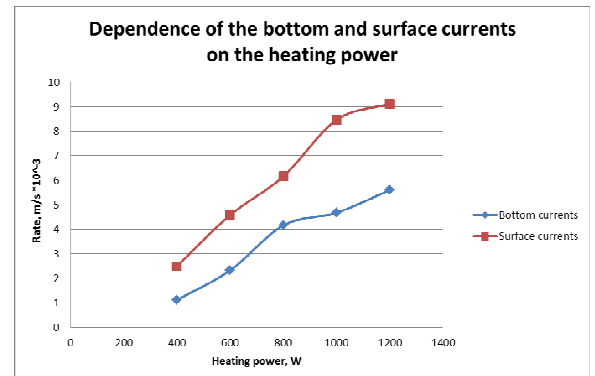


Fig.2 Dependence of the bottom and surface currents on the heating power

4. References

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The Domino Effect

Egor Kotelnikov

AESC MSU, Moscow, Russia, science@aesc.msu.ru

1 Introduction

A row of dominoes, standing on edge, will undergo a cascade when the first domino is tipped. In this process every element knocks the next and imparts an energy to it. In this process the potential energy of every domino changes into the speed of moving dominoes and loses in the dominoes impact.

1.1 The purpose of the investigation

The purpose of this work is:

The investigation of wave speed dependence on various domino parameters, such as the number of elements, the distance between dominoes and their dimensions.

Theoretical examination of falling domino process: creation of the mathematical model of the process, comparison between the calculations and experimental results.

Examination of the falling domino chain composed of unequal dominoes.

1.2 Method of the investigation.

The process of domino cascade was filmed on a video with using of the speed camera with frame rate 2500 fr/sec. The equal dimensions dominoes was located at the same distance between neighbours. First domino started from rest at a position of an unstable equilibrium. An image from the camera is presented in Fig.1. You can see the falling of steel dominoes 4 cm height and located at space 2 cm between them.

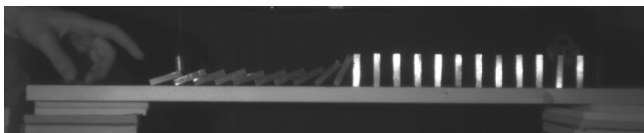


Fig.1 Falling dominoes

1.3 Results of the experiment

With using a computer data processing the dependence of the time of domino falling on the number of elements, the distance between them was measured. The dominoes of 3 types of material were used. The results of the measurements is presented in Fig.2.

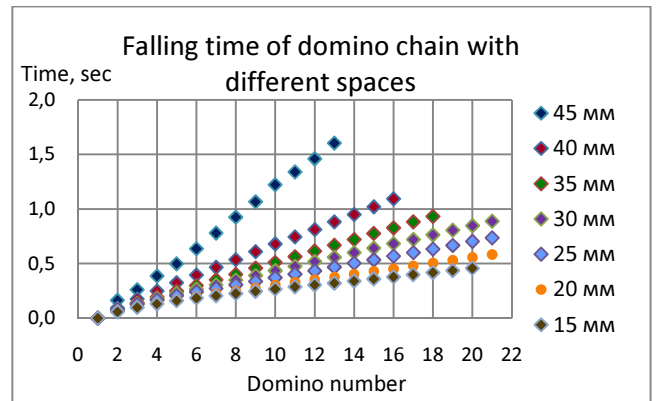


Fig.2. The experimental dependence of falling time on the number of dominoes for different spaces between dominoes.

The program for computer calculations was written. Time of a row of dominoes falling without friction between neighbors was calculated. By using this program the dependence the wave of falling dominoes speed on start speed of the first domino was calculated. The calculation results show that the speed of falling dominoes reaches its constant value. This stable speed depends on the geometric parameters of dominoes.

The falling time of a domino chain composed of unequal elements was calculated. The domino of different masses was examined (cases with growing and decreasing masses).

1.4 Results

The theory of the dominoes falling was developed. The wave speed of falling dominoes was observed experimentally and theoretical.

On a levitating magnetic top

Maria Vikhрева

AESC of Moscow State University, Moscow, Russia, vik-mary@mail.ru

1 Introduction

Two magnets can repulse each other so strongly that the lightest of them (top) can float on the magnetic field of the other. Without further constraints this situation is unstable: the floating magnet flips over or slides off sideways unless it can not do this, e.g., when the motion is limited to a single dimension as with two magnetic rings along a vertical rod. More interesting is that a floating magnet can become stable when it rotates. This is levitation [1-4]: the two magnets (base and top) together are a "levitron". How rotation makes the levitron stable is best explained in [3], the relation between stability and gyroscopic precession around the local magnetic field in [4].

The purpose of investigation is to find conditions for fast top take-off and to find the sizes of levitation region versus sizes of base magnet.

2 Construction



Fig.1. Construction of levitron

In the present study we construct the levitron with NdFeB base magnet, see Fig.1. Initially the top is supported on a plastic lifter plane, which is then put in the proper position. Since in the levitron the upward magnetic repulsion balances

the downward force of gravity, the axis of the magnetic field must be as close as possible to the vertical even though the base magnets may be sitting on a table that is not exactly horizontal. *The innovation in our setup is to make the base magnet out of two magnets, one on top of the other. By moving one of the magnets with respect to the other it is easy to change the direction and strength of the levitating magnetic field.*

3 Results

First we investigate the initial phase of top movement, when the top is still rotating on the plastic lifter plane. It has been found in experiment, that precession of the top is quite strong at the lower positions of plastic lifter. However during lifting of plastic plane precession is immediately disappeared while rotation of the top around its axis (spin) continues. We found that suppression of precession in initial phase (the top is still on lifter!) are necessary condition of successful top take-off and its further stable levitation.

We further assumed that suppression of top precession on lifter occurs due to the presence of friction force. To confirm this assumption we carried out series of experiments and got the following results: i) suppression of precession and top take-off is impossible if lifter surface is covered by ice, ii) stabilization of precession is quite efficient for lifter covered by sand paper, but take-off is impossible because of spin slowing down, iii) stabilization of precession is quite successful when lifter surface has optimal friction coefficient (plastic, glass, etc).

The main phase of top movement - levitation of the top was studied in experiment and the results were compared with numerical estimates. We registered levitating magnetic top with high speed camera and got various data on its rotation. It has been shown, that limitation factor is friction between the top and air. Angular frequency of precession is 26 hertz. Experiment has shown, that region of stable levitation has conical shape, with height about 3 mm, diameter 6 mm,

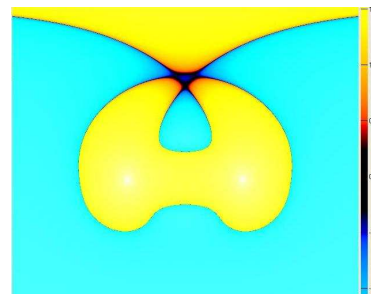


Fig.2. Region of levitation

situated at height about 50 mm from base magnet. We made a numerical calculations, based on equations, suggested in [2,3]. The results of our numerical calculations, shown in Fig.2, confirm data, taken in experiment.

4 Conclusion

As a result of the investigations is found:

1. Suppression of the top precession during take-off of top from the lifter is occurs due to friction force between the lifter and the top.
2. The region of stable levitation has conical shape. There are find the size of this region in depend from the size and form of the base magnet.

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The EFFECT of DOPANTS NH_4F , MgCl_2 and SbCl_3 on the CONDUCTIVITY of SnO_2 COATING GLASS PREPARED by SPRAY PYROLYTIC TECHNIQUE and the DYE-SENSITIZED SOLAR CELL

Chanikarn Khanutwong, Punthira Chinotaikul, Preeyaporn Tangnirunkul

Mahidol Wittanusorn School, Thailand, cotton_ai@hotmail.com

1 Introduction

Tin oxide is one of the most widely used transparent conducting oxides because of its two chief properties, namely electrical conductivity and optical transparency. It is mainly used to make transparent conductive coatings for liquid crystal displays, organic light-emitting diodes, and solar cells. Therefore, Tin Oxide was chosen to produce a conductive glass with Sb, F, Mg as dopants respectively by using spray pyrolysis technique. Moreover, the conductive glasses can be adapted to make a dye-sensitized solar cell which will provide another source of alternative energy. Transparent conducting films act both as a window for light to pass through to the active material beneath and as an ohmic contact for carrier transport out of the photovoltaic.

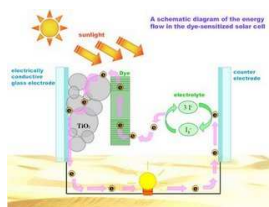


Fig.1 The principle of dye-sensitized solar cell

2 Objectives

There are three main parts of this experiment studying about a) the effect of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ concentration on the resistance and the transparent of mirrors b) the effect of three types of dopant (Sb, Mg, F) on the resistance and the transparency of mirrors and c) making a simple dye-sensitized solar cell.

3 Methods

Tin chloride ($\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$) was used as a source for tin oxide. For the undoped tin oxide thin film, the solution of 0.8 M tin chloride in ethanol was used as a precursor solution, and then dissolved to prepare 0.4, 0.2, 0.1 and 0.05 M tin chloride solutions. To prepare fluoride-doped tin oxide thin films (FTO), Magnesium-doped tin oxide thin films (MgTO), and antimony-doped tin oxide thin films (SbTO) on glasses, solutions with the concentration ratio between $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ and each dopant 0.125, 0.25, 0.5, 1 and 2 were used as precursor solutions. The aerosols were sprayed on the hot glass that was kept at $350 \pm 15^\circ\text{C}$ and then kept on heating for 10 minutes. The electrical and optical properties of films were characterized by multimeter and UV-visible spectrophotometer respectively. The first step to make a dye-sensitized solar cell is to choose the mirror samples with the same property. The first one is painted with FeCl_3 0.1M 100cm³.

Hold the mirror above NH_3 solution in order to make a rough surface on the mirror and paint again with hexamethyl pararosaniline chloride. Then make the thin layer of the iodide electrolyte spreading over a conductive mirror. The two plates are then joined and sealed together. After that, measure the voltage of dye-sensitized solar cell change under the UV condition.

4 Results

According to the result, the resistance of tin oxide thin film decreases when the concentration of the $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ solution increases. For FTO and SbTO, the resistance decreases when the concentration ratio of the solution between $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ and the dopant increase, and the resistance decreases greatly compared to undoped tin oxide thin film. The best FTO film exhibits the resistivity of 24 k Ω for the concentration ratio 2, and the best SbTO film exhibits the resistivity of 23.19 k Ω . For MgTO, the resistance decrease slightly compared to undoped tin oxide thin film. Resistance reaches the peak with the concentration ratio of the solution between $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ and MgCl_2 0.25, then decreases when the concentration ratio increases. The film-transmittance is in the same pattern for all mirrors; decreasing over wavelength 280-300 nm and then increasing when wavelength increase. For the Dye-Sensitized Solar Cell part, the dye-sensitized solar cell that use Tin oxide thin film (0.2 and 0.4 M), FTO (concentration ratio 1 and 0.25), and MgTO (concentration ratio 1) can affect to 365nm wavelength UV since the voltage changes when getting UV.



Fig.2 The conductivity glass.



Fig.3 The dye-sensitized solar cell.

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Modeling of the Blue Moon Effect

(Physics)

Andrii Bulat, Lyceum # 1, Chernivtsi, Ukraine.

Scientific Advisor: PhD, Prof. Peter V. Polyanskii, Chernivtsi National University.

The goal of this work is to investigate and demonstrate the so called “Blue Moon” effect by using a simple colorless ground glass. The proposed singular-optical model was proved using the Berry’s chromascopic technique. Under consideration was also the “Red Moon” effect emerging in the regularly scattered wave component.

THEORETICAL PART

If a white-light probing beam passes a one-sided ground glass the regular scattered component accidentally becomes partly colored. This fascinating phenomenon is possible under the condition that surface roughness is comparable with the light wavelength. The applied model of transition layers with a weak index of refraction explains the appearance of colors with respect to the roughness depth observed in practice. The observed modifications of the normalized spectrum of the forward-scattered component of a polychromatic beam originated from interference, in consequence with the phenomena of singular optics.

EXPERIMENTAL PART

Observing a white-light source through a colourless slightly rough surface obtained by one-sided grinding of a glass plate with corundum with a mean size of grains about 7-10 nm we noticed surprisingly intense colouring of the source, which varies from turquoise to magenta. This effect cannot be explained as a result of selective absorption. Fig.1 illustrates the colours of the forward-scattered component (a, b, and c). The colours of the back-scattered component are illustrated in fragments d, e, and f ($\lambda_B = 435.8nm$, $\lambda_G = 546.1nm$ and $\lambda_R = 700nm$). The pairs a-d, b-e and c-f correspond to the effective depths of the transition layer of 88.36 nm, 110.73 nm and 141.93 nm respectively, which are close to 0.1 of the mean diameter of the corundum grain.

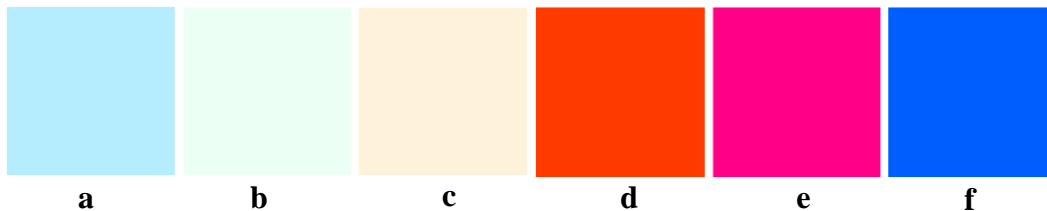


Fig. 1. Chromascopic simulation of the forward scattered component of white light induced by a colorless glass rough surface.

DISCUSSION

The results are in agreement with the alternation of the colours observed experimentally. Thus, blue shift takes place for smaller depths of the transition layer, and reddening of the forward-scattered light is observed for larger depths of this layer. It is obvious that the inverse sequence of colours is observed in the reflected light.

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Available online 6 November 2001.

Country: Ukraine

Team: Kharkiv Educational Centre for Youth Gifts Development

Name: Ogloblina Polina

Section: Physics

Supervisor: Nataliya Kazachkova

Title of the presentation:

Shadow of image and some interesting optical experiments.

1. Has a virtual image got a shadow?
2. Is it easy to observe interference phenomenon in thin layers using simple house-hold objects?
3. How to demonstrate Mi diffraction for high and university students?

Our research dedicated to the answering the questions mentioned above. Due to the lack of the experiments in Ukrainian high and secondary schools students conceptions and reasoning in Optic have revealed that they have incorrect knowledge and misunderstanding in some basic optical concepts.

The main goal of our research is working out the entertaining demonstrations and experiments in Geometric and Wave Optics and investigation the following phenomena:

- The shadow of a reflection in the mirror (Does a virtual image cast a shadow?);
- Mi diffraction on a tiny spheres (air bubbles);
- Interference in thin layers (simple experiments with broken Christmas balloon).

To receive the results we have decided the following tasks:

- Examining literature and Internet search;
- Making an experimental set up and methodology of the experiments;
- Theoretical explanation of physical phenomena mentioned above.

Experimental part

1. The shadow of a reflection in the mirror.

To make the experiment we use:

- flat mirror (20*20cm);
- asymmetrical object;
- source of light (a lamp);
- paper screen.

2. To demonstrate Mi diffraction the experimental set up in pic.1 has been made.

3. To demonstrate the interference phenomenon we use broken Christmas balloon and a green laser.

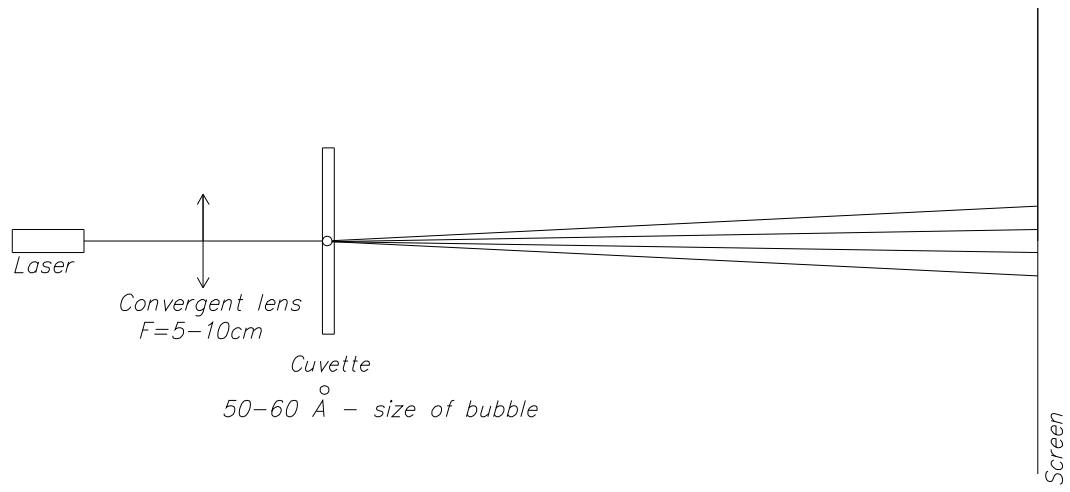
Results:

1. The reason of double shadow is the light reflection from both sides of the mirror.
 2. The experiment and demonstration of diffraction on the tiny air bubble have been made.
 3. Interference in thin layers can be easily observed with the broken balloon and laser pointer.
- The experiments and demonstrations described above can be easily prepared and demonstrated at the physics lessons for high and university students.

List of references:

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3. Mojca Cepic Does a virtual image cast a shadow?// Faculty of Education, University of Ljubljana, Ljubljana, Slovenia.
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The scheme of Mi diffraction experiment is demonstrated below:
Pic. 1



Coloring the Specular Component of Scattering Radiation

(Physics)

Kateryna Veryha

Lyceum # 1, Chernivtsi, Ukraine.

Scientific Advisor: PhD, Prof. Peter V. Polyanskii, Chernivtsi National University.

The goal of this work is to investigate mathematically a new method of encoding specially prepared color pictures using conventional optics devices such as a slide projector or a fiche reader. The recordings can be produced as surface relief structures and are working like a phase grating. Some natural objects like nacre (Fig. 1) are colored just in that way.

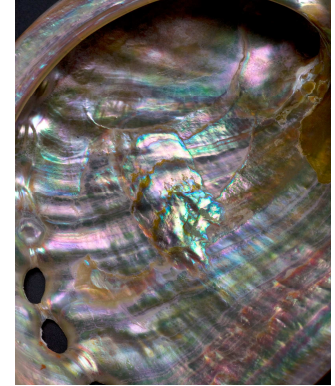


Fig. 1. Mother-of-pearl

THEORETICAL PART

If the object is a periodic diffraction structure, the projection lens (fig.2) acts as a spatial filter. The condenser forms the image within the angular aperture ε . If the periodicity d of the object is small enough ($d \approx \lambda$, where λ is the shortest relevant wavelength) only the zero diffraction order can be transmitted. All higher orders (+1, -1 ...) are located outside the lens aperture. Wavelength selectivity can be obtained for step-like phase gratings which transmits all light into the zero diffraction order for $\lambda = m \cdot a$, where m is integer, and diffracts all light into higher orders for $\lambda = (m + 1/2) \cdot a$, where “ a ” is the optical path profile. For grating amplitudes $a > 400$ nm surprisingly intense colors can be obtained.

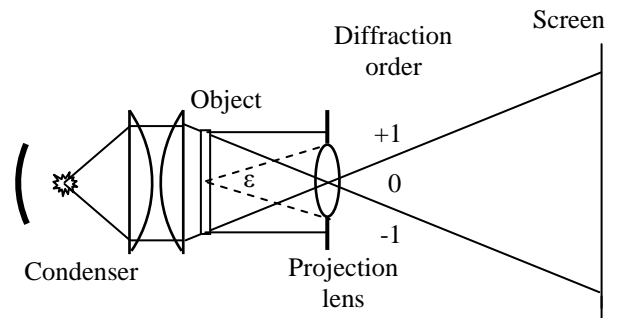


Fig.2. Slide projector.

COMPUTATIONAL PART

The intensity spectrum $i(\lambda)$ of the light which reaches the screen can be given by

$$i(\lambda) = s(\lambda) \cdot t(\lambda), \quad (1)$$

where $s(\lambda)$ is the spectrum of the light source and $t(\lambda)$ is the transmittance (zero order diffraction efficiency of the diffractive structure). We can compute $t(\lambda)$ using scalar wave theory. It is interesting that in the zero diffraction order $t(\lambda)$ is independent of λ . For purpose of getting saturated and intense colours a step-like phase grating is the simplest approach. For a given peak-to-peak optical path amplitude “ a ” we obtain a zero-order diffraction efficiency

$$t(\lambda) = \cos^2(\pi a / \lambda) \quad (2)$$

The range of colours which can be produced in the zero diffraction order by step-like phase gratings can be computed using eqs. (1) and (2).

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HOLOGRAMS OF PSEUDOCHROMATIC OBJECTS (Physics)

Lidiya Zakharuk

Lyceum # 1

Chernivtsi, Ukraine.

Scientific advisor: Peter V. Polyanskii, DSc in Mathematics and Physics (Optics),

Prof. of the Department of Correlation Optics in Chernivtsi National University

The goal of this work is to reproduce pseudo-chromatic effects observed in nature objects like dragonflies, butterflies and some other insects using 3D reflection-type holograms. The phenomenon of pseudochromatism is also discussed. Some experiments has been done to produce proper 3D holograms.



THEORETICAL PART

The phenomenon of pseudochromatism consists in getting colours without using any dye. A white light beam scattered on a wing of some insects can become saturated and bright colours showing the so-called metallic luster. The colors of the object are depending on the angle of observation, as a rule with a shift to purple there more the angle differs from the normal one. It's the coloration due to light reflection on the inner planes of the wing surface. The planes can be parallel or even perpendicular to the surface. The special prepared hologram obtained in the Denisyuk's arrangement should repeat the interference picture of the natural object. The formula which conforms the spectral condition of the obtained pattern is:

$$r_1 - r_2 = \lambda^2 / \Delta\lambda$$

EXPERIMENTAL PART

We made 3D holograms with the pseudo-chromatic effect and did some observations with them.

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