

# ABSTRACTS 2011

## 1. Equilibrium And Chemistry

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The human activity affects the equilibrium of the planet, even down to its chemistry. Experiments were performed to assess the response of a chemical system to a change of temperature, concentrations of reagents or products and even pressure. This work allowed us to rediscover the principles enounced by Le Chatelier.

## 2. Light and Luminol structure

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A chemiluminescent product called Luminol is used by the scientific police to find blood traces. We synthesized this compound Luminol in a two-step process from 3-nitroptalic anhydride and an aliquot of the intermediate compound was kept. The synthesis of a parent compound from phtalic anhydride was also carried out. All the products were tested for chemiluminescence to show what is really essential in the molecule structure.

## 3. Let there be light: Luminol

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In the TV series CSI, the scientific police use the Luminol to detect bloodstains. To discover how Luminol works, we focused on the action of the Luminol and the conditions of its use. The luminescence was tested at various temperatures and we tried to see if the luminescence is possible with different metallic ions as well as with bleach.

## 4. Natural Colours: Are They Really Environment Friendly

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According to colour therapy, colours are capable of influencing many aspects of our lives, including our mood, mental state and energy level. Each colour is thought to be associated with one of seven energy centres, or chakras, in ayurveda. If a person's chakra is thought to be out of balance or weak, the colour it's associated with is believed to help strengthen it.

Studies conducted showed the advantage of natural colours/dyes over chemical/synthetic colours/dye. Chemical colours are toxic and can result in skin allergies, eye irritation, blindness, renal failure, learning disability, bronchial asthma etc. They are also carcinogenic and can cause skin cancer. When washed, they enter the rivers and the soil and increase pollution.

This project aims to give an insight on preparation of various Natural Colours and also their advantage over chemical colours. Various different dry colours were prepared using flowers, tree leaves, tree barks, and flour of different types. Wet colours were also prepared by extracting pigments from natural resources available.

Red Colour was prepared by grinding wood of Lalchandani (Pterocarpus santalinus). Red colour was also made by drying and grinding red hibiscus flowers. To increase the bulk flour was added to it.

We made use of the dry petals of marigold and yellow chrysanthemums to obtain a fine yellow powder. Yellow colour was also made using gram flour and mixing it with turmeric.

By mixing red & yellow colour, orange colour was prepared. Orange colour was also prepared by drying orange peels in the sun and then grinding them and mixing with gram flour and turmeric.

Similarly work is being done to prepare green, brown, and blue colour. Natural wet colours are also being made by extracting the pigments of flowers, fruit peels in water.

These colours when used by human beings did not cause allergies and were totally safe. They did not cause allergies, eye irritation, and also did not trigger allergic asthma.

These colours also have a cooling effect on skin. Natural colours can therefore be used to a large extent as they do not harm human beings; and their advantages are manifold. Their disposal is easy and does not cause environmental pollution.

## 5. Colours In Daily Life

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In our experiment we produced films out of starch and glycerine. Then we dyed the films with different colours and juices. Our aim was to find out how good you can dye the films and which colour is most suitable for dyeing films. When producing a film out of starch one uses its property to dry to kind of a film in aqueous solutions. These films are slightly brittle and so one uses glycerine as a softening agent. The glycerine binds the starch and prevents the starch from forming crystals. Besides: glycerine binds water and prevents the film from drying and becoming brittle. In our experiments we learned that potato- and maize-starch are equally suitable for the production of films. As dye we used beetroot-juice, carrot-juice, red-cabbage-juice and Easter egg colour (E141), as well as food colouring (patent-blue V). We noticed that each of them dyes the film, but beetroot- juice and Easter egg colour worked best. Beetroot juice produced a colour quality equal to the chemical Easter egg colour (E 141 chlorophyll).

## 6. Blue Bottle

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Imagine a colour changing soda... With this goal in mind, parameters of the famous blue bottle experiment were studied. But a problem was evidenced: the pH requirement. Is there a solution? Let's work on it !

## 7. Ocean's CO<sub>2</sub>

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Nowadays, global warming and carbon dioxide increasing in the atmosphere are in all the minds. Our activities' rejections are upsetting the equilibrium of the planet, and especially the ocean's equilibrium. Experiments were made to understand how the oceans could absorb and throw out carbon dioxide. Thanks to these experiments, it was proven that cold water could absorb more carbon dioxide than warm water, that seawater becomes more acidic when it has absorbed carbon dioxide, and the ocean's acidity has a adverse effect on shells and threatens marine ecosystem.

## 8. Reaching The Core Of The CO<sub>2</sub> Sink

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Without the proper functioning of the carbon cycle, every aspect of life in our planet will change dramatically. It is generally accepted that human activity plays a major role in the increasing of the carbon dioxide (CO<sub>2</sub>) emissions released to the atmosphere. It is known that the ocean absorbs about ¼ of the CO<sub>2</sub> emissions and turns about 1% of it into carbonic acid. The formation of this acid causes the pH of sea water to drop, making it less and less basic. This will eventually lead to acidic water which in turn will eat away all the calcium carbonate (limestone) in the ocean and will destroy the marine species that use limestone to survive. Does the sea water return to its chemical equilibrium? Photosynthetic aquatic plants use CO<sub>2</sub> during their photosynthesis, so we assumed that these plants would also be able to restore the pH by absorbing the CO<sub>2</sub> from the water. For the experiment we used sea water and fresh water photosynthetic plants in order to investigate how they restore the pH under different conditions in the presence of dissolved CO<sub>2</sub>. The experiments were performed using pH indicator and the colour changes were monitored. From the experiments it was concluded that plants in both fresh and sea water have the ability to restore the water's initial pH, indicating that nature has its own mechanism for restoring equilibrium.

## 9. Euglena And Biofuels

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Oil supplies go dry... Biological fuels are the centre of attention of a lot of scientists. Aiming at producing a green energy, we attempted to produce lipids from Euglenas. Many experiments were made to identify the best way to produce this alga. Euglenas were placed in various conditions such as the presence of CO<sub>2</sub>, altered pH, absence of light. A final experiment was made with Euglenas, fertilizer and CO<sub>2</sub>. Euglenas were then crushed to obtain lipids.

## 10. Between Fire and Water: Biogas. Flaming Vision of the Future or Just a Liquid Game?

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In the last few years a lively discussion has been going on, concerning the energy policy about becoming more independent of fossil fuels. Events such as rising oil prices or the disaster in the Japanese nuclear power stations force us to rethink our energy sources. The new sources of energy should be secure, ecological and efficient. Accordingly, we have chosen the subject of this project: biogas. The biogas production makes us independent of fossil fuels, is not as dangerous as nuclear power stations, and produces green energy. In our investigations we are trying to find solutions to raise the efficiency of the biogas production. When pursuing our aim we conducted some basic research and constructed our own "biogas station". During the next few weeks we want to figure out whether the addition of zinc will increase the production of biogas. It is our goal to find out whether biogas is just a liquid game or a flaming vision of the future...

## 11. Microwave Impact On Everyday Life

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Microwaves are currently used on a world wide scale, both for communication purposes and for cooking food. While research has clearly proven that direct exposure to microwaves (such cases include mobile phones) is harmful to living organisms, science has not yet proven the indirect effects of microwaves on life (in the cases of microwave ovens).

By cooking food in a microwave oven, the structure of the food remains unchanged. This leads to the hypothesis that microwave ovens have no effect whatsoever on the organisms consuming substances heated in a microwave oven.

Our purpose in this experiment was to try to investigate any possible effects of microwave ovens on life. To do this, we have taken two sets of plants which we watered daily. One set was watered using water heated in a kettle and then left to cool, while the other set was watered with water that had been heated using the microwave oven.

Our results led to the conclusion that in the short term, microwaves do not cause any harm to living organisms. However due to the short time period in which this experiment was conducted, the real effects of microwaves which might occur in the long run have not been proven.

## 12. The Effect Of Temperature On Bacterial Growth On A Regular Student's Meal.

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These days students spend many hours at school – both in the cool winter months, and the hot summer months. This inspired us to investigate the safety of student's meals during school hours. We studied the bacterial growth on a typical student meal, a sandwich. A typical sandwich in Cyprus consists of a white bread roll with halloumi (Cypriot cheese), smoked ham called lountza and sliced tomato. Tests were carried out to analyse the bacterial growth on the sandwich. We took into consideration the average summer and winter temperatures, as well as refrigeration temperature (32°C, 18°C and 4°C respectively). Swabs were taken using sterilised cotton buds at three time intervals throughout the day most representative of the times students consume their sandwiches. The agar plates were then inoculated and incubated at 32°C for 24 hours in order to investigate the bacterial growth on our sandwiches. We predicted that the least bacterial growth would occur at refrigeration temperature, early on in the school day. Using our results we would then be able to suggest reliable solutions for educational institutions to minimize, if not eliminate, bacterial growth on students sandwiches. Such solutions could possibly include providing students with a refrigerator, especially for the students who stay at school for long periods of time.

Final results showed that for both ham and bread, the temperature for minimal bacterial growth was 18°C, while for cheese it was 32°C and only tomato proved our hypothesis that the fridge would minimize the bacterial growth. We can clearly see that there is bacterial growth on different foods at different temperatures. Due to the fact that bacterial growth is encouraged at higher temperatures it is still recommended that sandwiches be kept in the refrigerator to maintain safety of the sandwiches.

### **13. The antibacterial effects of essential oils**

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During my work I examined the effect of different essential oils on bacteria in the respiratory system. Applying of essential oils has become more and more popular recently. They can clean the respiratory tracts perfectly, in case of having a cold, and according to some people they kill bacteria. That's true, or false? In my work it turns out.

I worked in the SzentLászló Hospital, in the Bacterial Laboratory.

### **14. Some Cytochrome P450 Alleles And Genotype Frequencies Comparing Of The Asian And Caucasian Population**

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It's a general experience that the products of the pharmaceutical industry are not the same in Asian and European countries. We wanted to know if one of the main causes of these differences are connected with the fact that there are differences between the genes in the Asian and Caucasian (that is European) population.

Our presentation focuses on the Cytochrome P450 enzyme-family. These enzymes are responsible for drug metabolism. If there is a point mutation in the enzyme's gene, it can cause inactive enzyme or low enzyme activity. We can determine these mutations by genotyping. This method can be helpful to set drug therapy in a more personal way for patients with serious illnesses (leukemia, schizophrenia etc.)

We were dealing with some important Cytochrome P450 gene mutations.

We compared the Asian and Caucasian population based on references and examined our personal DNA by genotyping to see how we fit the average of our population. (One of us belongs to Asian and the other to Caucasian population.)

On the basis of this we tried to find out what can be done to avoid the problems arising from the differences between the two populations and respectively the pharmaceutical products of Asian and European countries.

## 15. Caffeine in the Chinese Tea

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I want to give a lecture about the caffeine content of some Chinese teas, and their effects. My main question was why is a tea stronger than another.

I chose this topic because I do kungfu, and me and my friends often make traditional shaolin tea-afternoons. This way, I experienced a lot of the effects of the tea. I've looked it up a bit, and it seemed that the easiest to examine is the caffeine, that's why I started to research it.

When I tried to think about my research, I thought it will be easy. I supposed that the stronger tea contains more caffeine. That's why I went to the TÜVKERMI lab, where I could detect the caffeine by liquid-chromatography.

But the results didn't show what I counted on, so my theory failed. That's why I made more inquiries about it, and I found a thing what I've ignored before.

This is the time of fermentation. There's a process which happens under it and changes the effects of the tea.

Then I've tried to verify this theory according to the physiological effects.

I've bring a blood-pressure apparatus with me to our tea afternoon, and I've measured the blood-pressure and the pulse of some friend of mines before and after drinking the teas.

Those results were more or less verified my theory. If I make some corrections, they would be adequate. I mean I have to say my researches weren't as exact as a real research could be, and we also have to count on personal tolerance.

## 16. Chemistry In Indian Kitchen

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This study will take you on tour inside an Indian kitchen and will give an insight into the various steps involved in cooking various dishes and the chemistry involved in every step.

Study conducted showed various aspects of reaction in spices, vegetable oils, herbs etc and innovative methods adopted to understand biochemical reactions in human beings. Spices supply chemicals that, in small quantities, have beneficial effects other than inhibiting food spoilage microorganisms. Some other phytochemicals, particularly those in cloves, rosemary, and pepper are powerful anti oxidants. By retarding the oxidation of oil or fat, phytochemicals help preserve foods and also reduce the production of free radicals, which have been linked to cancer and aging. Regarding the effects of cooking, most phytochemicals are thermostable, although a few are destroyed by heat. Some spices (e.g., garlic, pepper and onion) are typically added at the beginning of cooking, whereas others (e.g., parsley and cilantro [i.e., coriander leaf]) are



added near the end. The «delicate» flavours of the latter would be destroyed by heat. If, as seems likely, thermostable spices are the ones added early and thermolabile spices are added later (or are used primarily as condiments), differences in timing of use may function to maintain beneficial anti microbial properties (and corresponding flavours) until food is served. This project deals with understanding and explaining the chemistry behind day to day cooking. Traditional use of Indian spices involves great understanding of chemistry. Food so prepared is very healthy and environment friendly. This project will be very useful as an educational module, establishing coherence and rhythm in study of chemistry and biology. Moreover it strengthens ones faith on the scientific basis of Indian traditions.

## **17. Warm Food Without Fire? Salt-Hydrate and Overcooled Liquefied Materials as an Opportunity for Mobile Warm Food**

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Whoever was stuck as a truck driver during a strong winter in the snow, who just crested as a mountain hiker or whoever has lessons without a cafeteria in the afternoon as a student, appreciates a hot meal, even if there is no electricity, no fire and no boiling water.

In our research project, we investigate the various possibilities for the Construction of such Flameless Ration Heaters.

To heat food all exothermic chemical reactions are appropriate. The heat, which is released during the reaction may be used to heat the meal. For the practical implementation redox reactions with aluminium or magnesium as the starting material as well as solution processes of various salts are suitable.

The disadvantage of these reactions is that they are generally not reversible for the user and can therefore be used only once. This is different with pocket warmers; these use sodium acetate trihydrate as a phase change. These pocket warmers, which utilize the heat of crystallization of a overcooled sodium acetate trihydrate-melt can be used again and again, because they can be regenerated by simply placing them in boiling water.

In our research project we have studied these three mentioned methods for heating meals to find out which method is suitable for the point of heat release, environmental friendliness and best price.

## **18. Herbs In Cosmetics**

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Cosmetics are substances used to enhance the appearance or odour of the human body. Cosmetics include skincare creams, lotions, powders, perfumes, lipsticks, fingernail and toe nail polish, eye and facial makeup, coloured contact lenses, hair colours, hair sprays and gels, deodorants, baby products, bath oils, bubble baths, bath salts, butters and many other types of products. The market is flooded with chemical cosmetics which are harmful to human beings as they can cause allergies, asthma, irritation, skin diseases and could also be toxic if absorbed into the body over a long period of time.

This project aims at preparing herbal cosmetics and comparing them with chemical cosmetics.

Herbal eyeliner was prepared using cotton swabs, homemade fruit extract powder, distilled water, coconut oil and sugar. For selection of colours, like orange, used orange fruit extracts. All the contents were stirred and refrigerated for 10-15 minutes. Repeated stirring and refrigerating till the mixture hardens forms the eyeliner which is ready for use.

Herbal lipstick was made by adding warm almond oil/jojoba oil/ sunflower or chamomile oil in beeswax or plant wax like carnauba or candellila and mixing vigorously. For colour pigments used were natural herbs (turmeric imparts yellow colour), vegetables (beetroot imparts a red colour), fruits (berries of indigo plant impart a blue colour)

Herbal toothpaste was made by mixing baking soda, salt, glycerine, 15 drops peppermint oil/ clove oil/ cinnamon oil/pudinhara to tooth paste consistency.

Further work is being done to prepare herbal face packs, herbal mouth washes.

These cosmetics were used tried by a large number of people and were found to be safe. There were no allergies, irritation etc. reported by people using these natural products and these were reportedly safe to use. Further studies will be undertaken in three groups using a control group where people use only herbal cosmetics, second group with chemical based cosmetics and the third one using both.

## **19. Fire, Fumes and Water. Comparative Analysis of Harmful Substances in the Fumes of Cigarettes and Water pipes**

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Smoking is an important cause of death in western countries and could quite easily be prevented. The recent decrease of adolescent smokers, especially

in secondary schools, is therefore very beneficial. Contrary to this tendency, however, the Arabic tradition of Shisha smoking has increased among young people at home and in bars over the past few years.

The goal of our project is to present information concerning the spread of this new "fashion" and the insufficient knowledge of its risks, which has only been collected scarcely so far.

Our findings will hopefully persuade young people to stop any kind of smoking: our measurements have proven high concentrations of carbon monoxide, which binds to haemoglobin, leading to a decrease of the oxygen saturation as well as the rise of blood pressure and increased heart rate after smoking. Apart from proving the toxic consequences, our experiments also achieved our aim to create a thought-provoking impulse among our voluntary probands.

## **20. Idrija Mercury Mine: Will Its Closure Improve The Quality Of Surface Waters?**

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Since the discovery of mercury, Idrija has been globally known mostly for its mercury mine. Because of the Idrija Mine used to be the most mercury polluted area in Slovenia and its vicinity, primarily due to smelting remains and exhaust fumes, produced by smelting cinnabar ore. Idrija mercury mine has been closing since 1986 and is scheduled to close completely this year. Closing works included backfilling of tunnels and injecting of empty inaccessible galleries with concrete. When this stage was completed, underground pumps used to drain water out of the mine, were disassembled and consequently water started to flood the mine. When the mine closes, water will reach the 4th level (161 metres below ground level). Our research was made after stopping the pumps at the 9th level and water level rose.

The aim of our work was to assess the effect of gradual closure works in the mine on the environment. The surface waters in the vicinity of Idrija were monitored and concentrations of mercury, ammonium, nitrite, nitrate, chloride and phosphate ions and metals were measured. Water hardness, total organic pollution, biodegradable organic pollution and the amount of total carbon were also determined. Three samples were taken, the first one being from the Idrijca river before the inflow of stream containing mine water effluent, which was the second sample. The last one was the sample from the Idrijca after mixing with mine effluent. Our samples were analysed in the laboratory of Idrija Mercury Mine Company (RŽS Idrija), in the laboratory of Faculty of Chemistry and Chemical Technology of the University of Ljubljana and at Chemical Institute, using the following methods: CVAAS (Cold Vapour Atomic Absorption Spectrometry), mass spectroscopy, spectrophotometric method and the trimetric method.

The results obtained were compared with the mine's records for some previous years and it was found out that the concentrations of pollutants in the stream in which mine effluent flows have been decreasing since the mine pumps were stopped in December 2010. After this the concentration of mercury has increased significantly at the second sampling site. We will try to explain this unusual phenomenon in our future research.

## **21. Thermocol Glue**

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Thermocol is a chemical compound of polystyrene (synthetic petroleum product) molecule. It is now a principal component for packing items. Discarded thermocol responds very slowly to bacterial decomposition in the soil, thus making the soil infertile. Moreover it is not easily recycled because of its light weight and low scrape value. This project is my effort towards recycling of thermocol and using it as glue.

Studies show that the principle behind dissolution is Like dissolves in like ie the nature of solute and solvent needs to be same for dissolution to happen. Using this concept thermocol was dissolved in various organic solvents and it was found that the resulting mixture had adhesive properties.

Equal weight of thermocol was dissolved in 100ml of different solvents like chloroform, carbon tetrachloride, acetone, and benzene. It was found that this dissolution lead to the formation of a mixture which was sticky and had adhesive properties.

Glue formed by this method had a high tensile strength and could stick metals, wood, plastics and various other materials together.

Glue prepared by dissolving thermocol in acetone was the best as it had a smooth consistency and had a longer shelf life. Difficulty was encountered for storing this glue as the solvents used were volatile and left behind solidified polymer.

Glue prepared by this method was also cheaper than commercial glue and the adhesive properties were similar.

Experiments are being carried out to find out certain additives/solvents which do not reduce the quality of glue thus formed but enhances its shelf life. Also experiments are being conducted to find the tensile strength of thermocol glue. Thermocol thus recycled will reduce the pollution caused by its disposal and will lead to a cleaner and greener earth which is the need of TODAY!

## 22. Making Of Paper From Waste Vegetable Peels

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In today's world pollution is a threat to all species on earth. Soil pollution, water pollution, noise pollution, air pollution etc. are all taking its toll on our Mother Earth. This project deals with reducing pollution by recycling waste vegetable peels and making paper out of it.

Collected waste vegetable peels (basically pea peels and other fibrous peels) from the vegetable market and let them dry for a day, to make them slightly crisp. Chopped the vegetable peels into smaller pieces and shred them with a mortar and pestle. Roasted them in an oven to a high temperature till moisture was lost and they became crispy and brown. These were softened by heating in hot water. Waste paper was added at this stage to improve the quality of paper produced. Excessive water and moisture was removed by squeezing the pulp over a strainer and returned to a pot, adding sufficient water to cover the pulp. The pulp was bleached, water was drained out, and it was rinsed until no smell of bleach remained.

This pulp obtained after washing was grinded till it became soft and smooth. It was then spread as a thin layer over a fine cloth. Using lifting net, excess water was drained and the sheet was pressed.

It was left for drying for 2 days. The paper is trimmed and is ready for use.

Paper made out of waste vegetable peels was found to be sturdy and was used to make various decorative items like photo frames, greeting cards, visiting cards, paper bags etc. Paper made out of waste vegetable peels was found to be a good substitute for paper made by felling trees.

Experiments are being conducted to make coloured paper and textured paper. Due to increasing perils for the environment, the importance of trees has increased in our lives it is hence imperative to use alternate methods of paper manufacture that would decrease the pressure on the environment. This project is a step forward towards achieving this goal.

## 2010

- [« Liquid crystals: A link between science and everyday life »](#),

[http://www.institutdegenech.fr/fichiers\\_symposium/LIQUID\\_CRYST\\_LS\\_V13-1.pdf](http://www.institutdegenech.fr/fichiers_symposium/LIQUID_CRYST_LS_V13-1.pdf)

- Illusion and reality in living or non living microscopic nature [« Mayonnaise! »](#),

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- ▪ Illusion and reality in living or non living microscopic nature [« Yeast and alcohol production »](#)

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