FINALISTS 2007 STOCKHOLM JUNIOR WATER PRIZE

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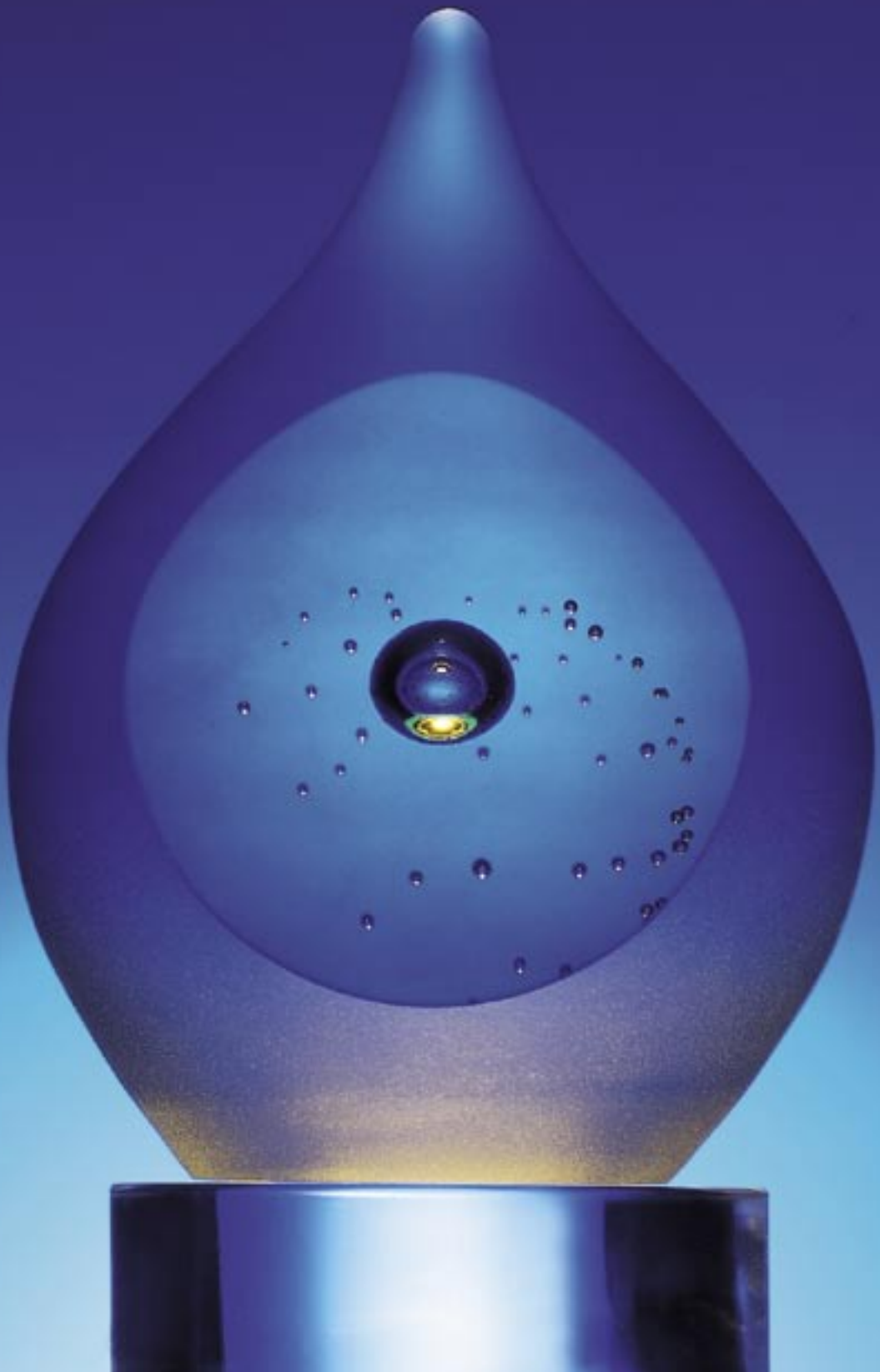


The Stockholm Junior Water Prize

Water and Young People – Linked to the Future

The international Stockholm Junior Water Prize contest aims to encourage young people's interest in issues concerning water and the environment.

The award is given annually for an outstanding water project by a young person or a small group of young people. With this, the competition seeks to inspire young people to a continued engagement in water and related subjects.

While the global water environment remains in peril, the future depends on our ability to manage this life-sustaining resource. Today's youth are indeed tomorrow's leaders and must be encouraged to pursue water-related careers or our scarce supply risk further erosion.

The finalists at the international Stockholm Junior Water Prize competition are the winners of national SJWP contests. The national and international competitions are open to pre-university people between 15–20 years of age who have conducted water related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance.

The winner of the international Stockholm Junior Water Prize receives a USD 5,000 award and a blue crystal sculpture in the shape of a water droplet. The national competitions have inspired young people around the world to become active in water issues.

H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize.

The SJWP International Nominating Committee

The international Nominating Committee includes experts within the field of water and by committee consensus appoints the winner of the international contest. The decision is based on the written report and on a short presentation of the display material. The Stockholm Water Foundation Board appoints the Committee members.

2007 Nominating Committee members are:

Dr. Magnus Enell (Chair), Sweden
Mr. Björn von Euler, USA
Ms. Mercy Dikito-Wachtmeister, Sweden
Dr. Nighisty Ghezae, Sweden
Ms. Linda Kelly, USA
Prof. C.S. Kiang , China
Ms. Tabeth Matiza-Chiuta, South Africa
Associated Prof. Ines Restrepo-Tarquino, Colombia
Ms. Elin Weyler (Secretary), SIWI, Sweden

Last year's international Nominating Committee members.

Finalists 2007

ARGENTINA

Plant for Arsenic Removal from Water

By Agustín Losano and Agustín Perez

Micro organisms living in water can spread illnesses and threaten human health. In addition, large water supplies, particularly in the state of La Pampa's northern region, have naturally high levels of arsenic in the groundwater. If consumed, arsenic can cause serious health problems. Although 93% of the population in La Pampa has access potable water, rural areas depend upon ground water supplies contaminated by arsenic. These rural areas include a massive cattle population consisting of 3,500,000 animals that consume this contaminated water, further threatening human and animal health.

Realising the seriousness of this problem, the Argentinean finalists have designed a device which turns non-potable water into potable. The two-stage process starts with sterilisation through ultraviolet light, which not only eliminates the micro organisms but also oxidises the arsenic. The second stage of the process uses a series of filters to remove the arsenates. The prototype has been analysed from a technological, economical, functional and structural point of view, and the finalists believe that this device will improve potable water supply throughout the world.

AUSTRALIA

The Identification of Critical Salinity Thresholds for Upper Estuarine Plants

By Robbi Bishop-Taylor

With increasing water extraction and decreasing rainfall, Australia faces a crucial need to devise environmental-flow restrictions to protect its national estuaries. To do this, information on critical salinity thresholds for important estuarine plants is urgently required. Through detailed experimental work, the Australian finalist has provided such information on five species of Australian upper-estuarine plants.

A pilot experiment identified workable plant species, determined stress characteristics, and made initial estimates of the critical salinity thresholds. The main experiment exposed five plant species to twelve variations in salinity concentrations over a one month period. After the experiment was replicated, the salinity concentrations marking the greatest change in the percentage of stressed plants were determined as the "critical salinity threshold." The thresholds for the species were: 1-2 parts per trillion (ppt) for *Potamogeton octandrus*, 2-3 ppt for *Vallisneria nana* and *Lomandra hystrix*, and 8-10 ppt for Hydrilla verticillata and *Myriophyllum verrucosum*.

These thresholds will likely help in developing environmental flow restrictions for estuaries, which could minimise damage from water extraction, and help preserve Australia's valuable estuarine environments.

BELARUS

Greening the Milk Industry in Belarus – Whey Bioconversion for Natural Water Protection and Biogas Production

By Usevalad Ihumnau

Each year, the natural waters of Belarus are polluted by over one million tonnes of discharged milk whey. The Belarusian project sought to increase the efficiency of whey bioconversion into methane, which could be used as fuel.

Usevalad Ihumnau developed a method to accelerate the process of bioconversion. For his experiments, he built small scale methane reactors from plastic bottles and started a process of whey fermentation. The research showed that the application of electric currents led to a considerable increase in the methane content of biogas. Further, the application of the electrical current stabilises the conversion process and increases the output of methane per volume unit of whey.

The research suggests that collection and fermentation of whey may be valuable as a biofuel for use as an alternative energy source and and as additional income to the dairy industry. The natural waters of Belarus would benefit from a nutrient reduction, which could result from increased bioconversion of whey. Dairy industry experts applauded the work and it has already been recommended for application at dairy factories in Belarus.

CANADA

Kick That Salt Away

By Simon Bourgault-Côté and Alexis St-Gelais

The "Kick That Salt Away" project aims to remove the most abundant salts from sea water through a chemical process. Before developing their own process, the Canadian finalists tested and evaluated existing physical desalinisation processes. They also examined alternative methods such as filtration, freezing, centrifugation and an anion exchange column. They found that distillation and reverse osmosis were efficient but energy consuming. Reverse osmosis required regular changing of filters. The anion exchange column has great potential but is at present both time consuming and expensive.

The study developed a six step chemical process to efficiently remove magnesium, calcium, sulphate, chloride, potassium and sodium ions from water. Techniques such as precipitation, liquid-liquid extraction and chemical products conversion were used to create the process.

Bourgault-Côté and St-Gelais will continue working on optimising the process for next year by removing a weak reaction with potassium, lowering the costs of the treatment, and removing the remaining non-toxic sodium bicarbonate through the use of flocculates.

CHILE

Presence of Vascular Aquatic Plants in Continental Fresh Water and Their Relation with pH

By Angelo Belmar and Nicolás Cerda

There are two types of plants found in continental fresh water – *algae*, in the form of unicellular organisms and micro organisms, and – *macrophytes*, aquatic vascular plants.

Angelo Belmar and Nicolás Cerda examined if the acidity of continental fresh water was affected by the presence of macrophytes. Their hypothesis was that the large capacity of plants to carry out photosynthesis, which generates certain byproducts such as carbonates and bicarbonates, would affect the pH of water containing macrophytes.

The species chosen for the project were the Southern Cat Tail, the Common Water Hyacinth and the Brazilian waterweed. From their experiments they concluded that the presence of vascular aquatic plants considerably alters the acidity of continental fresh water. The Brazilian waterweed *Egeria densa* was the species which resulted in the most pH differences. It averaged pH 6.5 compared to the control sample of pH 5.7. The students concluded that their the use of vascular aquatic plants is an inexpensive alternative to lower the acidification of continental fresh water, and could also be applied to waste waters.

CHINA

The Biochemical Detoxification of Heavy Metals and its Application to the Water-soil Environment in the Agricultural Wetlands of the Pearl River Delta, China

By Yang Guo, Junhong Wu and Sisi Yu

The rapid industrial and agricultural development of the southern Chinese Pearl River Delta has left the region's waters and agricultural soils seriously polluted. State surveys claim the content of heavy metals in the delta's vegetable patches exceeds desired levels by 40%.

The project aimed to find new, efficient and practical alternatives to conventional methods for heavy metal decontamination. In order to trace and show the changes of heavy metals in the waters and soils, the study examined changes in the heavy metal content of several typical vegetables under different environmental conditions. The experiments used the synergic methods of microbes and acid-base buffering.

The group successfully found ways to screen the microbes by modifying the acid-base conditions of soils and merge microbes with acid-base buffering. The synergic application of *Azotobacter chroococcum* and white lime both inhibited the frequent transport of heavy metals between water and soil in the wetlands, and effectively reduced secondary pollution. This method could be used in the remediation of the water-soil environment in the Pearl River Delta.

DENMARK

The European Eel

By Kirstine Fleng Steffensen

European eel breeds in the Saragasso Sea, where the eel larvae drift or swim with the Gulf Stream to Europe, develop into glass-eels that can mature into adult eels. It is presumed that they swim back to the Sargasso Sea eight to fifteen years later. Research concerning the eel-larvae's swimming abilities, or specifically their energy consumption levels during slow or fast swimming, can give more information about the life cycles and migration patterns of European eels.

The study hypothesises that if the energy consumption was known it could be estimated whether the eels are able to swim from the Sargasso Sea to Northern Europe on their own, or if they instead float with the current. Another important aspect is whether it is possible to make them breed in captivity. European eel-farmers currently rely on wild caught glass-eels. The European eel population is only about 1% of what it was about 30 years ago. The international commission for exploration of the sea has suggested that the European Union ban all fishing for eels for several years, but such a ban has still not been imposed. Perhaps it is already too late to save the species?

ESTONIA

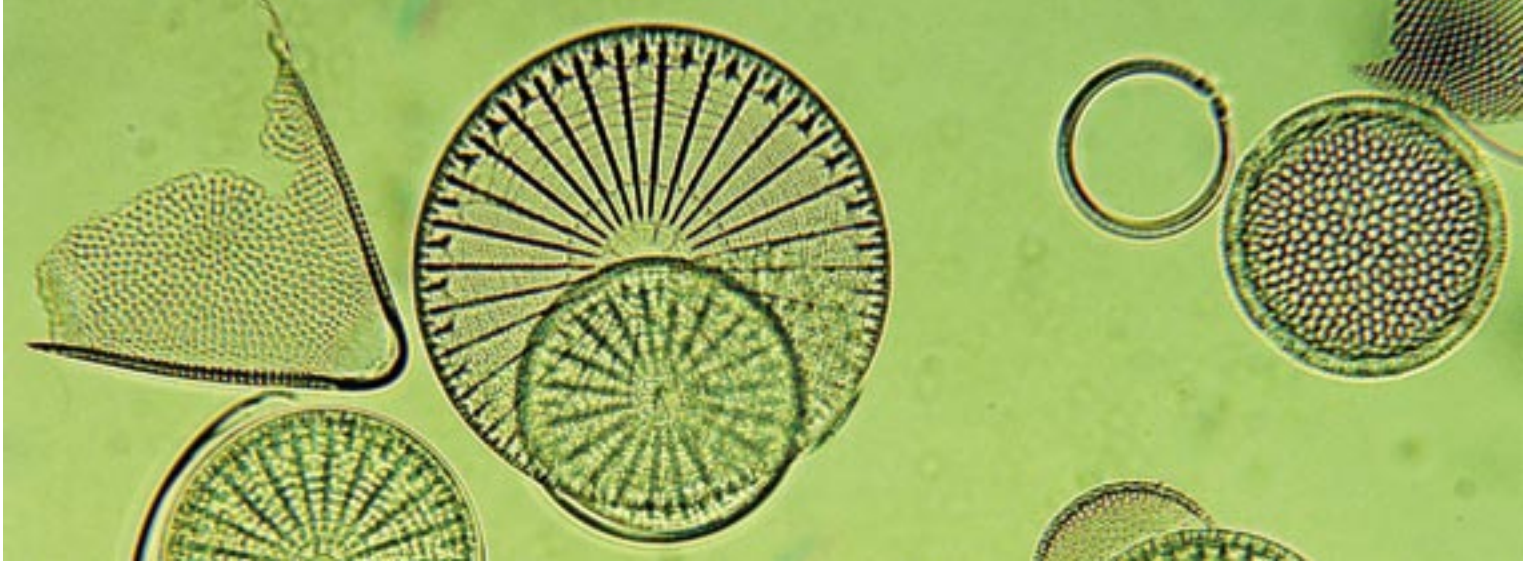
Reducing Formation of Scale with Magnetic Descaler

By Maria Orb

The Estonian town of Jõgeva has hard water, which causes high levels of scale when heated. This makes heating water more energy consumptive. Though the method is sometimes met with scepticism, Maria Orb wanted to explore the impact of magnetic treatment of water on the formation of scale.

The study compared an Elcla magnetic descaler and a homemade scale preventer composed of old computer hard discs. Test results showed that magnetic descaler reduces scaling. Heating of non-treated water left 0.33 g of sediment, heating of water descaled with Elcla 0.04 g (8.3 times less) and heating of water treated with home-made magnetic device 0.09 g of sediment (3.7 times less). Thus, magnetic descalers effectively and significantly reduce the sedimentation of scale.

Permanent magnetic devices have multiple advantages. First, they are maintenance-free while retaining their magnetic properties for decades. Moreover, they can be made at home and do not consume any additional resources after completion. Finally, they can even prolong the usefulness of an old computer by recycling old hard discs and transforming them into descalers.



FINLAND

Comparing Cyanobacteria in Fresh and Brackish Water

By Heidi Heinonen

The quantity of cyanobacteria in the Baltic Sea and in the fresh waters of Finland has increased in recent years. Some species are toxic and harmful to humans; the toxicity of the same cyanobacteria species, however, varies depending on whether they live in fresh or brackish water.

Heidi Heinonen investigated possible reasons for variation in cyanobacteria toxicity by comparing properties of two water bodies they inhabit: the Baltic Sea and Lake Kallavesi. Cyanobacteria appeared in warm waters, but no significant differences were found due to temperature differences. Cyanobacteria caused an increase in the pH values of the waters, where larger cyanobacteria populations consumed more oxygen.

A significant difference in the pH values and oxygen content of the Baltic Sea and Lake Kallavesi was detected. Also, the depth where cyanobacteria were found differed, which could suggest cyanobacteria have adapted to each ecosystem differently by developing different levels of toxicity. Heidi concludes that further research is needed to account for which factor has the largest effect on cyanobacteria levels and if this property can be used to control the amount of cyanobacteria in water.

FRANCE

When Science and Art Come Together

By Laura Dondelle and Timothée Penot

The sustainable development policy of the horticultural high school of Angers Le Fresne aims to improve the quality of the runoff water from their nursery. The irrigation water used on the 5,000 m² of greenhouses and a two-hectare nursery amount to some 30,000 m³ of water each year, coming entirely from the Loire river.

Nearly half of this volume is not consumed by the plants, resulting in excess runoff. The water that is not absorbed by the plants is contaminated with pesticides and excess fertiliser. The polluted runoff then flows through fragile and protected meadows before reaching the Maine river.

To avoid flooding as well as nutrient and pesticides additions on the meadows, the French students decided to purify part of these polluted excess waters by building a 4,000 m² willow plantation with grasses and a hedge. The nitrates and the phosphates will be absorbed by the willows and the hedge, and the pesticides will be reduced by the rhizosphere of the grass. As well as being a sound environmental practice, the willow plantation includes landscaping and artistic features.

GERMANY

Development and Application of an Easy-to-use Biosensor Based on the Oxygen Production of Microalgae

By Philomena Apitzsch and Tobias Hahn

In order to secure drinking water quality and maintain ecological balance, water quality monitoring is one of the most significant duties in modern civilization. World wide, algae produces nearly 50 per cent of the annual oxygen production.

Philomena Apitzsch and Tobias Hahn studied the oxygen production of the micro algae *Chlorella vulgaris* as a parameter for determination of the water's quality. With the biosensor, they examined several toxic substances, several limnic waters and various waste waters. They set up an algae concentrate on an oxygen electrode surface. This test method makes it possible to get information about the toxicity of waters in less than 10 minutes.

Hence, this biosensor is much better and faster than the known biological test procedures. By using oxygen of the photosynthesis, this test method deals with a meaningful parameter. Because the measuring system is simple, it has the potential for world wide use. In addition, the German finalists also constructed their own cultivation attachment to improve the growth of algae, which is based on a novel stirring method that improves the fluctuation of the algae solution.

ISRAEL

Development of a Robot for Measuring Water Salinity in Desalination Plants

By Koral Elisha and Mor Gross

Since osmosis reversing membranes were introduced, the price of desalinated water has dropped. Still, one of the problems encountered in existing plants is the need to manually replace deteriorated membranes.

The Israeli finalists designed and built a prototype robotic system that performs automatic salinity checks in the bundle of vessels of a desalination unit. The mechanical part of the system consists of a robot that can move vertically and insert a tube in any vessel of the bundle of membranes. A sensor that measures electrical conductivity conveys the data to a microchip that converts the information into digital form. They have also developed computer codes and display screens that permit the operators to detect cross sections of high salinity, which indicates a defective membrane or a junction between elements.

In collaboration with technical personnel working at the plant, the robot was tested in a small desalination plant at the Ma'agan Michael in Israel. Further development of prototypes and their use may result in savings in manpower, membrane replacement costs and maintaining desalinated water quality.

ITALY

Water Sources of Cuneo's Valleys

By Valentina Abbona, Gianluca Borio and Virginio Morra

An increasing number of plain and hill aquifers are contaminated by pollution, and rising sea levels threaten underground aquifers. Therefore, the Alps are becoming a principal source of potable water. Because of the increasing value of the water, it is essential to safeguard the natural water sources in the Cuneo valley in Italy.

The Italian finalists tested the water quality of samples collected from springs to make a chemical, physical and microbiological analysis of water sources in the mountain area. They focused their research on detailed analysis of the water samples, considering the risk of dangerous substances for human health by comparing their results to indicators fixed by Italian and CEE regulations. They also carried out a survey of the valleys and their morphology in order to check possible contamination sources, recognising the relation between the geological aspects of the area where the source has its origin and the chemical-physical property of the water.

The group's work provided useful information for the local community, who rely on the water for daily use.

JAPAN

The Mystery of Ike-Boshi – Draining and Drying a Pond

By Satoshi Kimura, Hideki Matsuba and Yuki Tsujii

Modern rice cultivation practices have lead to eutrophication problems. The Japanese project therefore sought to validate the scientific significance of an ancient Japanese practice, *Ike-Boshi*, draining and drying a pond during the agricultural off-season.

With a primary purpose of preserving the Japanese rose bitterling, the students carried out Ike-Boshi in a field. After the pond was emptied, the sun and weather exposure caused the reduced mud to oxidise. Surplus nutrients were eliminated, while the silicate was maintained. In the spring, with new water in the pond, numerous diatoms grew while the growth of green and blue-green algae was suppressed. Larvae *Glochidium* of freshwater mussels ate the diatoms, allowing many young mussels to develop. The numbers of rose bitterling and mussels correlated strongly with each other.

Meanwhile, the nutrient-rich sludge was drained into a rice field, where the nutrients were then re-absorbed and the toxic substances were removed. The results suggest *Ike-Boshi* can suppress eutrophication and provide benefits by reusing nutrients. The students believe that this Japanese ancient wisdom could be applied in water and agricultural management in many other countries as well.

LATVIA

Water Pollution in River Gauja in the Territory of Carnikava

By Reinis Švarchabs and Zane Vitenberga

Access to fresh water is one of Latvia's greatest assets. Unfortunately, rapid industrial growth, urban expansion and intense agricultural practices have increased pollution in the natural water reservoirs. The large quantity of surface waters is affected by polluted runoff generated by developing industrial and agricultural sectors. There is now growing concern in Latvian society over the environmental impact of pollution.

The project used the methods of spectrophotometry and "School Kit Color Chart & Instruction Card" to investigate the quantity of chemical pollution in the waters of the Gauja in Carnikava. They aimed to determine whether the pollution levels in the River Gauja was affected by local population densities. They established measures for different types and amount of pollution, and analysed possible sources of pollution along the river. Their data was composed of water samples taken from four different spots, with varying population densities, along five kilometres of the river with approximately with one month intervals between samplings. Analysis of the water samples showed that the concentration of phosphate ions changed depending on density of population and water level.

LITHUANIA

Investigation on the Population of Seaweed *Furcellaria lumbricalis* in Littoral Areas of the Baltic Sea

By Giedrė Ašmonaitė and Jelena Synanovič

Large amounts of red seaweed *Furcellaria lumbricalis* are washed ashore during storms in the Baltic Sea. A decade ago, rapid decrease of the population of the seaweed was observed. As this seaweed is the main spawning ground of the main species of wholesale fishery in Lithuania, a scientific research program to investigate the condition of the weed was established.

The main objective of the work was to study the population characteristics and epibionts of the red seaweed *Furcellaria lumbricalis*. Samples of the weed were collected in the year 2006 in a littoral area of the Baltic Sea and picked from a depth of two to four meters in the same territory. The morphology (including weight, length, dichotomy, age and structure), quantitative and varietal composition, distribution percentage and biomass of epibionts were measured.

On the basis of the collected measurements, data analysis and comparison, the students concluded that the biomass of the sea mat did not cause any significant difference within the two forms of red algae. Thus the sea biomass had no measured influence on the longevity of algae and its removal from substrate.

NORWAY

Are Parts of the Ljan River Exposed to Pollution? – A Limnological Examination of the Gjersrud Lake and the Stensrud Lake and Their Corresponding Brooks

By Erik Bråthen Solem, Ingrid Eskild and Henrikke Sørlie Marstrander

Salt put on roads to reduce ice formation, nutrients and pesticides used on agricultural land, and leakage from landfills all have detrimental effects on water ecosystems. The Norweigian team studied the effects that salts had on the water quality in two local lakes, Gjersrud Lake and Stensrud Lake, over a one-year period. The degree of pollution from the landfill of Grønmo was also analysed in the Gjersrud Lake and its corresponding brooks.

Temperature, pH and conductivity were measured and the amount of oxygen, nitrate and phosphate, and presence of amphibians was recorded. The amount and type of metals was analysed by the Water and Drainage Authorities' laboratories.

The group found that melted snow from the disposal, as well as salts from roads and agricultural runoff, all brought large quantities of ions to Gjersrud Lake. The effect of these pollutants remain in the lake for several months. The metal contamination problem could be resolved if the water was transported in pipes, and snow disposal was moved closer to the ocean. The water quality may also impact the expansion of amphibians.

MEXICO

Elimination of Pb(II) from Water via Bio-adsorption Using Eggshell

By Adriana Alcántara Ruiz, Dalia Graciela Díaz Gómez and Carlos Hernández Mejía

In order to prevent environmental contamination and negative impacts on human health, lead removal from water should be legally obligatory and prioritised. Several methods exist to eliminate this pollutant from water; the high cost, however, makes companies reluctant to implement the technology.

In this work, a bio-organic material – eggshells - was studied in order to determine its capacity of adsorption. Eggshells have the advantage of being an abundant, common and inexpensive bio-residual. The Mexican finalists mixed eggshells with Pb(II) aqueous solution to remove the pollutant from the liquid phase. Morphology and elemental composition of this compound, before and after reaction, were determined using atomic force microscopy (AFM), scanning electron microscopy (SEM) and energy dispersive X-Ray analysis (EDAX). Atomic adsorption was used for determination of the metal adsorption percent.

The reaction was carried out in ambient conditions, and the team concluded that it can be reproduced to industrial scale. The results showed that the use of eggshells for the treatment of wastewater that contains heavy metals is a simple, innovative, effective and economically viable method of wastewater treatment.

RUSSIAN FEDERATION

Revival of Small Rivers with the Aid of Biological Ponds

By Alexey Razgulov and Anna Prudnichenkova

Small rivers in the Russian Federation face two central problems: water pollution and reduced water flow. Alexey and Varvara's study looked into the environmental rehabilitation of the Rzhavka river – a small river in the Upper Volga river basin – and proposed an original solution to the problem of water pollution.

They suggested accumulating and cleaning the river water in semi-flowing biological ponds. This low-cost solution takes into account specific features of the local landscape and the environmental characteristics of the river's ecosystem. Water purification ponds can serve as efficient mechanisms of water pollution abatement. In 2006, using locally available construction materials, they designed and erected an experimental dam in the lower reach of Rzhavka river.

The results showed that the degree of cleaning varied from 18% to 80% for certain chemicals but reached almost 100% for microbiological indicators of water pollution. Local residents and the municipal authorities enthusiastically supported the project. In order to bring concentrations of water pollutants down to maximum permissible limits (i.e. hygienic standards), two or three additional biological ponds in the middle and lower reaches of the river were recommended.

SOUTH AFRICA

An Integrated Approach to Saving and Managing Water – Empowering Communities, Building Lives

By Scott Mahoney, Bronwyn Metcalf and Nicole Purdon

The South African team identified water and sanitation problems in a rural community that they had been visiting as part of their school's outreach programme. Their aim was to enable the community to have enough water for agriculture and to prevent water wastage, but also to become self-sufficient. The second aim was to help the people in the community become independent and economically stable through the solutions that they design.

The team brainstormed and researched various solutions to these problems and developed a model of a system for catchment and storage of rain water and household waste water, which could be filtered and reused.

They proposed to build gutters in order to catch rainwater, which was captured into tanks, made of brick and plastic lining. Water from the tanks and filtered household water would be used primarily for subsistence farming. In the "bottled garden" the evaporated water would be caught on a plastic canopy, which could be reused by the crops. They proposed that increased production would enable the community to extend their gardens and engage in small enterprises.

SPAIN

Cold Water Saving in a Domestic Hot Water (DHW) System

By Oleguer Puig Mas

Domestic Hot Water (DHW) supply systems are wasteful. Pipes only carry the hot water from the point where it is heated to the tap, which means that when the tap is turned off the hot water stops circulating and cools down. Every time hot water is used, the cold water pipes must be emptied down the drain before hot water can emerge from the tap.

The Spanish finalist calculated that 17.5 % of the total water used per inhabitant per day at home is poured down the drain, approximately 30 litres per day. The study revealed a real and unnecessary, albeit not great, wastage of water in DHW supply systems.

The study has therefore suggested an improved system design that provides a solution to cold water wastage. The proposal also calculated the cost and feasibility of building the system from items available on the market. The system is comprised of several parts, including: a flow sensor, boost pump, non-return valve, cold water direction sensor and electrical system. The cost to build and incorporate this system is estimated to be from €500 to €800.

SRI LANKA

Water – Waste Not Want Not – Leap from Known to Unknown

By A.G. Indunil Eranda, D.M. Ranuri Samavini and D.M. Shashika Sanjeewani Dissanayake

Rice is the staple food in Sri Lanka and rice paddy cultivation is relatively water intensive. Innovations for water conservation in paddy cultivation have a remarkable impact not only in Sri Lanka but across the world.

A "Spilled Water Supply System" is used for paddy cultivation and large amounts of water are wasted due to improper management. To maintain the required level of water recommended by the Agricultural Department, farmers have continuous water flow through the paddy fields to compensate the water lost due to leakages, evaporation and infiltration. Nearly 22% of the water used is wasted through this practice.

The Sri Lankan finalists show that introducing an automated device, a *wakkada*, decreases the amount of water wasted when it is allocated from the main supply to the paddy plots. In addition to water and soil conservation, this method solves a serious social problem by reducing a major cause of conflict among farmers who share water for their paddy fields. The study suggests this device and method has numerous further social, economic and environmental benefits.

SWEDEN

Purification of Water from Phenolic Compounds Using Enzymatic Polymerisation

By Isak Hägg and Emil Nilvebrant

The emission of phenols is a growing environmental issue. Phenol exposure to animals often leads to damaged respiratory systems and decreased fertility, and significantly decreases average lifespan in fish. Using cheap and simple methods, water can be purified from poisonous phenols with an enzyme from a common fungus.

An enzyme from Turkey Tail, commonly found in many countries, can be used to bind phenols together in long chains. This process effectively neutralises the poison, making it harmless to humans and animals. One proposed application is to attach the enzyme to the wall of sewage pipes where contaminated water passes through, which would reduce the amount of enzyme needed to purify large quantities of water.

To be economically feasible, however, the enzyme must be available in large amounts and must have higher activity than the natural laccase that is extracted from *Trametes versicolor*. If the gene producing the laccase were identified, then recombinant DNA-technology could be used to enable industrial scale production of the enzyme. Hopefully, this method could in the future provide another alternative to current methods of purifying water.

TURKEY

A New Hot Water Source Established with Environmentally Friendly Zeolite

By Seyma Savas and Kevser Uz

Finding ways to provide energy to power our societies, while preventing pollution to the environment is a pressing issue. The Turkish project takes one step forward by not only providing hot water during the winter but by preventing pollution as well.

Seyma Savas and Kevser Uz have enabled zeolite (minerals with micro-porous structures) to absorb gas heat. By covering a water pipe and trapping the gasses from the heat source within the substance, the water passing through the pipe becomes heated. Due to zeolite's insulation properties, the availability of hot water could be secured even during power cuts. Moreover, the absorbing properties of zeolite used in this system trap CO^2, SO^2 and other pollutant gasses. The cost of these substances, which are abundant in Turkey, is quite low. Zeolite's insulating properties will make it one of the most important raw materials of the 21st century.

The students' proposal utilises cost-efficient materials and is especially useful as a way to preserve water heat and secure hot water during winters in places with frequent power cuts.

UKRAINE

New Electrochemical Method of Processing of Plating Rinsing Waters for Achievement of Economical and Ecological Purpose

By Kira Shovkoplyas

Industrial activity has increased the use of chemical elements from 19 elements in the beginning of the 20th century to about 60 elements today. Galvanic production, especially, affects water quality and adds heavy metals to water. Therefore, there is a great need for new resource-saving and low-waste technologies that can maximise the use of components.

Available chemical methods are uncomplicated, but expensive. Other limitations include: high energy consumption, pre-treatment of large-dispersed admixtures, the need of cleaning electrodes mechanically, and the use of valuable and scarce membranes.

Kira Shovkoplyas has therefore developed a local electrochemical method of processing plate rinsing water through slit diafragm electrolizer with an insoluble anode. Her experiment cleansed rinsing water from zinc and nickel through hydroxidation. The study of the zinc extraction process after chloride ammonium zinc-plating was done both in free metal form and as hydroxide.

The results showed that the determinative factor for macro kinetics of extraction is relative density rather than current density. Kira Shovkoplyas' pilot model of this electrochemical method showed hydrodynamic and electric stability, making it suitable for use in industrial installations.

USA

Toxicity and Bioaccumulation of Nanomaterials in Aquatic Species

By Jingyuan Luo

Nanotechnology has revolutionary applications but potential negative side effects of the technology remain unknown due to current lack of knowledge on nanoparticle behaviour.

Jingyuan Luo studied the toxicity of nanoparticles by testing nano-carbon particles (fullerenes) and nano-zinc oxide particles on green algae and daphnia (water fleas). She conducted three tests, two of which involved directly introducing nanoparticles at various concentrations into the environments of the experimental organisms. The introduction of regular sized particles and no particles were control variables. The third test examined the accumulation of nanoparticles in an aquatic food chain by feeding nano-treated algae to daphnia.

The first two tests demonstrated that nanoparticles are more toxic to organisms than regular-sized particles. This toxicity is most evident after longer periods of exposure, on which little research has been conducted. The third test revealed that particles can be transferred from algae to daphnia. Future modifications, including lengthening the experimentation period and nanoparticle characterization, will be important in better understanding the mechanisms of nanotoxicity.

The study advises caution when further developing nanotechnology so environmental consequences can be mitigated.

VIETNAM

Using Local Natural Materials to Clean Oil Spills on Rivers in the Mekong Delta

By Phan Phuoc Duy, Tran Trung Hoang and Vo Phi Thoan

Oil spills on the water surfaces are commonplace in the rivers, canals and waterways of the Mekong delta regions in Vietnam. Small boats, using internal combustion engines with petrol and kerosene as fuels, have resulted in numerous small scale boat repairing activities along the rivers. These activities greatly contaminate domestic water sources and negatively affect aquatic biota in the regions.

Observing the pollution, the Vietnamese finalists carried out a study on oil absorption capacities of natural materials available in local areas, such as coconuts fibers, bagasse (sugar cane dreg) and kapok (a fruit of the silk cotton tree) fibres. The main objective of the study was to find the best available materials for oil spill absorption based on absorbing qualities, cost effectiveness and environmental impact. The project resulted in a pilot oil spill collection system from petrol trading boats and repairing establishments along the river, where kapok fibres were used as an absorption material. The collective results were promising and suggested that their system can provide effective means to protect and improve the river water condition in the local areas.

Stokholm Junior Water Prize Finalists, 2006.

Stockholm Junior Water Prize Winners

2006

In 2006, Wang Hao, Xiao Yi and Weng Jie, China, won the Prize for their originality, ingenuity and tenacity in their use of low-cost, ecologically friendly technology to restore a polluted urban river channel.

2005

In 2005, Pontso Moletsane, Motebele Moshodi and Sechaba Ramabenyane, South Africa, the Prize for their revolutionary solution to minimise the need for water in small-scale irrigation. They developed a low-current electric soil humidity sensor which uses light detection to control water pipe valves and improve irrigation efficiency.

2004

Tsutomu Kawahira, Daisuke Sunakawa and Kaori Yamaguti from Japan won the Prize for the development and application of an environmentally friendly organic fertiliser for the Miyako Island. The method is applicable to many places around the world.

2003

Claire Reid, South Africa, won the Prize for an innovative, practical, easily applicable technique for planting and successfully germinating seeds in water-scarce areas to improve rural and peri-urban livelihoods.

2002

Katherine Holt, USA, won the Prize for research that looked at how foreign species could be introduced to benefit the Chesapeake Bay while preserving the bay's native oyster species and meeting national environmental goals.

2001

Magnus Isacson, Johan Nilvebrant and Rasmus Öman from Sweden won the Prize for their innovative and relevant research on the use of natural materials to remove metals in leachate from landfills.

2000

Ashley Mulroy from the USA won the Prize for a contemporary project that investigated how inefficient wastewater treatment processes can lead not only to antibiotic contamination in American waterways, but also to progressive resistance among harmful bacteria to those same antibiotics that once controlled them.

1999

Rosa Lozano, Elisabeth Pozo and Rocío Ruiz from Spain won the Prize for an innovative project that used sea urchins, starfish and sea cucumbers to measure the effectiveness of an EU beach protection program on Spain's western Mediterranean coast.

1998

Robert Franke from Germany won the Prize for his design of the Aquakat, a solar-powered, flow-through reactor for the treatment of industrial wastewater.

1997

Stephen Tinnin from the USA became the first international Stockholm Junior Water Prize winner for research that investigated the correlation between the reproductive rate of sea urchins and water pollution.

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The Future of our World's Water Depends on our Water Experts of the Future.

There are challenges ahead for our world's water. Increased need, stressed supplies, pollution and geopolitics seem to be muddying our future.

At ITT, we have a different outlook. We believe that how we use this precious resource and return it for reuse will help define the future of humanity. We are deeply involved in the cycle of water and are committed to the wise and sustainable development and utilization of the world's water resources.

That is why we are a proud founding sponsor of the Stockholm Junior Water Prize. We congratulate all of the State and National winners. It is their research and discoveries that will play an important role in the future of this most natural and critical resource.

For more information on ITT and the cycle of water: www.ittfluidbusiness.com

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China: The Center for Environmental Education & Communications of State Environmental Protection Administration (SEPA CEEC), ITT Corporation

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Italy: Federazione delle Associazioni Scientifiche e Tecniche (FAST), FOIST, Fondazione Lombardia per l'Ambiente, Sanofi-Aventis, with the patronage of Presidenza del Consiglio dei ministri, Ministero della pubblica istruzione, Ufficio scolastico per la Lombardia and CusMiBio

Japan: Japan Water Prize Committee (JWPC), Lion Corporation, CTI Engineering Co. Ltd., Tokyo Construction Consultants Co. Ltd., Nippon Koei Co. Ltd., Pacific Consultants Co. Ltd.

Latvia: Education, Youth and Sports Department of Riga City Council, Riga Water Ltd.

Lithuania: Druksiai Ecological Education Academy and Lithuanian National Youth Technical Creativity Palace, Swedish Institute

Mexico: FEMISCA (Mexican Federation of Environmental Engineering), Embassy of Sweden, Ministry of Environment and Natural Resources, Ministry of Public Education, National University of Mexico, The Mexican Institute of Youth, Ministry of Environment (Government of Mexico City), Ministry of Works and Services (Government of Mexico City), Mexican Academy of Sciences, Environmental Engineers Federation, Environmental Engineers Association, The Mexican Swedish Chamber of Commerce, Kemira de Mexico, S.A. de C.V., Alfa Laval, S.A. de C.V., ITT Flygt México, Tetra Pak S.A de C.V.

Norway: Norsk Hydrologiråd, Norsk Vannforening, VA-yngre, AnoxKaldnes, Fujitsu-Siemens, Norges Vassdrags og Energidirektorat (NVE), Norwegian Metrological Institute, Statkraft

Poland: Polish Foundation for the Protection of Water Resources, Polish Foundation for the Protection of Water Resources, The Economic Chamber of "Polish Waterworks", The National Fund for Environmental Protection and Water Management

Russian Federation: Environmental Projects Consulting Institute, Coca-Cola Export Corporation, Federal Agency of Water Resources, Canadian Foundation "Civil Society", Russian Regional Ecological Centre

South Africa: Department of Water Affairs and Forestry, Department of Education, Cape Peninsular University Of Technology, University Of KwaZulu - Natal, Water Research Commission, Randwater, Umgeni Water Board & Umhlathuzi Water Board

Spain: AGBAR Foundation (Centre d'Estudis i Investigacio del Medi Ambient), Kemira Iberica S. A.

Sri Lanka: ISB Environmental Services, ITT Corporation

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