

# 2018 Finalists



**SIWI** STOCKHOLM  
JUNIOR  
WATER PRIZE

# The Stockholm Junior Water Prize

**Each year, the Stockholm Junior Water Prize congregates young scientists and innovators from around the world who have created new solutions to the planet's growing water challenges. Each of the finalists represented in Stockholm are the champions of their national competition and have been selected as winners from thousands of entries for their outstanding work.**

We are proud to host the 22nd annual Stockholm Junior Water Prize competition. This year 35 national competitions have been held all around the world and 32 countries are arriving for the international final in Stockholm: Argentina, Australia, Bangladesh, Belarus, Brazil, Canada, Chile, China, Finland, Germany, Hungary, Israel, Italy, Japan, Latvia, Malaysia, Mexico, The Netherlands, Nigeria, Norway, Republic of Korea, Russian Federation, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom and United States of America.

The Stockholm Junior Water Prize competition proves that brilliant young minds can find inspiration in unlikely places. They see opportunity and hope where others find challenges and have developed cost-efficient and immediate solutions, applicable the world over. In this catalogue, you can learn more about the innovative research and inventions that earned each of the finalists a

place to compete for this international honor.

All the finalists are invited to Stockholm for the special opportunity to meet with leaders of the global water community and to make life-long friendships with likeminded youth from around the world who share the passion for water and science. This visit includes the chance to receive the international prize from H.R.H. Crown Princess Victoria of Sweden during an exciting award ceremony which will be held this year on Tuesday August 28th at Berns Salonger in Stockholm.

World Water Week participants have the opportunity to meet this next generation of water leaders by visiting the i-poster exhibition in Folkets Hus.

## About the Stockholm Junior Water Prize competition

The competition is open to young people between the age of 15 and 20 who have conducted water-related projects at local, regional, national or global levels with environmental, scientific, social and/or technological importance. The aim of the competition is to increase awareness, interest and knowledge of water and the environment.

The international winner will receive an award of USD 15,000 and a prize sculpture, the winner's school receives USD 5,000 and the winner of the Diploma of Excellence USD 3,000. H.R.H. Crown Princess Victoria of Sweden is the patron of the Stockholm Junior Water Prize and Xylem Inc. is the global sponsor.

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## The international jury

The competition's international jury includes experts within the field of water who appoint the winner of the international final by committee consensus. The decision is based on the finalists' written report, a short presentation of their display material and three rounds of interviews. The jury members are appointed by Stockholm International Water Institute Board.

All members of the jury have extensive experience and represent a wide range of disciplines from natural to social sciences in order to ensure all projects are equally reviewed and judged.

The 2018 International Jury Members:

- Dr Victoria Dyring (Chair), Sweden
- Ms Fabienne Bertrand, Haiti
- Dr Paula Owen, UK
- Prof. Krishna R. Pagilla, USA
- Prof. Yoshihisa Shimizu, Japan
- Mr Johan Bratthäll, Sweden
- Mr Manuel Fulchiron, France

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## Argentina

### Biological control of the Aedes aegypti

**Micaela Itatí Linera and Emiliano Aquino**

The World Health Organization and the Pan American Health Organization (PAHO / WHO) had expressed the importance of adopting a series of measures to help prevent Aedes aegypti-borne diseases. The presence of Aedes aegypti has constituted a public health problem in our country, registering dengue outbreaks in 15 jurisdictions as from August to September 2016, the worst epidemic in history. The situation demands the urgent need to seek appropriate measures to find new control methods that do not cause environmental problems. Therefore, it was decided to locate biocontrol agents to fight for the important population vector control in their aquatic phase. The predatory capacity of Hopleythrinus unitaeniatus (caballita) proved an important control of Aedes aegypti population in the home environment.

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## Bangladesh

### Combating Water Contamination using Plastic Waste

**Didarul Islam**

High valued multiwalled carbon nanotube (MWCNT) was synthesized from noxious plastic grocery bag waste with a simple technique to minimize disposal problems. Conventional methods for synthesizing carbon nano structured materials involve complex reaction system design, toxic chemicals and high growth temperature and also the production of hazardous wastes. This paper describes an economically viable and

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## Australia

### Recycling waste into biochar: A novel, sustainable model of wastewater filtration and crop fertilization for the agricultural industry

**Minh Nga Nguyen**

This project essentially focused on waste treating waste. Agricultural plant-wastes such as corn cob were recycled into a multi-purpose biochar, that could act as wastewater filters before being reused as crop fertiliser. A novel, self-sustaining biochar model was engineered, that maximised its adsorption of harmful wastewater nutrients to 45.6%. This level is competitive with current bioadsorbents, and significant as this was achieved within in-situ conditions involving competitive adsorption. Effluent quality met Australian standards, with biochar's adsorption sites transferring nutrients from where they are damaging (in wastewater), to where they are valuable (within soil). As this provides a continuous cycle of waste treating waste, it presents agricultural industries worldwide an accessible and cost-efficient manner to reduce their environmental pollution.

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## Belarus

### The definition of colour, colouring and turbidity of the water

**Pavel Schlyaga**

The main idea of our research is that the use of a digital camera and a camera with artificial lighting makes it possible to determine the colour, colouring and

turbidity of water much more accurately than visual observation. When we get the exact colours of water samples from local reservoirs, much can be said about the quality of water in them, the availability of certain substances, and also determine the directions for further research. The method we used in our work to determine the colour, colouring and turbidity of water does not require expensive reagents and equipment, it is easy to use and can be used in the field or home observations.

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Básico do Estado  
de São Paulo

## Brazil

### SIMECHR - Residential Water Monitoring and Control System

**Guilherme da Cruz Catharino**

During 2014-2015, the city of São Paulo, the biggest metropolis in Brazil, struggled with a very serious water crisis. In this context, SIMECHR - Residential Water Monitoring and Control System was developed. It is an equipment able to monitor in real time the incoming water flow to any house and residential buildings. Access can be made remotely through a mobile application. The tool

allows the users to monitor the water level in their tanks and enables them to check undesired air flow in water pipes, as well as leaks, leading towards a more efficient consumption. It also helps the users validate the amount charged in the supplier bill. Therefore, SIMECHR contributes to engage the society in more conscious water habits.

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Canada Water Environment  
Association, Canadian Water  
and Wastewater Association

## Canada

### Disappearance ≠ Disintegration: The Environmental Impact of Pseudo Flushables

**Holly Tetzlaff**

The international flushable manufacturing industry is growing while globally sewer blockages are increasing. Sewer authorities remain steadfast - only toilet paper and human waste should be flushed down toilets but manufacturers continue to claim product flushability. Using controlled trials disintegration rates of 'flushable' products were determined to see if there were correlations between consumer products intended to be flushed into wastewater systems and increase in costly sewer

clogs. Conclusions found 'flushable-labelled' products did not disintegrate like toilet paper. Post-experiment residual masses could become sources of sewer clogs and fatbergs. A Red Fish Route education program for youth and communities can be a solution. People are shown the connection between what we flush down our toilets and how it directly affects our water environment fostering lifelong, environmentally friendly flushing habits in the next generation.

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## Chile

### Wet Scrubbers: A Key Tool Against Air Pollution Caused by Wood-Burning Household Stoves

**Pablo Oyarzo and Guillermo Varela**

Wood stoves are a major source of air pollution in both Chile's capital Santiago and some cities in the country's south, notably Temuco and Quellón. A wood stove can emit up to PM 10  $\mu\text{g}/\text{m}^3$ , which is equivalent to the air pollution caused by 1,500 new cars. This problem is often compounded by the widespread use of highly-polluting wet wood. The role played by water in reducing atmospheric carbon dioxide (CO<sub>2</sub>) is

well known. Rain, for example, dissolves CO<sub>2</sub> into bicarbonate, an ion which in lakes and rivers binds with certain anions to form carbonates. To address this issue, we designed a system capable of reducing carbon dioxide emissions based on water recirculation (a wet scrubber). This process dissolves unwanted gases and converts them into carbonic acid, an easily-handled, weak, and environmentally-safe aqueous solution.

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## China

### Automatic Control System of Biogas Pool

**Li Yu and Tan Xiaolin**

With the development of Chinese economy, biogas pool, which can deal with slops and produce clean energy, becomes more and more important in the life. The automatic control system of biogas pool adds dominant

strains by the actual changing conditions of fermentation to optimize the fermentation process. The system can not only increase the concentration of methane, but also decrease the concentration of hydrogen sulfide. Also, the system can ensure the safety and the stability of the fermentation. In general, the automatic system has a good advantage in the life and can bring the economic benefits.

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## Finland

### Analysis of a storm water bio-filtration system

**Santeri Langdon**

An increase in urban areas is increasing volumes of stormwater, as rainwater cannot be absorbed by the ground naturally. Stormwater can cause financial losses and harm to the environment. Measures have already been taken in Helsinki to deal with the rising volume of stormwater.

For instance a bio-filtration system was constructed, which is designed to remove pollutants from stormwater. In this research paper the effectiveness of the bio-filtration system was analysed by taking water samples before and after the filtration process. The concentration of nitrates, chloride and iron were measured from the samples through the use of spectrophotometry and precipitation titration, so that the efficiency of the bio-filtration system could be determined.

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## Germany

### Microplastics in sewage effluent

Swantje Pieplow and Felix Pochert

Small plastic particles – called microplastic – can be found nearly everywhere nowadays. On the one hand they come from cosmetics on the other hand they come from abrasion from tyre or from

washed clothes made out of plastic fibre. We analysed in which extend microplastic can be found in water after it went through the cleaning process in a water-treatment facility. With nets of different mesh openings as well as I plankton net we filtered the water that flows out of the water works and into the nature. Especially particles between 25 and 40 micrometres interested us. We counted the remaining particles under a microscope and calculated the results of 9 plastic particles per cubic metre. But we only counted those particles which were clear to identify and also assumed that only 25 percent of the found particles are microplastics, so this figure must be seen as a minimum.

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## Hungary

### Hillside Water Management and the Possibilities of Melioration in the Csatári-Valley

Bence Zsolt Rappay

The focus of my research is one of the valleys of the Wine Region of Szekszárd (Hungary), called Csatári-Valley, which allows different agricultural activities.

This area has not been monitored from the perspective of water management.

The problem of the valley (and its owners) rests in the fact that it is not prepared

for the extreme weather of the next decades, thus the risk of soil erosion in the area is extremely large. The purpose of my research was to find and suggest a solution which can provide a stable future for the valley. My suggestion is to make lakes by swelling back the water of this stream. I examined the workability of this with stream gauging, water and soil analyses also with soil erosion estimation. As an addition, I recommend improvements against soil erosion. If my suggestions will be developed, then the valley would have safer, more stable water management.

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## Israel

### Monitoring Genotoxic Materials in Wastewater Using Biosensors

Hava Herman and Sarah Borni

This study examines how the various stages of the wastewater treatment at the Sorek Treatment plant located in central Israel, affect the presence of genotoxic substances in the water. The genotoxic materials were monitored using biosensors based on genetically modified E. coli bacteria.

Our hypothesis was that the level of genotoxicity in the wastewater would progressively decrease at each phase of the treatment process. However, our results

showed no apparent effect of the treatment process on the genotoxicity level of the water, besides the final stage of chlorine disinfection, which caused an increase in the genotoxicity level of the water or damage the SOS system up to a point that the cells were not able to respond anymore.

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the Italian Federation of the Scientific and Technical Associations (FAST)

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## Italy

### The Manna from the Sky: H2O Km0

**Carlo Solari and Silvia Faravelli**

The project offers a simple solution, at low cost, without any environmental impact, which can be implemented quickly in all the farms in Italy. It involves recovering rainwater from farm roofs, water is entered by the downspouts into tanks that, equipped with pumps, can provide the necessary

water supply in crops such as corn, tomato, vine during dry periods. The experiment done at the school farm (G. Raineri) confirms the validity, feasibility and convenience of the proposal; in fact, the rain collected from a cover in 80 days (from 01 October to 20 December) than stored into a cistern, fulfil the water needs of the Christmas star crop (*Euphorbia pulcherrima*) and showed how unnecessary dispersion of "transparent gold" is senseless.

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## Japan

### The New Green Revolution: Hybrid System of Phytoremediation and Food Production in Eutrophicated Ponds/Lakes

**Tatsuyoshi Odai and Narumi Sakamoto**

Many countries suffer serious food shortage and water pollution problems simultaneously. In such areas, chemical fertilizers are excessively applied to farmland to increase food productions, and cause water contaminations such as eutrophication in lakes to cause algal bloom and hazardous chemicals.

Our solution for eutrophication is an integrated system that alters ponds/lakes as water cultivation fields, and purifies water by the water surface's plants. We verified this system can purify water and produce food highly effectively by combining plants, nitrifying bacteria, and mycorrhizal fungi.

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## Latvia

### Biochemical methane potential of microscopic and macroscopic algae of the Baltic Sea and the effect of pre-treatment on biomass efficiency

**Alise Anna Stpniece and Evelina Valtere**

The basis of the issue being analyzed in this paper is the necessity to adhere to principles of long-term development in order to find ecologically friendly replacements to the wide-spread fossil fuels while also reducing the high levels of biological pollutants in the Baltic sea. The goal is to determine the connection between the potential

of biochemical methane and the type of algae (microscopic or macroscopic) and different methods of preparation.



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## Malaysia

**A Novel Way to Reduce Chlorine in Drinking Water by Using the Seed of *Trigonella Foenum Graecum*, *Cynodon Dactylon* and Charcoal**

**Prevena Ramakrishnan and Nishaanthini Mohan**

The purpose of the innovation, 'Home Aeroponic Phytoremediation System with Herbal Filtration' is to prevent human from consuming excessive chlorinated water and dying from cancer. This innovation was invented after conducting multiple science tests on chlorine which causes cancer to thousands of lives in this world. The problems faced by water consumers in Malaysia is they are effected by many diseases especially Cancer and thus increase the rate of cancer patients in the world. This is caused by the excessive chlorine in water. Therefore, through this new 'Home Aeroponic Phytoremediation System with Herbal Filtration' this problem can be solved and provides health beneficial water to human.

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## Mexico

**Water footprint in the production of natural cellulose biofilms for the preservation of vegetables**

**Juan Rojoand and Emmanuel Mantilla**

The objective of the project consisted of the production of paper and two plastic biofilms from cellulose obtained from corn bagasse, which constitutes the waste of corn plant. This with a double objective, on the one hand, reduce the impact to the environment derived from the use of synthetic plastics and on the other,

increase the life time of vegetables. In each of the processes, the water footprint was calculated and compared with that reported in the literature for all cases, as well as the biodegradability of the material produced. Additionally, the plastic biofilms were used as a vegetable coating, determining its preservative and antioxidant effects on some fruits and vegetables.

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## The Netherlands

**Blue Battery**

**Centine Du Toy van Hees**

The Blue Battery is an alternative storage medium in which electrical energy can be stored and extracted by reactions from a redox couple. When a Blue Battery is charged, energy, in the form of electrical energy, is added to energy-poor substances. The acid-base-salt fuel stack can serve as a sustainable alternative. The principle of this fuel stack is based on the properties of ion-selective membranes in

combination with acidic, basic and saline solutions, whereby water can be split and formed without the formation of gas. The substances can be re-used and the battery could form an new alternative to store solar or wind energy on household level. In this way people can sustainably produce and store energy by using water.



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## Nigeria

### Water Purification Using Natural Plant Fibers

Iniso Edward and Blessing Umoukpong

Our project utilized readily available local materials- coconut (*Cocos nucifera*) husk and costus plant (*Costus afer*), to purify water for domestic purposes. The fibers of coconut and *Costus afer* plants were used to purify dirty/impure water obtained from shallow wells from Etim Ekpo Local Government Area of

Akwa Ibom State, Nigeria. The purification process was more efficient when the fibres from the coconut plant were placed between the leaf fibres and the stem fibres of the *Costus afer*. This was because the coconut fibers removed the chlorophyll from *Costus afer* leaves. The filtrate has a characteristic colourless nature due to the fibers ability to absorb metals with the hydroxyl group (OH) present in them. This project could be scaled-up for use in community water treatment.

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## Norway

### Monitoring of marine resources: Marine pollution and microplastic

Maja Grauff Erntsen and Kamilla Blekk

The aim of our project was surveillance of marine resources, with the focus to analyse the occurrence of both microplastic and visible waste. In addition to this we wanted to examine the waste on some of the so-called untouched

islands. We did our field work at Mausund field station. Throughout our research we found an alarming amount of plastic in the soil, which shows the serious consequences of marine pollution and microplastics. Since we know that plastic will never disappear; animals, humans and nature pay dearly for this. Microplastics that end up in the ocean accumulates in the food chain and animals get constipated by plastic. In addition to this, microplastic can absorb environmental toxins and by eating seafood both microplastic and environmental pollutants can end up on our dinner plates. There is a lack of knowledge about marine pollution and microplastics, therefore we are a part of method development by using new equipment and gaining new knowledge.

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## Republic of Korea

### Designing rainwater drain structure for pre-treatment of non-point source pollution

Dong hoon Jang and Yun su Kang

We have devised various types of methods to address non-point pollutants and to prevent flooding by inundation. As a result, four types of solutions were specified in the process of developing and fleshing out ideas, and the verification process of experiments was used to create the most efficient type of drainage structure in terms of non-point pollutant elimination and flooding prevention.

We have devised various types of methods to address non-point pollutants and to prevent flooding by inundation. As a result, four types of solutions were specified in the process of developing and fleshing out ideas, and the verification process of experiments was used to create the most efficient type of drainage structure in terms of non-point pollutant elimination and flooding prevention.

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## Russian Federation

**A study of drift aquatic invertebrates in Nepryadva River**

**Alexander Kiselev**

The bioindication tests of water bodies with strong current should consider the drift propensity of the indicator species. The author identified 56 macrozoobenthos species in Nepryadva River, of which 32 species were able to drift. Invertebrate drift was typically observed only during specific time intervals. Some invertebrate groups drifted only during night-time, whereas others drifted during day and night. Specific

features of invertebrate drift should be taken in account during evaluation of saprobic capacity of water reservoirs. The data on daily variations of drift activity was used to recommend the optimal time of the day for harvesting of bioindication samples. The collected scientific evidence can be used to predict the long-term changes in the state of benthic ecosystems.

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## Singapore

**A Novel, Eco-friendly Synthesis of Reduced Graphene Oxide (rGO) from Durian Rind and Sugarcane Bagasse for Water Filters**

**Caleb Liow Jia Le and Johnny Xiao Hong Yu**

The conventional method of synthesizing reduced graphene oxide (rGO), a promising material for water purification, is expensive and produces toxic gases. In this study, rGO was synthesized from durian rind and sugarcane bagasse using a novel, eco-friendly, simple and low-cost process. The rGO synthesized from durian rind was comparable to commercial activated carbon in removing methylene blue, a toxic dye, and is 32% more effective than commercial activated carbon in adsorbing copper(II) ions. The rGO synthesized can be incorporated into filters for the removal of dyes and metal ions.

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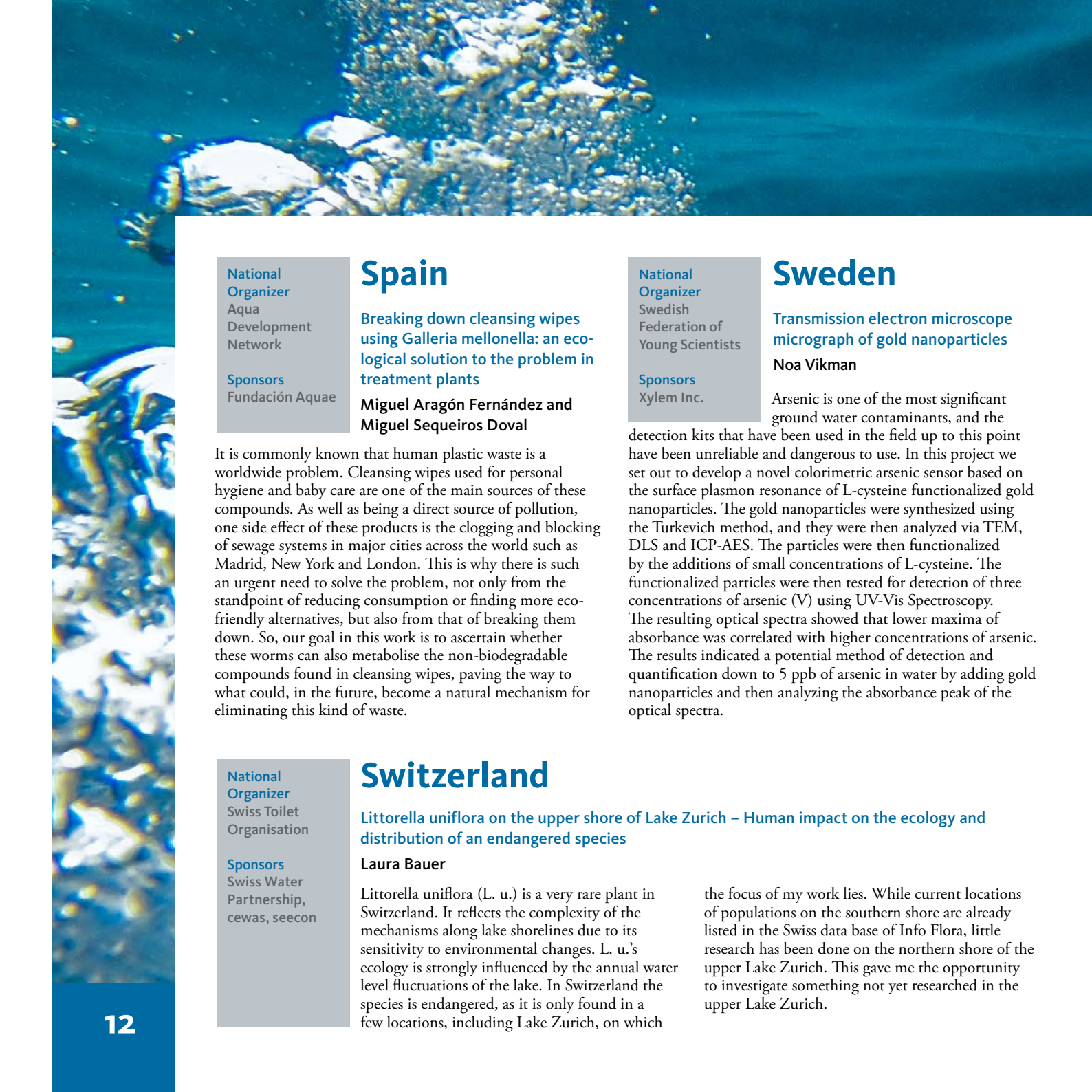
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## South Africa

**Water from Air: The Rainmaker.**

**Kwazi Zwezwe**

While looking at the outside of a bottle with ice, an idea then came to mind. This idea prompted Kwazi to design a model, called the "Rainmaker" which uses a prototype as the main component to dehumidify the air, causing it to condense into droplets of water by the use of a thermoelectric cooler. The rainmaker is designed using cheap and easily accessible materials such as a CPU, SLA battery, aluminium heat sink, solar power/wind power as an alternative power supply and a thermal compound. Over a period of 24 hours, 1.2 litres of water is collected, and according to laboratory chemical analysis, the water produced is as good as rainwater and thus can be used for household purposes.



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## Spain

**Breaking down cleansing wipes using *Galleria mellonella*: an ecological solution to the problem in treatment plants**

**Miguel Aragón Fernández and Miguel Sequeiros Doval**

It is commonly known that human plastic waste is a worldwide problem. Cleansing wipes used for personal hygiene and baby care are one of the main sources of these compounds. As well as being a direct source of pollution, one side effect of these products is the clogging and blocking of sewage systems in major cities across the world such as Madrid, New York and London. This is why there is such an urgent need to solve the problem, not only from the standpoint of reducing consumption or finding more eco-friendly alternatives, but also from that of breaking them down. So, our goal in this work is to ascertain whether these worms can also metabolise the non-biodegradable compounds found in cleansing wipes, paving the way to what could, in the future, become a natural mechanism for eliminating this kind of waste.

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## Switzerland

**Littorella uniflora on the upper shore of Lake Zurich – Human impact on the ecology and distribution of an endangered species**

**Laura Bauer**

*Littorella uniflora* L. Asch. is an aquatic plant which is endangered in southern central Europe. Because of its sensitivity to environmental changes, it reflects the complexity of ecosystems along lake shores. In my study I examined the north shore of the upper Lake Zurich for the presence of *L. u.* and characterized the ecological conditions under which the species grows. I

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## Sweden

**Transmission electron microscope micrograph of gold nanoparticles**

**Noa Vikman**

Arsenic is one of the most significant ground water contaminants, and the detection kits that have been used in the field up to this point have been unreliable and dangerous to use. In this project we set out to develop a novel colorimetric arsenic sensor based on the surface plasmon resonance of L-cysteine functionalized gold nanoparticles. The gold nanoparticles were synthesized using the Turkevich method, and they were then analyzed via TEM, DLS and ICP-AES. The particles were then functionalized by the additions of small concentrations of L-cysteine. The functionalized particles were then tested for detection of three concentrations of arsenic (V) using UV-Vis Spectroscopy. The resulting optical spectra showed that lower maxima of absorbance was correlated with higher concentrations of arsenic. The results indicated a potential method of detection and quantification down to 5 ppb of arsenic in water by adding gold nanoparticles and then analyzing the absorbance peak of the optical spectra.

applied a broad spectrum of wide-ranging surveys including transects, comparisons of different sites, and soil and water analyses. These different ecological approaches enabled the identification of factors critical for the survival of the few remaining populations in Lake Zurich and serve as a reference for the conservation of this plant in other places where it is struggling to survive.

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The Institute for the Promotion of Teaching Science and Technology (IPST)

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The Institute for the Promotion of Teaching Science and Technology (IPST), Government Savings Bank (GSB), Metropolitan Waterworks Authority (MWA), Nestlé (Thai) Ltd.

## Thailand

### The synthesis and development of magnetic nanoparticles test kit for heavy metal detection

Praitsunan Chanpanich and Pimfa Kamkalong

This research aims to produce dissolved heavy metals in water test kit by attachment of synthesized Rhodamine B derivative sensors with magnetic nanoparticles (RB-MNPs). The synthesized RB sensors and MNPs were attached by click reaction. The characteristic of RB-MNPs is 155 nm diameters of spherical shapes. The results showed that 7 metals: Cu<sup>2+</sup>, Ni<sup>2+</sup>, Hg<sup>2+</sup>, Co<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, and Pb<sup>2+</sup> could be detected by RB-MNPs test kit. The appearance of solution with

heavy metals by test kit was in the color shades of pink and orange (visible and fluorescence). Furthermore, the accuracy of test kit was obtained by integrated with the RGB color imaging technique.

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Ukrainian Water Society WaterNet

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## Ukraine

### The Converter of Three-Dimensional Mechanical Oscillations into Electrical Energy

Valeriia Tyshchenko

Wave power is an eco-friendly alternative to environmentally harmful hydropower. But most wave power stations are cumbersome and unreliable because of big amount of kinematic connections, need for movable junctions sealing etc. In this project an autonomous and reliable power generator that uses different three-dimensional oscillations (particularly, waves on the water surface) and in which the number of

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## Turkey

### New Generation Water Production System Water Generation from Moisture in the Air

Yusuf Çolak

The project aims to obtain freshwater by condensing moisture in the air by means of a designed portable apparatus using solar power, which is renewable energy. The apparatus and solar panels have been attached to a backpack. Solar panels charge not only the battery but also the other technical apparatus nearby. According to results from this technical apparatus, we aim to get large amounts of freshwater by establishing large scale facilities to meet freshwater demand. Besides, this apparatus would help soldiers who need fresh water during their duties. This apparatus would be a solution of freshwater problem of military camps located in remote areas.

moving parts is minimized, has been developed. The proposed design is based on the magnetic core that is taped between the coils through the gimbal. The electromotive force generation in the coils is caused due to oscillations of the generator body. The prototypes of the proposed generator were created and tested; the cost of the obtained electricity is 66,5 \$/MW·h.



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## United Kingdom

Employing Computer Vision and Cellulosic Biocomposites for Rapid, Automated and Cost-effective Water Analysis and Purification

**Krtin Kanna Nithiyandam**

In-lab water diagnoses are currently expensive, time-consuming and inaccessible to many rural communities. However, the ubiquity of smartphone technology provides a powerful platform for water analytics. A bio-composite was engineered to filter various contaminants whilst retaining water samples for analysis with a smartphone camera system. A random forest (RF) computer vision approach was designed to categorize image features to generate a probability map. K-means clustering grouped similar pixels and a secondary RF validated different cell regions for species identification. After training, the algorithm identified heavy-metals and individually trained bacterial species within seconds with 90.16% accuracy. Biocomposite filtration removed 2,671 parts per billion (ppb) of Pb<sup>2+</sup>, 2,234 ppb of Ni<sup>2+</sup>, 96% of bacteria and 100% of solid particulates; initial exposure to biocomposite casein resulted in 100% coliform bacterial inactivation within the filtrate in 10 minutes.

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## United States of America

The Development of a Novel Heavy Metal Bioremediation System

**Braden Milford**

The goal of the project was to create a cost-effective, low impact system to remove heavy metals from water systems. First two field studies, both at EPA Superfund Sites, were conducted. At these sites, seven heavy metals concentrations were measured along the streams and water samples were taken. 250 bacterial strains were then isolated from the water samples. The bacterial isolates were screened for heavy metal resistance and successful biofilm formation in heavy metals. 24 bacteria that showed the greatest potential for heavy metal remediation were then selected from the group and identified with a 16S Ribosomal Subunit Analysis. To create the system, the bacteria were combined with mixed algae in an immobilized format called a sodium alginate bead.

## 2017 Stockholm Junior Water Prize Finalists



Stockholm Junior Water Prize gathers imaginative young minds from all over the world. In 2017, the 64 finalists came from 33 countries to World Water Week to participate in the international final of Stockholm Junior Water Prize and to discuss their projects with the wide range of conference attendees, including researchers, politicians and media.

# Stockholm Junior Water Prize Winners, 1997-2017

**2017** | Rachel Chang and Ryan Thorpe, USA

“A Novel Approach to Rapidly and Sensitive Detect and Purify Water Contaminated with Shigella, E.coli Salmonella, and Cholera”

As the pair received the prize, Rachel Chang said: “I’m feeling so overwhelmed with emotions. All the projects here are absolutely amazing, truly of the highest quality. So, to be able to win such an achievement, it feels incredible”.

The students constructed a system that detects and purifies water contaminated with Shigella, E. coli, Salmonella, and Cholera more rapidly and sensitively than conventional methods. The students’ novel approach could prevent the contraction and outbreak of waterborne diseases and expand potable water throughout the world.

The Jury was impressed by the winners, in particular their “exceptional intelligence, enthusiasm and true passion for water and human health.”



Ryan Thorpe and Rachel Chang, received the 2017 Stockholm Junior Water Prize for their novel approach to detect and purify water contaminated with Shigella, E. coli, Salmonella, and Cholera. H.R.H. Crown Princess Victoria of Sweden presented the prize at an award ceremony during World Water Week in Stockholm.

**2016** | Sureeporn Triphetprapa, Thidarat Phianchat and Kanjana Komkla, Thailand  
“Natural innovative water retention Mimicry Bromeliad (Aechmea aculeatosepala)”

**2015** | Perry Alagappan, USA  
“Novel renewable filter for heavy metal removal”

**2014** | Hayley Todesco, Canada  
“Waste to water: Biodegrading naphthenic acids using novel sand filters”

**2013** | Naomi Estay & Omayra Toro, Chile  
“Psychrobacter: Antarctic co-operation on bioremediation of oil-contaminated waters”

**2012** | Luigi Marshall Cham, Jun Yong Nicholas Lim and Tian Ting Carrie-Anne Ng, Singapore  
“Investigation of the use of sodium-activated bentonite clay in the removal and recovery of non-ionic surfactants from wastewater”

**2011** | Alison Bick, USA  
“Development and evaluation of a microfluidic co-flow device to determine water quality”

**2010** | Alexandre Allard and Danny Luong, Canada  
“Research on biodegradation of the plastic polystyrene”

**2009** | Ceren Burçak Dag, Turkey  
“A solution to energy-based water contamination: Rain as an alternative environmentally friendly energy source”



- 2008** | Joyce Chai, USA  
“Modelling the toxic effects of silver nanoparticles under varying environmental conditions”
- 2007** | Adriana Alcántara Ruiz, Dalia Graciela Díaz Gómez and Carlos Hernández Mejía, Mexico  
“Elimination of Pb(II) from water via bio-adsorption using eggshells”
- 2006** | Wang Hao, Xiao Yi and Weng Jie, China  
“Application research and practice of a comprehensive technology for restoring urban river channels ecologically”
- 2005** | Pontso Moletsane, Motebele Moshodi and Sechaba Ramabenyane, South Africa  
“Nocturnal hydro minimiser”
- 2004** | Tsutomu Kawahira, Daisuke Sunakawa and Kaori Yamaguti, Japan  
“The organic fertilizer – An alternative to commercial fertilizers”
- 2003** | Claire Reid, South Africa  
“Water wise reel gardening”
- 2002** | Katherine Holt, USA  
“Cleaning the Chesapeake Bay with oysters”
- 2001** | Magnus Isacson, Johan Nilvebrant and Rasmus Öman, Sweden  
“Removal of metal ions from leachate”
- 2000** | Ashley Mulroy, USA  
“Correlating residual antibiotic contamination in public water to the drug resistance of Escherichia Coli”
- 1999** | Rosa Lozano, Elisabeth Pozo and Rocío Ruiz, Spain  
“Echinoderms as biological indicators of water quality in the Alborán Sea coast”
- 1998** | Robert Franke, Germany  
“The Aquakat – A solar-driven reactor for the decontamination of industrial wastewater”
- 1997** | Stephen Tinnin, USA  
“Changes in development, sperm activity and reproduction across a 105 exposure range in Lytechinus Variegatus Gametes exposed to pesticides in marine media”



## WaterTank – The world’s best young water minds, their water projects, and the global community that supports them.

WaterTank is a community for the finalists of the Stockholm Junior Water Prize competition. It allows participants to keep in touch, seek advice and advance their careers and projects in water.

Would you like to join WaterTank? Participation is open to finalists of Stockholm Junior Water Prize as well as mentorship opportunities for senior professionals. We also welcome organizations to join as partners.

Get involved! Contact Ania Andersch at [ania.andersch@siwi.org](mailto:ania.andersch@siwi.org)

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## Do you want to be part of the Stockholm Junior Water Prize?

For more information about leading a national competition in your country or opportunities to contribute, please contact

[ania.andersch@siwi.org](mailto:ania.andersch@siwi.org)

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