SIWI STOCKHOLM JUNIOR WATER PRIZE

HUNGARY

2015

About the Stockholm Junior Water Prize

The Stockholm Junior Water Prize (SJWP) was established in 1997 and is an annual competition open to young people between ages 15 to 20, who have conducted water-related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance. The Stockholm International Water Institute administers the Stockholm Junior Water Prize, its awards, while it serves as its secretariat (www.siwi.org/prizes/stockholmjuniorwaterprize/)

The Stockholm Junior Water Prize consists of two parts: the National Competition and the International Final. All participating countries begin by arranging their own National Competition. The winner proceeds to the International Final in Stockholm. As a result of the competitions, thousands of young people around the world develop personal interests, undertake academic studies and often pursue careers in water or environment related fields.

The International Final takes place at the World Water Week in Stockholm. It is an event where people from all over the world meet. This generates many opportunities for networking and exposure. The efforts of the participating countries are highlighted globally.

The winner of the Stockholm Junior Water Prize receives a USD 15,000 award, a blue crystal prize sculpture, a diploma as well as the stay in Stockholm. Nevertheless, the participation is what genuinely matters.

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

Hungary and the SJWP

Hungary joined the SJWP in 2013. Mr. János Áder, the President of the Republic, has been the patron of the competition since 2014.

The national organizer of the SJWP is the GWP Hungary Foundation in agreement with the Stockholm International Water Institute. Details of the competition are available at www.ifivizdij.hu

Previous winners of the national competition

2013: Dézi Kakas, János Béri and Péter Polák Jr. (Fényi Gyula Jesuit Secondary Grammar School, Miskolc) – Project title: The Importance of the Szinva Stream: Biological and Chemical-Physical Examinations

2014: Claudia Li, Lívia Mayer and Nikolett Sebestyén (Eötvös József Grammar School, Tata) – Project title: Our Water is Our Future

Contents

Finalists of the national contest

The Hungarian National Final

The jury during the national final

Fifteen entries were received for the 2015 Hungarian National Competition. Altogether, there were 36 secondary school students involved, including individual contestants, two- and three-member teams as well.

The projects were written in English, according to the requirements of the call and dealt with different topics, such as surface water bodies, groundwater, wetlands, drinking water, industrial pollution, local issues and global challenges. For the national final, five projects were selected by the jury on the basis of the SJWP judging criteria.

The Hungarian National Final was organised at the Hungarian Water Utility Association (MaVíz) in Budapest on 30 May 2015. The finalists were requested to prepare an A0 poster per team displaying the results of their project.

During the final the contestants orally presented their main findings and answered the jury's questions. Approximately 15 minutes per team were allocated. The presentations and the interviews were conducted in English.

The jury of the SJWP – Hungary 2015

Chair:

- **László Somlyódy,** member of the Hungarian Academy of Sciences

Members:

- **Edit Nagy,** Secretary General at the Hungarian Water Utility Association
- **Marcell Marschall,** R&D leader of GE Power & Water / Water & Process Technologies
- **Péter Szűcs**, Dean at the University of Miskolc
- **Tamás Krámer**, Associate Professor at the Budapest University of Technology and Economics
- **Adrienne Clement,** Associate Professor at the Budapest University of Technology and Economics
- **István Bálint**, Managing Director for Xylem Water Solutions Hungary
- **Csaba Haranghy**, CEO of the Budapest Water Works
- **Károly Kovács**, President of the Hungarian Wastewater Association

Secretary:

- **József Gayer**, Chair of GWP Hungary Foundation

Summary of the finalists' projects

Binding the Arsenic Content of Water Treatment Sludge

Dorka Bélteki, Lilla Bagi and Petra Tóth – Kőbányai Szent László Secondary Grammar School, Budapest

In its elementary form and because of inorganic salts, arsenic is highly toxic and also lethal in high doses. The high content of arsenic in drinking water resources represents a serious problem worldwide.

In more than 300 lowland Hungarian settlements, drinking water is gained from arsenic affected groundwater bound in aquifers. In the course of arsenic discharge of potable water a ferrous sludge is generated. This sludge, because of its high arsenic concentration, can only be disposed in hazardous waste deposits. The cost of disposal as hazardous waste, however, is much higher than discharging it into a communal landfill.

The aim of the project is to elaborate a method which prevents the leaching of arsenic present in the sludge, thus allowing the sludge be disposed in a communal landfill. Our further plan is to bind the arsenic content of the sludge in concrete without risking that arsenic would leach into natural waters.

While preparing the project, we carried out several experiments. We used different additives in order to bind the arsenic and barium content of the sludge. Our object was to generate apatite and carbonate compounds which would hold pollutants bound in an insoluble form within a wide range of pH value. According to our results, the measured dissolution values would already be in compliance with the standardised limits of communal waste deposits.

With the help of this method, it will be possible to decrease in the future the quantity of arsenic-polluted waste disposed in hazardous waste landfills. For the insoluble binding of arsenic in concrete further experiments are needed.

Summary of the finalists' projects

The Secrets of Drinking Water – How to Combat Polyethylene Terephthalate

Márton Czikkely, Tamás Gergely Iványi, Tamás Márkus – Városmajori Grammar School, Budapest

Our interest in water-related issues started in the autumn of 2014 when we entered a project competition organized by the Austrian Association of Chemistry Teachers. Then our aim was to present water as a versatile material, but it was also during that work that we noticed the harmful effects of PET bottles. The present project grew out of this realisation which we carried further including several measurements, surveys, and experiments.

We started from the fact that each year more and more PET bottles are released into the environment. These pollute nature for a long time. They create floating islands on the oceans. If combusted, carcinogens get into the atmosphere. If put under UV light, toxic materials dissolve from PET into the mineral water. In addition, bacteria grow at the neck of the bottles.

We also examined the route of water in Budapest, from the Danube to the consumers, and the treatment used by the Budapest Waterworks in the different premises where we spent a day. After studying the chemical and biological aspects of this journey we became satisfied that the tap water in Budapest is of impeccable quality.

In our poll on water consumption habits, we learnt that people consumed about the same amount of tap water and bottled water. From this, the amount of PET water bottle discarded by a person could be calculated. In addition, the analysis of the comments written on our questionnaire showed that the majority of people consume tap or bottled water instinctively without having a precise cause and without caring for the possible consequences of their decisions. This realisation also convinced us about the necessity of our research.

In order to avoid the growth of PET dumped in landfills, rivers, and oceans, we came up with four easily implementable solutions: (1) purchasing PET bottled water in the largest possible container; (2) using glass instead of PET; (3) drinking water captured from a natural spring; and (4) drinking tap water, especially where tap water is of excellent quality, like in Budapest.

While developing the solutions, we were not only thinking and writing about ecological problems, but we actually took an action to achieve our objective for the first time in our lives. On the 12th of April, we joined the "With Children for Nature Association" in cleaning the Kárpát Spring in the Pilis Mountains, thereby also initiating a relationship to perform community service.

After this intensive work, all three of us observed that we pay more attention to our environment than before, and we consume far less PET bottled water. We also hope that one of our solutions will be adopted by those who read the text of our research.

Water Budget – The Prospects of Rehabilitation of Mocsárosdűlő

Richárd Abuczki, Ferenc Szalisznyó and Gábor Takács – Petrik Lajos Vocational School, Budapest

The objectives of our work are the measuring of Mocsárosdűlő's water balance (Óbuda), the monitoring of changes caused by human intervention in the last 250 years and the preparation of the area's rehabilitation based on the principles of hydrological methodology.

We examined the extent and the time course of human intervention in water balance by studying topographical and cadastral maps of the past 250 years. We defined the corporate identity of the area as one separated from the Danube and a locked basin, based on geological details and terrain analysis.

We confirmed with measurements and shed new light on the issue of refill and seepage of groundwater in the area. Consequently, numerous assumptions were raised. The basis of our research was provided by 10 groundwater monitoring points which we set considering weather factors and the water level fluctuations of the Danube. According to our measurements and observations, it seems highly questionable that the territory is influenced by the Danube. We have to conduct more measurements and we need a longer period of time to confirm this statement.

It is obvious that the landscape gets water supply from the surrounding areas and its maintainers are the fluctuation of runoff and direct rainfall. We examined the operation of the channels and the flow of groundwater in order to justify this statement and we listed the possibilities of aboveground inflow and leak. We attended that the substructures of buildings and the leakage of channels and ducts are instrumental in water table fluctuation. Based on our observations and measurements, we could develop the area's water budget.

We compared the former coenological inquiry and longer time series of detection points. Therefore, we diagnosed that groundwater fluctuations are larger than it would be healthy for this species composition with higher water demand. As scientific literature argues, the balanced condition of this type of habitat should be higher groundwater level than 0.5 metres and the fluctuation must be lower than 0.5 metres. According to our GIS-models and water level measurements, we plan to set the groundwater level at the high of 103.0-103.5 m.a.s.l. It could be regulated by the branching of the actual canals, installing drains under the ground and temporarily sluicing. We wish to quadruple the size of the protected area based on the results of water budget. From the landscape architecture's point of view, this would mean a special project to synchronize a built-in area with a nearby protected area.

Summary of the finalists' projects

Local Nitrate Contamination as a Worldwide Environmental Problem

Eszter Faragó, Mirtill Rohonczi and Lili Weich – Dombóvári Illyés Gyula Grammar Schol, Dombóvár

By nitrate contamination we mean the entrance of nitrate with agricultural origins into waters and environment causing harm to human health and wildlife, hindersthe use of waters and spoils their esthetical value.

During the project, we followed the course of nitrate from the pollutant sources to the recipients using literature data, observations and local examinations with water samples. Institutes with their experts and employees, as well as and students from our school helped in our work.

For the analysis of surface water we asked the National Inspectorate for Environment, Nature and Water for measurement data from the catchment area of Kapos River. For our research regarding nutrients dispersed to the ground we requested data from NEBIH. We analysed the given data and illustrated the values on graphs.

During the examination of pollution sources, the organic manure output and manure processing solutions, we observed different methods in ten livestock farms. We investigated whether the livestock farms observe the necessary regulations in manure management regarding the needs of surface and groundwater.

During our research, we examined the surface water's nitrate concentration with samples from Kapos River in Dombóvár and in Kurd and from the creek in Szakcs. We made the measurements with Visocolor rapid tests on the spot, in the laboratory and at the university in Kaposvár. We received the information in connection with drinking water from the public service and from the Mayor's Office.

During the examination of groundwater, we analysed 84 water samples and we indicated the values of drilled and dug wells on map.

The surface and groundwater are contaminated because of the incorrect agricultural exercise and collection of sewage water which causes local and global problems as well.

Let Off the Steam - and Make Water. Or How to Produce Water from Biomass

Laura Szalóki – Lehel Vezér Grammar School, Jászberény

In my project, I am studying an apparatus which can produce water by fermenting organic materials. The components and quality of second generation biomass – which can be used in a device like this – varies from country to country. Therefore my research focuses on the properties of biomass originating from the different countries taking part in Stockholm Junior Water Prize. This is important because the proportion of specific chemicals produced during fermentation varies by using different starting substances.

My apparatus has a standard structure. Its central unit consists of two compartments. One of them is the fermenting tank in which the pre-treated biomass is put and then it is hermetically sealed. It must be closed hermetically since fermentation is an anaerobic process. The catalysis of fermentation seems to be expedient, which can be carried out both by increasing the temperature or adding fermenting bacteria like Lactobacillus rossiae to the starting material in advance. The movement of the biomass and thus the speed of fermentation are enhanced by mixing paddles. When the pressure in the tank reaches a certain limit, the valves open into the direction of outlet tubes and the produced gases and steam (including methane, carbon dioxide and hydrogen sulphide) get into the second compartment of the central unit. This part of the device works in a similar way as a mass spectrometer since the materials from the outlet tube get into a vacuum pipe where a fast ion-tail is formed, which is deflected by the electromagnetic field of an adjustable electromagnet. The degree of deflection depends on both the intensity of the magnetic field and the charge / mass of the ions. A charge-sensitive detector is placed at the end of the vacuum pipe, which can help to define the exact mass of a certain molecule or ion. After measuring its size, the substance gets into the right mass range collecting trap, and this is the outer compartment of the device.

The reason for the traps is to carry out controlled and separated chemical reactions in order to produce water as the following example shows: methane is discharged from the fermenting tank and enters its own trap where it is burnt and thus water and carbon dioxide are created. After cooling the trap water steam condenses and goes into the final water collecting tank while carbon dioxide goes to its own collecting trap. It is formed into methane again, by hydrogenating it and some water is produced this way again. It is only one example, but a lot of other processes take place with the separated substances reacting with oxygen or hydrogen molecules and resulting in a considerable amount of water.

To conclude, producing water from organic waste would be considered an important milestone. Due to human activities several millions of tons of rubbish are produced a day. Utilizing this, our natural fresh water source can be saved replacing it with artificially-produced water.

The result of the National Final

The jury decided on the winner in a closed session. The decision was based on the same judging criteria used during the international final (Relevance, Creativity, Methodology, Subject Knowledge, Practical Skills, Report and Presentation), considering both the written version of the project and the presentation, including the interview. The winners of the Stockholm Junior Water Prize – Hungarian competition 2015 are:

Márton Czikkely, Tamás Gergely Iványi and Tamás Márkus (Városmajori Grammar School, Budapest). Their project “The Secrets of Drinking Water” deals with four innovative proposals on how to avoid the overuse of bottled water which could be applied worldwide.

As the patron of the Hungarian competition, President János Áder, was not present – because of to other obligations –, the “SJWP – Hungary 2013” prize was handed over to the winning team by Szilvia Szalóki, Vice-president of the Hungarian Energy and Public Utility Regulatory Authority and Péter Kovács, the Head of Department of the Ministry of Interior.

The second place goes to Eszter Faragó, Mirtill Rohonczi and Lili Weich from Dombóvári Illyés Gyula Grammar School for their team work titled “Local nitrate contamination as a worldwide environmental problem”.

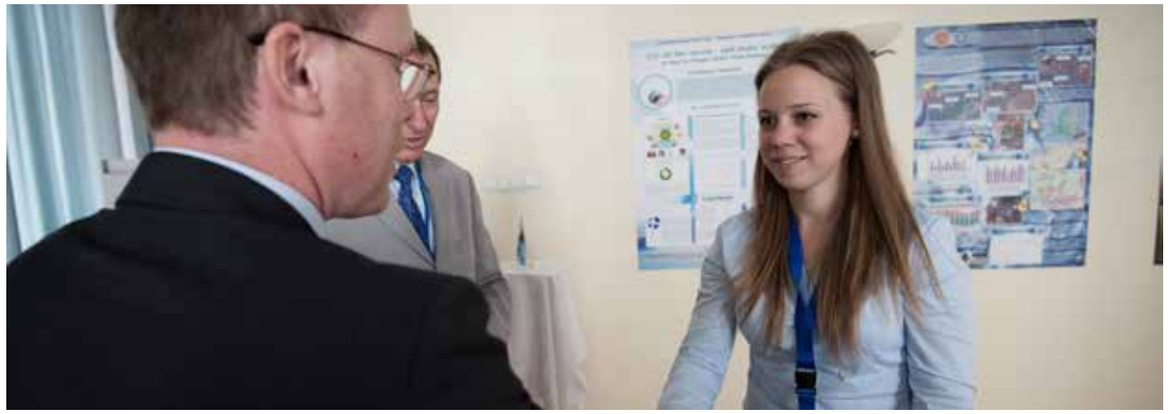
The third place was awarded to Richárd Abuczki, Ferenc Szalisznyó and Gábor Takács from Petrik Lajos Vocational School for their wetlands project “Water budget - the prospects of rehabilitation of Mocsárosdűlő”.

All finalists received diplomas and recognition on stage. The members of the first three teams were awarded a six-month subscription to National Geographic. All the finalists were invited to the Budapest Zoo and the Széchenyi Bath as well. The support of the teachers was recognized on stage too.

The winners with their teacher dr. Anna Solt

Grundfos special prize winners and the representative of the company

The team of the second place with Szilvia Szalóki and Péter Kovács



GWP Central and Eastern Europe Regional Coordinator Richard Müller also greeted the contestants

The international final

The finalists from the participating countries were invited to the World Water Week in Stockholm. There they actively took part in the global conference through a variety of activities for five consecutive days. A poster exhibition of all student projects gave the finalists an opportunity to discuss their projects with a wide range of conference attendees including researchers, politicians and the media.

This year, representatives from 29 countries competed for the SJWP: Argentina, Australia, Bangladesh, Belarus, Canada, Chile, China, Cyprus, Finland, France, Germany, Hungary, Israel, Italy, Japan, Latvia, Mexico, The Netherlands, Nigeria, Norway, the Republic of Korea, the Russian Federation, Singapore, South Africa, Sweden, Turkey, Ukraine, the United Kingdom and the United States of America. Following the poster presentations, each of the finalists was interviewed by a jury of international experts, who then decided on the winner.

Hungary was represented by the three-member team formed of Márton Czikkely, Tamás Gergely Iványi and Tamás Márkus (Városmajori Grammar School, Budapest), with their project “The Secrets of Drinking Water” (see page 6.).

Novel renewable filter for heavy metal removal

Perry Alagappan, USA

Rapid advances in technology in the 21st century have resulted in the recent and significant rise of electronic waste, which contains highly toxic heavy metals such as mercury, cadmium, and lead. These heavy metals frequently leak into water sources, thus posing a dire threat to us. The problem with existing heavy metal filters is that none of them are readily renewable. Leveraging the power of nanotechnology, a fully regenerable, sustainable, efficient, and first-of-its-kind filter has been created that can remove over 99 per cent of heavy metal contaminants from drinking and industrial wastewater.

The 2015 Stockholm Junior Water Prize was awarded to Perry Alagappan from the United States of America for inventing a filter through which toxic heavy metals from electronic waste can be removed from water. H.R.H. Crown Princess Victoria of Sweden presented the prize in an award ceremony held on the 25th August. The winner also received an award of 15,000 USD, including a sculpture prize.

A Diploma of Excellence was awarded to the students Katherine Araya and Katya Urqueta from Chile, for improving water use efficiency in agriculture. In their project, the students used fungus from an Antarctic root in lettuce production, which decreased the amount of water needed.

The venue of the World Water Week

The Hungarian team with its poster

Ready for the award ceremony

Stockholm Water Prize laureate Rajendra Singh addressing the finalists of SJWP

The winner of SJWP 2015 Perry Alagappan receiving the prize from with H.R.H Crown Princess Victoria

The Hungarian team entering the stage

The Diploma of Excellence was awarded to the team of Chile

Stockholm Junior Water Prize 2015 finalists with H.R.H Crown Princess Victoria of Sweden

Sponsors

Partners

National Organiser

GWP Magyarország Alapítvány

1119 Budapest Etele út 59-61.

Phone: +36 1 37 11 333

Fax: +36 1 37 11 334

E-mail: gwpmo@gwpmo.hu

Web: www.gwpmo.hu

Photo credit: SIWI, GWP Hungary

Edited by József Gayer

www.ifivizdij.hu