Renewable energy brings water to all

■ Ines Zucker, PhD student

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More than a billion people in developing countries have no access to safe drinking water. Population growth, pollution and over-exploitation have all contributed to water scarcity. An EU-funded project is working on developing a solution: a simple, low-cost, user-friendly water purification system which converts contaminated water into quality drinking water using renewable energy without any chemicals. A journalist from the EU Neighbourhood Info Centre visited the project, and sends us this report.

Text by: **Marc Weiss**

Photos by: **AFP © EU/Neighbourhood Info Centre**

TEL AVIV – Ready access to drinking water is taken for granted in Western states, but for residents of many developing countries water scarcity is a growing problem.

According to the World Health Organisation, more than a billion people in developing countries, mostly in rural areas, have no access to safe drinking water. Population growth, pollution and over-exploitation have all contributed to water scarcity. Every year, unsafe water, coupled with a lack of basic sanitation, kills at least 1.6 million children under the age of five.

Water purification infrastructure costs can be prohibitive and therefore European Union-funded scientists are seeking to develop a simple and inexpensive water purification system to clean contaminated water and increase access to drinking water and water for irrigation for millions of people.

The EU's NATIOMEM (Nano-structured TiON photo-catalytic membranes for water treatment) project seeks to develop a new technology for treating contaminated surface and waste water, transforming it into potable water, safe for human consumption. The technology does not require electricity, chemicals, or other logistical support, and is therefore suitable for underdeveloped areas that are lacking infrastructure. Israel's Tel Aviv University was one of the centres chosen for the project.

Scientists developed an innovative water treatment system, which uses sunlight to activate a nanostructured photo-catalyst immobilized on membranes. Water passes through the membrane, which removes particles and large microorganisms. The activated surface then kills microorganisms that may have passed the membrane.

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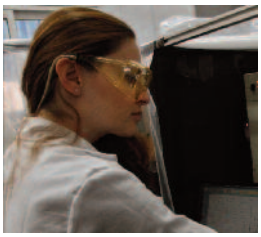


Inna Horovitz, PhD student, works with the Solar simulator

Dr. Vered Cohen-Yaniv

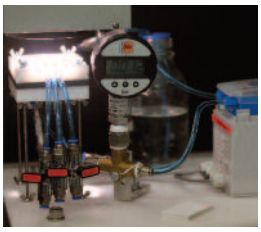
Israelis Ines Zucker,(Right) PhD student, Alon Riani, (Centre) MSc student, and Roi Peretz, MSc student during a routine work at the laboratory

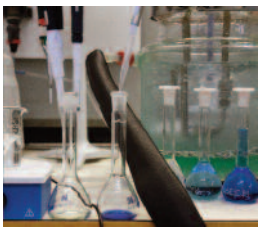
"The beauty of this project is that you don't need electricity because natural sunlight is used and you don't need chemicals"

No chemicals, just sunlight

Inna Horovitz, a PhD student heading the project at the Tel Aviv University laboratory under the supervision of Dr. Dror Avisar and Dr. Hadas Mamane, said good results were achieved in photo-catalyst oxidation of water pollutants and microorganisms, and the work is continuing even though the project has finished. "The beauty of this project is that you don't need electricity because natural sunlight is used and you don't need chemicals," she explained. "We believe the technology can be applied to improve water quality in both developed societies and in the Third World."

Laboratory test results were quite promising and scientists provided recommendations on the design and application of the photo-catalytic membranes. The technology has the potential to provide effective water treatment in regions suffering from extreme water scarcity.





General view of a the lab in Environmental Engineering program, Faculty of Engineering Tel Aviv University

Pilot plant testing in South Africa and Jordan

Based on the results of laboratory testing, three pilot plants with photo-catalytic membranes were designed and constructed, each holding 16 coated membranes with a total effective area of 0.35 square metres. The pilot plants were set up in South Africa and Jordan, and were used to quantify the performance of the coated membrane treating natural waters, to investigate fouling tendencies and to develop suitable cleaning strategies. In South Africa, NATIOMEM focused on the production of safe drinking water for rural areas.

Approximately 38 percent of South Africans live in rural communities where the available raw water sources are rain, ground and surface water. Due to the lack of electricity and infrastructure, the photo-catalytic membrane unit should be inexpensive and easy to use with minimum maintenance required, bringing safe water to remote villages.

The NATIOMEM treatment units were also intended to treat domestic grey water as a rooftop solution. In urban areas in Jordan, household water (so-called grey water) will be treated in reuse non-potable applications such as toilet flushing and irrigation, dovetailing with a government directive to reuse grey water. Potentially unsafe piped water will be disinfected to reduce dependence on bottled water.

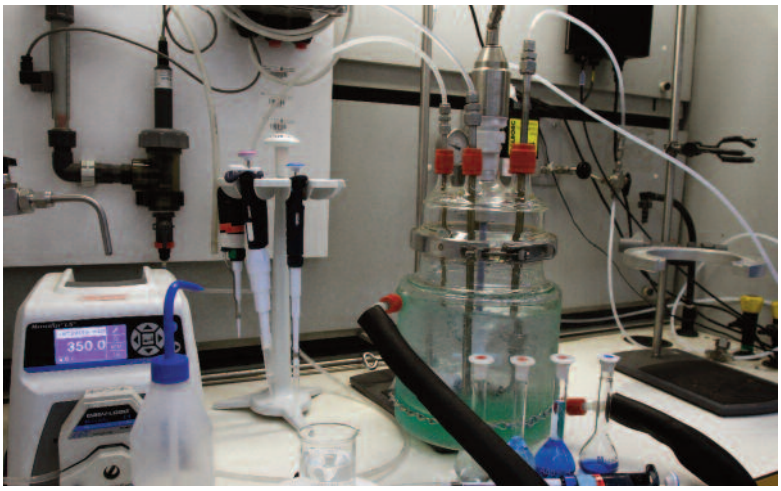
It is hoped that decentralized reuse of treated grey water for toilet flushing and

Petri dish containing a selective medium for E. coli bacteria determination at the lab in Tel Aviv University

"We believe the technology can be applied to improve water quality in both developed societies and in the Third World"

irrigation will reduce fresh water consumption and alleviate the critical water shortage facing the Hashemite Kingdom.

NATIOMEM project coordinator Dr Gerald Heinicke noted that in the laboratory tests, the photo-catalytic membrane showed promising performance for disinfecting drinking water, but problems arose in the pilot plant tests. "The low pressure, low flux, low fouling strategy proved to be ineffective. This makes the concept unsuitable for the envisaged low-tech application. The treatment unit will require more effective pre-filtration and the use of electric energy for pumping water. The electricity may be supplied by a solar panel, but the additional equipment will increase the cost of the treatment unit, and make it more complicated to use."



Ozone quenching by Indigo method in batch ozonation system for water and wastewater treatmentat

"The combination of solar energy to activate nano-structured photo-catalyst via advanced oxidation process is among the most promising emerging water treatment processes and is anticipated to play a crucial role in combination with conventional technologies"

Perspectives of the technology

A positive spin-off was also noted: several novel coating techniques developed within the scope of the NATIOMEM project have potential for future use in solar-powered hydrogen production plants and third-generation solar cells. Following the completion of the project, the NATIOMEM partners are now trying to assemble a consortium for further technical development, leading to commercialization of the photo-catalytic membrane. Dr Dror Avisar, one of the three Principal Investigators of the project at Tel Aviv University, believes the future is bright. "The combination of solar energy to activate nano-structured photo-catalyst via advanced oxidation process (AOP) is among the most promising emerging water treatment processes and is anticipated to play a crucial role in combination with conventional technologies."

Natiomem

http://www.natiomem.eu/

NATIOMEM was co-funded by the 7th Framework Programme (FP7) of the European Commission under grant agreement No. 245513. The project proposes to alleviate people's suffering from water scarcity by developing novel technology for treating contaminated surface and waste water, so that it will be potable. This technology does not require electrical power, chemicals or other logistical support, and hence will be suitable for poor areas lacking infrastructure.

To find out more

Community Research and Developmente Information Service (CORDIS): Natiomem project fiche
http://cordis.europa.eu/project/rcn/96170_en.html

CORDIS: Making access to fresh water possible for everyone
http://cordis.europa.eu/result/rcn/91428_en.html

EU Neighbourhood Info centre thematic page: EDUCATION, TRAINING & RESEARCH
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