Water Research Center
Tel Aviv University

The Water Research Center News
"Qwaterly"
2nd Issue | August 2018

For more details, visit us at our new website: https://en-wrc.tau.ac.il/

"Qwaterly" drop: The 2nd "Qwaterly" is underway, summarizing the research activities, academic cooperations, publications and events that have been planned and have occurred in the last 3 months. In this "Qwaterly" we present one perspective of an issue that we are studying that is of big concern: micropollutants in water. Prof. Dror Avisar presents a treatment concept to deal with degradation products of chemotherapeutic drugs derived from oncology departments that end up in municipal wastewater-treatment plants. ENJOY!

Degradation of chemotherapeutic drugs derived from an oncology center: the treatment concept

Prof. Dror Avisar

The continuous growth of Israel's population over the last decades has created an increasing demand for quality water resources to maintain a healthy and normal life. Hence, protecting the quality of water resources is the most important and vital environmental mission of the 21st century. Concerns are increasingly being raised about the environmental and health effects of many chemicals used by humans, such as chemicals used in agriculture, industry, medical services, and domestic consumption. Studies have shown that these substances diffuse into the environment and are characterized by greater than expected stability and persistence.

The medical world employs about 4,000 active ingredients and more than 10,000 products for medical treatments; 90% of the substances/drugs consumed by patients are not absorbed in the body, but are secreted, through the urine, into the environment via wastewater-treatment systems that have not been designed to disassemble and remove these substances.

Between 2000 and 2007, the national expenditure for medicines and medical materials increased by 69.4%, which means a significant increase in the number of drugs reaching the treatment systems and being released into the environment.

The absence of a standard for medical materials and substances is of particular importance in Israel, since 84% of Israel's wastewater is recycled and used to irrigate some 115 million dunams of agricultural land. Added to the fact that the State of Israel itself supplies most of its agricultural needs, these medical materials are more likely to "return" to the population via drinking water and food. It should be noted that the Inbar Committee's regulations for upgrading effluents do not include standards for organic micropollutants, claiming that such standards have not yet been determined by the World Health Organization, European countries or the United States.

Hospital effluents contain substances with high toxic potential, such as type 3 antibiotics, which are found only in hospitals as the last treatment resort for "predatory multiresistant bacteria", radioactive substances, chemo-chemical substances, and solutions and materials for medical, laboratory and research purposes. It is estimated that these effluents contribute from 10% to 25% of the pharmaceuticals found in municipal wastewater.

There are differences of opinion regarding the effectiveness of early treatment of hospital wastewater for the detection of organic micropollutants prior to their discharge to wastewater-treatment plants, with some arguing

The hospital's wastewater-treatment pilot plant, in its new location at Tel HaShomer

Porter School of the Environment and Earth Sciences
The Raymond and Beverly Sackler Faculty of Exact Sciences
Tel Aviv University
הפקולטה למדעים מדויקים ע"ש ריימונד ובברלי סאקלר
אוניברסיטת תל אביב
בית הספר לסביבה ולמדעי כדור הארץ על שם פורטר

that the rate of effluents in municipal wastewater is about 20%, and therefore there is no need for pretreatment. However, the release into the environment of residues of type 3 antibiotics used only in hospitals for the treatment of particularly virulent bacterial strains may cause resistance to these unique antibiotics and impair the medical system's ability to use them.

Various research groups have been trying to develop technologies for the degradation of medical materials from potential pollution sources, such as municipal, agricultural and industrial effluents. In recent years, the research group at Tel Aviv University's Water Research Center has developed a unique technology based on advanced oxidation processes, which has been found to be effective in the complete decomposition of medical materials in both urban and industrial wastewater, and especially in hospital wastewater. The research group has recently implemented the technology in a pilot field study established near the oncology building of a big hospital, to break down chemotherapeutic drugs from the building's wastewater before they are discharged into the environment.



From left: Prof. Dror Avisar, Ms. Olga Meirov, Dr. Eyal Kurtzbaum.

Things are on the move:

The pilot research system for hospital wastewater has been transferred to a new location at the Tel HaShomer Hospital's campus. It is now receiving all of the hospital's wastewater, before it drains into the municipal wastewater system.

Conferences:

May 2018 – Micropollutants: Occurrence, Regulations and Innovative Technologies This conference, held at Tel Aviv University, was part of a collaboration between the Water Research Center at TAU and Dr. Ofir Menashe from Kinneret College. New approaches and reviews of the latest advances in the field of micropollutants in the environment, with an emphasis on new microbiological treatments for wastewater, were presented at this conference. The number of participants and the high response emphasize the importance of this conference.

Seminars:

The 1st lecture on a series of analytical chemistry seminars was taking place on August 7th. Dr. Igal Gozlan gave a fascinating presentation on Mass spectrometer (MS). He reviewed and explained the fundamentals of the instrument, the differences between the various types of MS detectors and some important tips and guidance on correct operation and data analysis.

Projects & collaborations:

A laboratory-scale bioreactor was set up in the laboratory to simulate the predicted acclimation process in the bioreactor of the pilot system set up at the hospital. The sludge brought from a municipal wastewater-treatment plant and the hospital wastewater were changed daily to acclimate the bacteria to feed with wastewater containing a mixture of toxic drugs. This experiment was part of a project of an undergraduate student from Shenkar.

Undergraduate student project from Shenkar. Left: Mr. Gal Geler; right: Mr. Itamar Peleg.

Coming events:

International conference on conflict resolution on November 7–9th. The following two Water, Environment and Conflict Resolution sessions will be organized by the Water Research Center: (1) Water Management: Assessment of Present Conditions in Israel, Jordan and Palestine; (2) Cooperation between Neighboring Countries in the Middle East.

The Moshe Mirilashvili Institute:

The institute supports international collaborations and outstanding scientists:

Dr. Vered Cohen-Yaniv is a research associate and laboratory manager in Prof. Hadas Mamane's Water Technologies Laboratory. She studies the responses of different bacterial promoters to both oxidative and UV stress. Her work also includes the use of the innovative Micro-Flow Image Analysis to rapidly measure, count/concentration, and morphological shape, before and after subjecting them to various disinfection methods.