Water Research Center
Tel Aviv University

The Water Research Center News
"Qwaterly"
For more details, visit us at https://en-wrc.tau.ac.il/

8th Issue
February 2020

"Qwaterly" drop: We are already in 2020, with many exciting research projects, cooperation and community involvement: a taste of these is presented in this issue, and we wish all readers an interesting year. ENJOY!

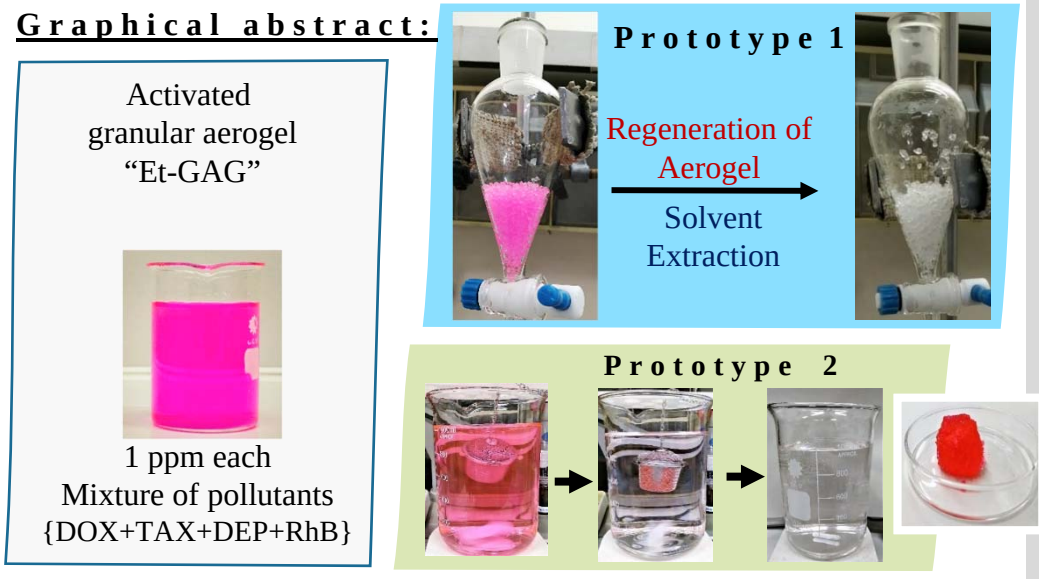
Sincerely, Qwaterly

Ethanol-activated granular aerogel as efficient adsorbent for persistent organic pollutants from real leachate and hospital wastewater

Published: Lakshmi Prasanna, V., Mamane, H., Vadivel, V. K. and Avisar, D. 2020. Ethanol-activated granular aerogel as efficient adsorbent for persistent organic pollutants from real leachate and hospital wastewater. Hazardous Materials. https://doi.org/10.1016/j.jhazmat.2019.121396

An abstract – Hydrophobic aerogels were used to remove three types of persistent organic pollutants: pharmaceutical drugs (i.e., doxorubicin [DOX], paclitaxel [TAX]), phthalates (diethyl phthalate [DEP]), and hydrophilic rhodamine dye from synthetic and real wastewater, using Lumira granular aerogel from Cabot activated with EtOH (ET-GAG). The hydrophobic silica aerogel was characterized by X-ray diffraction, high-resolution transmission electron microscopy, Brunauer–Emmett–Teller measurement and attenuated total reflection–Fourier transform infrared spectroscopy. The pollutants were analyzed by high-performance liquid chromatography (HPLC)–UV and HPLC–mass spectrometry. The adsorption process was governed by hydrophobic - hydrophobic interactions between the ET-GAG and micropollutants. The adsorption capacity of ET-GAG, examined by batch experiments, for DOX, TAX and DEP were 13.80, 14.28 and 17.54 mg/g respectively. The rate of adsorption to ET-GAG is high in the initial 40 min followed by no change in the rate due to saturation of adsorption sites. ET-GAG was able to completely remove micropollutants from real leachate and hospital wastewater, implying practical applications. Regeneration of the aerogel was studied by solvent extraction. Et-GAG adsorbent demonstrated better removal of toxic chemotherapeutic drugs and phthalates than GAC.

Graphical abstract:



Educational project in the community:

An educational science program, with 8th-grade students from St. Michael School in Jaffa and 9th-grade students from Sharet in Netanya, was initiated under the auspices of the Rotary Hands Across Water organization in cooperation with the Water Research Center (WRC). The pupils studied water and sanitation issues. Their project consisted of sampling tap water in their daily environment and bringing it to the hydrochemistry laboratory for analytical tests. During their visit to the WRC at TAU, our team introduced them to the hydrochemistry laboratory and the analytical instruments, and gave them a tour inside the laboratory. Using the analytical analysis of their tap-water samples, we presented a scientific research process to assess water quality.

School students visiting the TAU WRC.

Focus on the efficiency of the biological treatment:

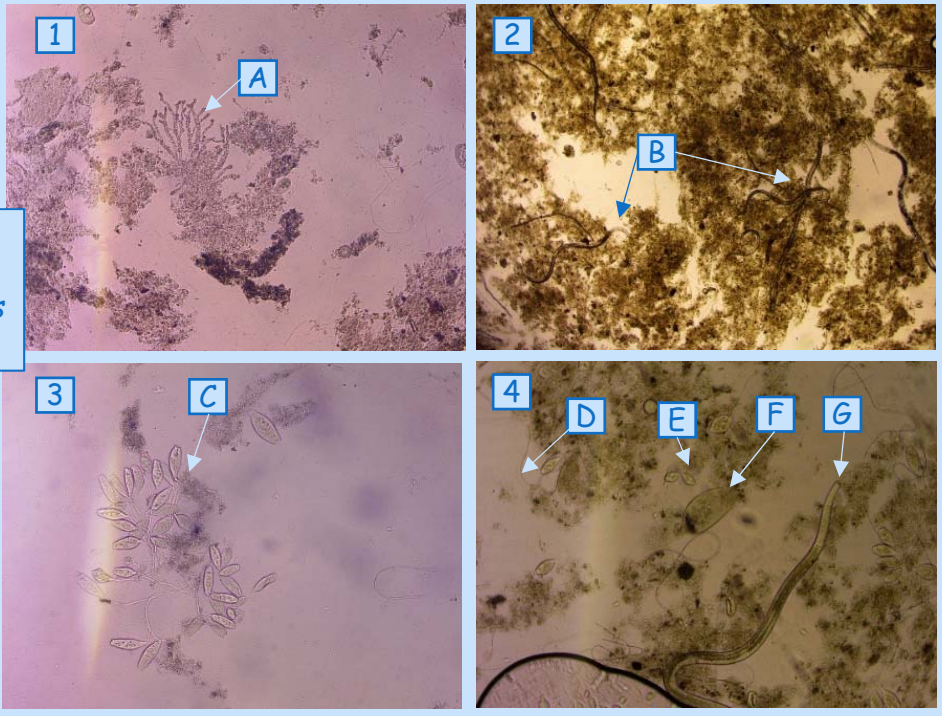
The efficiency of wastewater treatment can be assessed by its sludge's chemical characteristics (carbon and nitrogen removal) and/or its biological characteristics (microorganisms). The variability and amount of microorganisms in the treatment reactor indicate the biological (tropic) level and health conditions. There are four tropic levels, characterized by the microorganismal population. Small bacteria—Zooglea (1,A) and filaments (4,D)—are present in the first level; diminish protozoans, such as free-swimming ciliates (4,F) or amoebae appear in the second level; small predators, such as attached ciliates (3,C), characterize the third level, and the top, fourth level includes metazoans, such as nematodes (2,B) and rotifers. The tropic cascade consists of (bottom–up): bacteria, which removes nutrients; protozoans, which consume the bacteria and clarify the effluent; and metazoans, which consume both bacteria and protozoans and maintain balance. Optimally, the delicate balance of population sizes should be maintained at all tropic levels, and therefore the appearance of all tropic levels on one slide indicates that the treatment process is efficient and the sludge healthy.

New publications:

Mohan, S., Mamane, H., Avisar, D., Gozlan, I., Kaplan, A. and Dayalan, G. 2019. Treatment of diethyl phthalate leached from plastic products in municipal solid waste using an ozone-based advanced oxidation process. Materials, 12, 24. DOI: 10.3390/ma12244119.

Menashe, O., Raizner, Y., Kuc, M. E., Cohen-Yaniv, V., Kaplan, A., Mamane, H., Avisar, D. and Kurzbaum, E. 2020. Biodegradation of the endocrine-disrupting chemical 17α-ethynylestradiol (EE2) by Rhodococcus zopfii and Pseudomonas putida encapsulated in small bioreactor platform (SBP) capsules. Applied Sciences, 10, 336.

Morgan L. P., Zilberman, A., Kaplan, A., Ronen-Eliraz, G., Langenfeld, K., Wang, Y., Wigginton, K., Poretsky, R., Avisar, D. and Wells, G. F. 2020. Metagenomics-guided analysis of antibiotic resistance genes and viral communities in a hospital wastewater treatment system. Frontiers in Microbiology, in press.



Microorganisms population in the sludge's: Zooglea (1,A) ; nematodes (2,B); attached ciliates (3,C); filaments (4,D); attached ciliates (4,E); swimming ciliates (4,F); nematodes (2,B).

Conferences & seminars:

SAVE THE DATE:

November 19th, 2020

International Conference Supplying Drinking Water via Non-Conventional Technologies

The Moshe Mirilashvili Institute:

The institute supports international collaborations and outstanding scientists:

Oran Fradkin is a new Master's student in the hydrochemistry laboratory. He recently completed a double degree—a B.Sc in Mechanical Engineering and a B.Sc in Geosciences with an emphasis on Environmental Studies. In his current research, he is studying the efficiency of UV-LED technology for the degradation of chemical and pharmaceutical residues in contaminated water.