Editorial: Wastewater management and resource recovery

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While the focus in urban wastewater management has traditionally been in wastewater treatment to remove pollutants and in safe discharge of the treated wastewater, the potential to recover nonpotable or potable water or nutrients from water resource recovery facilities (WRRF) is gaining more attention (Kehrein et al., 2020). Especially in water-scarce areas, the treated wastewater could be used for nonpotable purposes, for example for irrigation or industrial purposes, while also drinking water can be produced from treated wastewater, as is done with the Singapore´s NEWater process. As phosphorous rock reserves are depleting and unevenly distributed in the World, phosphorous (as well as nitrogen) recovery from WRRF will also gain more importance in the future.

In the December 2020 issue of Water Environment Research, 14 articles are included (one perspective, 13 original research articles). These papers cover a broad range of topics, from which most focus on the removal of pollutants from municipal wastewater, industrial wastewater, hospital wastewater, groundwater, urban river or landfill leachate, but also on destruction on biofilm from water pipelines, removal of water hardness, and stormwater management. In this Editor´s Choice, I would like to concentrate on two of the articles: "Taking the water out of "wastewater": An ineluctable oxymoron for urban water cycle sustainability" that is the work of A.G. Capodaglio (University of Pavia, Italy), and "Systematic comparison framework for selecting the best retrofitting alternative for an existing water resource recovery facility" by V.C. Machado et al. (Universitat Autonoma de Barcelona, Spain).

To decrease the use of chemical precipitants and increase phosphorous removal of the present WRRFs, integration of enhanced biological phosphorous removal (EBPR) is an option. To determine an optimal retrofitting alternative to include EBPR to a municipal WRRF currently having anoxid/oxic (A/O) configuration, Machado et al. (2020) tested four different plant configurations by using dynamic modeling and simulation and compared the configurations with a multicriteria comparison framework to select the best retrofitting alternative. The plant configurations compared included single and double anaerobic/anoxic/oxic (A^2/O), BARDENPHO, and University Cape Town configurations. The multicriteria comparison included 13 criteria, including effluent quality, robustness under disturbances, and investment and operating costs. The double A^2/O configuration was recognized as the best retrofitting alternative (when keeping configuration changes at minimum) and resulted in phosphorous removal of 82.3%. The used decision support methodology was determined as a reliable tool for comparing WRRF retrofitting alternatives.

While integration of EBPR to an existing WRRF was able to enhance the phosphorous removal by 69% compared to the current configuration (Machado et al., 2020), using EBPR would also enable more efficient recovery of phosphorous. Phosphorous could be recovered either from the mainstream or via phosphorous precipitation after anaerobic digestion of the sludge originating from EBPR (Guisasola et al., 2019; Roldán et al., 2020). Recovering phosphorous from municipal wastewater with EBPR and mineral precipitation is also considered by Capodaglio (2020) as one of the most efficient methods for phosphorous recovery at present.

In the perspective article, Capodaglio (2020) reconsiders the whole wastewater collection and treatment infrastructure and suggests transforming the current wastewater collection systems that results in diluted wastewaters to source segregation that would enable water reclamation and nutrient recovery. Indeed, technologies for source separation, such as vacuum sewers, already exist. Source segregation would result in water savings and enable production of reused water, quality of which is lower than drinking water and that can be customized for local purposes, such as for toilet flushing, irrigation or industrial use.

Capodaglio (2020) suggests that source segregation would also save energy used currently for transportation and treatment of wastewater. At present, energy is required especially for transferring wastewater with gravity flow that requires frequent pumping and for the treatment of wastewater with energy-intensive activated sludge process. According to Capodaglio (2020), efficient harvesting of the energy present in municipal wastewater would enable water industry to become energy self-sufficient. This could be accomplished, for example, by using high-rate anaerobic treatment for source separated wastewater that has high concentrations of organics. This approach would reduce energy requirements for wastewater treatment and produce energy as methane. In addition, source segregation would result in more concentrated wastewaters, from which phosphorous could be recovered more efficiently. Since municipal wastewater is estimated to contain ca. 16% of the phosphorous consumed in the World, enhancing phosphorous recovery is advisable. While traditional collection systems and source separation could operate in mixed mode in cities especially in water-scarce areas to enable the use of treated wastewater for nonpotable use, decentralized water systems are ideal for source separation.

I encourage you to explore these two Editor´s Choice articles as well as the other twelve articles in the December issue of Water Environment Research. I hope you will enjoy reading them as much as I did.

References

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