Title: Elimination of organic contaminants from water using low chemical-intensive CO_2–triggered systems

Abstract:

In recent years, a vast and expanding array of anthropogenic compounds have been identified as alarming water pollutants and have been linked to negative impacts on the behavior, growth, and survival of aquatic organisms, in addition to a variety of health issues in humans, including cancer.[1–4] These contaminants are usually not included in the government monitoring programs, thus they are largely unregulated, which represents a significant challenge to environmental and public health. Main sources of these contaminants include industrial effluents and wastewater facilities, as well as pharmaceuticals and their metabolites that are not incorporated by the human body and are excreted directly into municipal waste streams. Although several methods to mitigate these contaminants are currently available, many of them generate a range of side-contaminants that possess unknown biological behavior and are possibly more harmful than the parent contaminant.

In this seminar, I will discuss about the development of physical methods that can remove contaminants from water using low-energy intensive and low-chemical intensive conditions. First, I will present a novel CO_2–triggered micellar–enhanced ultrafiltration routine that eliminates small organic contaminants from real and artificial wastewater samples. In this technique, a surfactant is purposefully used above its critical micelle concentration to induce the formation of micelles which, in turn, can entrap organic contaminants through favourable interactions. The method can reject contaminants possessing different chemical structures and hydrophobicities, with percent rejection ranging from 82–99%. Moreover, the system is tolerant to hardness, presents an exceptional flux performance, and allows for an easy recovery of the input materials. Next, I will discuss about the development of a CO_2–triggered adsorbent material that can quantitatively adsorb dyes from water. Overall, the new approaches use very mild conditions, are simple, easy to use, they allow for a facile reclamation of the input materials, they do not use aggressive chemicals, all while exhibiting environment-friendliness and a feasibility towards contaminant removal.

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(2) Stuart, M.; Lapworth, D.; Crane, E.; Hart, A. Review of Risk from Potential Emerging Contaminants in UK Groundwater. *Science of the Total Environment*. February 1, 2012, pp 1–21. https://doi.org/10.1016/j.scitotenv.2011.11.072.

(3) Gaston, L.; Lapworth, D. J.; Stuart, M.; Arnscheidt, J. Prioritization Approaches for Substances of Emerging Concern in Groundwater: A Critical Review. *Environmental Science and Technology*. American Chemical Society June 4, 2019, pp 6107–6122. https://doi.org/10.1021/acs.est.8b04490.

(4) Li, X.; Shen, X.; Jiang, W.; Xi, Y.; Li, S. Comprehensive Review of Emerging Contaminants: Detection Technologies, Environmental Impact, and Management Strategies. *Ecotoxicology and Environmental Safety*. Academic Press June 15, 2024. https://doi.org/10.1016/j.ecoenv.2024.116420.