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Recent Trends in Wastewater Treatment with Emphasis on Metal-Organic Frameworks (MOFs)

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Abstract

Water pollution is an increasingly major global problem, posing serious threats to human health, aquatic creatures, and ecosystem. Recently, emerging contaminates (EC) have gained a tremendous attention of scientist and researcher due to the development of more sensitive analytical techniques to detect traces of pollutant down to ng-µg/L concentrations. Given the low concentration of such contaminates, they are often called micropollutants. Micropollutants include wide range of chemical compounds such as pharmaceuticals (drugs), dyes, pesticides, cosmetics, personal care products, hormones, nanoparticles and others.

In the past few decades, due to the rapid urbanization and industrializing micropollutants have emerged in wastewater treatment effluent. Although their concentration is low as part per millions, yet they possess major challenge to be eliminated from municipal wastewater treatment plant (WWTP) with the current available processes. Therefore, there is an enormous emphasis on developing new technologies and strategies to mitigate their presence in WWTP effluents. Among the advanced wastewater treatment techniques (including reverses osmosis, ultrafiltration, nanofiltration, advanced oxidation, and ozonation) adsorption is one of the most promising methods for the removal of micropollutant from wastewater. Adsorption technique holds several advantageous over other advanced treatment such as ease of operation, inexpensive processes, simplicity of design, and less toxic by-products. A critical factor for the success of adsorption process is the choice of the best adsorbent which possesses high surface area, high adsorption capacity, recyclability, and chemical and thermal stabilities.

In recent years, Metal- organic frameworks (MOFs) have emerged as a new class of porous materials compromise of inorganic nodes (i.e. metal cluster, atoms) and bridging organic linker (i.e. carboxylates, phosphonates) coordinate to form one-.two-, or three-dimensional networks. Since the discover of this new material, hundreds of MOFs have been prepared thanks to the flexibility of changing the metal centres and organic linkers. MOFs own several extraordinary properties that make them attractive to micropollutant adsorption such as, high surface area, tunable pore size, high porosity, high adsorption capacities and surface functionality.

The current talk focuses on presenting an overview of the most recent trends on the removal of micropollutants using adsorption technique with emphasis on metal organic frameworks as a promising adsorbent candidate. Finally, case studies from Dr. Sabonis's research group will be presented and discussed.

Keywords: micropollutants, advanced treatments, adsorption, photodegradation, and metal organic frameworks.