

Contaminants Removal from Water by Heterogeneous MOF Materials Synthesized via a Reaction Diffusion Process at Room Temperature

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Abstract:

Most of MOF structures reported to date are made from one single ligand and one single metal cation. Nevertheless, MOFs incorporating more than one type of linkers (multivariate, MTV-MOFs) and more than one type of metal cation (solid solution MOFs) are rare, and their synthesis and characterization are still challenging. For the very few reported multivariate and mixed metal MOFs, it was demonstrated that they display enhancement in their physical and/or chemical properties. Herein, we propose the synthesis of new adsorbents based on multivariate (mixed ligands and/or mixed metals) metal organic frameworks (MOFs) for enhanced pollutants removal from water. These new materials will be synthesized via a reaction diffusion process, which is a new method developed in our laboratory. This process is based on using a precipitation reaction-diffusion mechanism of initially separated electrolytes within the gel matrix. Beside its novelty, this method is rapid, efficient, scalable, and environmentally friendly. It allows us to adjust and control the size distribution and the morphology of the particles. The latter is a very important parameter for the adsorption properties. Another advantage of this method is that different linkers and/or metals can be incorporated within the same framework in a controlled manner. Thus, different functional groups can be implemented within the framework, leading to controlled interactions between the MOF structure and the guest molecules. Finally, the adsorption performance over organic pollutants (e.g. dye molecules, PAHs, pharmaceutical compounds) and toxic elements (e.g. Arsenic, Lead) will be investigated and optimized by changing the ratio of the different functional groups in the hetero-MOFs structures. Furthermore, MOFs will be used as photocatalysts for the degradation of the organic pollutants. The visible light absorbance of the MOF photocatalysts will be tuned via doping process which can be easily controlled via our reaction diffusion framework.