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Synthesis of MOF Based Beads for Environmental Applications †

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Abstract: Metal-organic frameworks (MOFs) are a class of topologically diverse crystalline structures holding significant properties like high surface area, high porosity, and hydrothermal stability. MOFs are made up mainly of two major constituents: a metal ion/cluster and a linker. Since the linkers are organic in nature, these compounds are called hybrid organic-inorganic materials. The tunable structures of MOF have made them useful in various applications such as gas storage and separation, drug delivery systems, catalysis, sensors, etc. The MOFs in the form of beads are suitable for industrial applications due to ease of handling, storage, and transport, etc. The shaping of MOFs into millimeter sized particles is a potential advantage for adsorption applications. The formation of beads has been possible with poly-vinylidene fluoride (PVDF) due to its strong mechanical and chemical stability. The present work highlights the synthesis of UiO-66 MOF-based beads and their potential application for environmental applications and the removal of toxins from food/water matrices. Here, a facile hydrothermal method was used to synthesize water-stable zirconium (Zr) based MOF. The synthesized MOF was further characterized using several analytical techniques such as SEM, UV-Vis spectroscopy, XRD, FTIR, and photoluminescence spectroscopy. Further, the beads of MOF were prepared by mixing varying concentrations of MOF powder in PVDF matrix and further characterized to obtain highly efficient and stable beads for adsorption experiments. The characterization of the MOF beads was done using UV-Vis spectroscopy, Brunauer, Emmett, and Teller (BET) surface area analysis, field emission scanning electron microscope (FESEM), powder x-ray diffraction (powder-XRD), and Fourier transformed infrared spectroscopy (FTIR). The analyte adsorption capacity of the MOF beads can be further analyzed by performing batch adsorption experiments on various analytes, such as environmental pollutants and toxins. The designed MOF beads may be efficiently used for the elimination or detection of numerous environmental pollutants and toxins in food and water matrices.

Keywords: nanomaterials; MOF; adsorption; PVDF; beads; ligand.

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Conflicts of Interest
The authors declare no conflict of interest.