A New Anionic Metal-Organic Framework as a Platform for Selective Uptake of Cationic Dyes

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With the development of the dyeing and finishing industry, dye effluent is emerging as an environmentally challenging issue worldwide. Therefore, the removal of dyes from effluents before discharge into natural bodies is of great importance from an environmental point of view. Metal-organic frameworks (MOFs) have been widely studied for their structural diversity and potential applications, for instance, gas storage and separation, luminescent sensing, heterogeneous catalysis.[1] Recently, MOFs were also used for adsorbing and separating organic dyes with size exclusion effects. Furthermore, ionic MOFs exhibited unique advantage of selective adsorbing cationic or anionic dyes by host-guest electronic interactions and/or guest-guest exchange interactions.[2]

In this work, an In(III) based anionic MOF (In-MOF = $[Me_2NH_2][InL]\cdot x$DMF, L = methylenediisopthalic acid) with one dimensional (1D) channel about 15.8×10.3 Å^2 was solvothermally synthesized and well characterized. The anionic In-MOF with permanent pores can as host materials applied in the separation and purification of cationic organic dyes. This anionic In-MOF can rapidly and selectively adsorb cationic dyes such as Methylene Blue (MB), Crystal Violet (CV), and Rhodamine B (RhB), but hardly adsorb anionic Methyl Orange (MO), and neutral dye Sudan I. Moreover, the cationic dyes can be gradually released with the help of Cl^-. In addition, the In-MOF can be used as ion chromatography stationary phases to separate cationic organic dyes. The rapid adsorption and release of anionic dyes as well as using as ion chromatography stationary phases indicate that the In-MOF can be the potential materials to selectively remove cationic dyes.

Reference

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[2] Z. Zhu, Y. –L. Bai, L. Zhang, D. Sun, J. Fang, and S. Zhu, Chem. Commun., 2014, 50, 14674-14677.