Ionothermal synthesis of Zn-based metal organic frameworks in pyridinium ionic liquid

ABSTRACT

Metal organic frameworks (MOFs) are crystalline porous frameworks which have been investigated as absorbent for removing dye, metal ion, drug contaminant, and organic solvent from water. However, the traditional synthesis of MOF involves the use of organic solvents and also requires high temperature; termed solvothermal reaction. This study aimed to synthesis MOF in a rather mild condition (room temperature) using ionic liquids (ILs) instead of organic solvents. Theoretically, high ionic conductivity of cetyl pyridinium bromide (C16PyBr) ionic liquid can develop novel MOF compounds thus, this study also aimed to investigate the possible effects of using ionic liquid in MOF synthesis. Zinc nitrate hexahydrate ($Zn(NO3)2.6H2O$) was used as the metal precursor and was reacted with the organic ligands, which is either benzene-1,3,5-tricarboxylic acid (H3BTC) or benzene-1,4-dicarboxylate (H2BDC), at 6:1 ratio in C16PyBr ionic liquid at room temperature. We hope to fabricate Zn-BDC and Zn-BTC MOFs with the same compositions, and thus recognize the effects of ILs. The powder X-ray diffraction (PXRD) and Fourier Transform Infrared Spectroscopy (FTIR) spectra of both newly synthesized MOFs showed that both Zn-BDC and ZnBTC MOFs can be reproduced with these conditions. ILs have also been found to significantly accelerate the formation of MOFs at room temperature as the reaction time is shortened to 6 hours in IL, meanwhile the organic solvent DMF needs at least 120 hours.

Keyword: Metal organic frameworks; Ionic liquids; Zinc; Pyridinium