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# IMPROVED HEAVY METAL ADSORPTION BY MOF/$TiO_2$ NANO-COMPOSITES

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Over the years, heavy metal content in the environment has been increased drastically. Heavy metals have a high density and are toxic even at low concentrations. As heavy metals are non-biodegradable, they can be accumulated through food chains. As a result, to safeguard human health and other organisms in affected ecosystems, heavy metal removal from contaminated systems has been studied and practiced using different techniques. Adsorptive removal is one of the most practiced methods for heavy metal removal. Metal organic frameworks (MOFs) are one such efficient adsorbent. MOFs consist of a 3D porous network with a high surface area, that built up of metal ions/clusters and organic linker ligands. In this study, Fe-BTC [(BTC: 1,3,5-benzenetricarboxylate)] MOF was synthesized using hydrothermal method, and it was modified by incorporating $TiO_2$ nano-particles at the synthesis stage. Fe-BTC and $TiO_2$ are known adsorbents for heavy metals. An enhanced adsorptive removal was expected by combining these two materials to form a composite. Ni(II) and Pb(II) ions were selected for the adsorption study and removal efficiencies were studied for bare MOF, commercially available $TiO_2$ nano-particles, and MOF/$TiO_2$ composite. Parameters such as ion concentration, adsorbent dose, contact time and pH were optimized. Enhanced adsorptive removal was observed by incorporating $TiO_2$ in to the MOF structure. From a 5 ppm Pb(II) solution, 80%, 82% and 89% were removed within 3 hours, at pH 6 by bare MOF, $TiO_2$ and the composite, respectively. Furthermore, 90%, 85% and 99% of 5 ppm Ni(II) were removed within 4 hours at pH 10 by bare MOF, $TiO_2$ and the composite, respectively. Thus, there was a clear and a significant improvement in adsorptive removal efficiencies of both Pb(II) and Ni(II) by incorporating $TiO_2$ nano-particles to Fe-BTC MOF.

**Keywords:** Adsorption, Composite, Heavy metals, MOF, Optimise