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Evaluating three metal organic frameworks to adsorb nitrates and fluorides

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Background: Water pollution is the alteration of physical, chemical and biological properties of water to the extent it is hazardous to humans and the environment. Excess nitrate in water causes eutrophication, and methemoglobinemia, and excess fluoride causes dental fluorosis, skeletal fluorosis, reproductive and developmental effects. Adsorption is one among diverse approaches for removing hazardous anions from water due to its high performance.

Objectives: To determine the removal of anions by the process of adsorption using three synthesized Metal Organic Frameworks (MOF): – MIL53(Fe), MIL53(Al) and MOF 71(Co).

Methods: The MOF's were synthesized by using the respective metals Fe, Al and Co and 1,4-benzenedicarboxylic acid by microwave digestion and characterization was done by using P – XRD and FTIR. After determining the adsorption of nitrate and fluoride, Optimization, Kinetic study, Isotherm study and Thermodynamic study were also performed

Results: In the adsorption experiments, nitrate could not be adsorbed by any of the MOF's; all of the MOF's were able to adsorb fluoride: 96.42% by MIL53(Fe), 89.87% by MIL53(Al) and 24.73% by MOF71(Co). Optimization experiments were performed with MI53(Fe) and the optimum shaking time for the adsorption process was 30 mins, optimum pH was 7 – 9, and optimum shaking speed was 100 rpm. Removal of fluoride in the aqueous medium by MIL53(Fe) followed pseudo second order kinetic model and isotherm studies showed that this process followed the Langmuir isotherm model. Thermodynamic studies concluded that removal of fluoride in an aqueous medium by MIL53(Fe) is a spontaneous process at 300 K and 310 K.

Conclusion: The MOF - MIL53(Fe) is a good adsorbent for chemical treatment of wastewater and merits further investigation.

Keywords: *Adsorption, Fluoride, Nitrate, Aqueous, Metal organic framework*