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Effective Removal of Metal Ions from Aqueous Solution by Mesoporous MnO₂ and TiO₂ Monoliths: Kinetic and Equilibrium Modelling

Manisha Sharma^a, Diptiman Choudhury^a, Satyajit Hazra^b and Soumen Basu^{a*}

^a*School of Chemistry and Biochemistry, Thapar University, Patiala 147004, India.*

^b*Saha Institute of Nuclear Physics, Kolkata 700064, India.*

Correspondence: E-mail: soumen.basu@thapar.edu

Abstract: In the present study, ordered hierarchically porous silica (by sol-gel method) and metal-oxide monoliths (through nanocasting method) were synthesized. Porous silica and metal oxide monoliths (MnO₂ and TiO₂) exhibited excellent adsorption for heavy metal ions such as Pb(II) & Cd(II). The morphological and structural study of the synthesized silica and metal oxide monoliths were done by FESEM and XRD analysis. The adsorption studies were conducted in different batches. The maximum adsorption of Pb(II) on SiO₂, MnO₂ and TiO₂ varied from 91-125, 166-200 and 769-857 mg/g respectively depending upon the choice of PEG, which is used as a structure directing/controlling agent. Similarly the maximum adsorption of Cd(II) on SiO₂, MnO₂ and TiO₂ varied from 90-100, 100-125 and 667-770 mg/g respectively. The effects of contact time (0-80 min), temperature (at 303, 313 and 323 K) and pH (3-10) on the Pb(II) & Cd(II) removal were also explored.

Keywords: Nanocasting; Mesoporous; Monoliths; Metal-oxide; Metal-ions adsorption; Wastewater treatment.

1. Introduction

Removal of heavy metals from wastewater is very important to reduce the environmental toxicant load. Heavy metals are non-biodegradable and cause serious consequences when present in aquatic and soil ecological system. The pollutant in water hinders aquatic life [1] and

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