THEME: WATER POLLUTION AND SEWAGE MANEGEMNT

TITLE: THE REMOVAL OF HEAVY METALS FROM AMD USING POLYMER-BASED COMPOSITE

Sadiku, E. R

Tshwane University of Technology, Department of Chemical, Metallurgical and Materials Engineering (Polymer Division), Private Bag X 680, Pretoria 0001, South Africa

sadikur@tut.ac.za

Onyango, M.S

Tshwane University of Technology, Department of Chemical, Metallurgical and Materials Engineering (Polymer Division), Private Bag X 680, Pretoria 0001, South Africa

onyangoms@tut.ac.za

Perry, S [1]*

Tshwane University of Technology, Department of Chemical, Metallurgical and Materials Engineering (Polymer Division), Private Bag X 680, Pretoria 0001, South Africa

goitseperry@gmail.com
(Presenting author)

ABSTRACT

The use of chitosan/sisal composite to remove Cr (VI) ions from aqueous solutions and Cr^{6+} and Mn^{2+} from AMD was investigated. According to the Green Drop report prepared by the Department of Water Affairs, only 7% of SA's sewage treatment plants comply with international standards. Most municipalities lack the funds to maintain the sewage treatment works. This means the sewage is not adequately treated at most of SA's 850 sewage treatment plants, discharging sewage directly into our rivers.

The experimental conditions that enhance the adsorption of Cr (VI) from aqueous solutions and Cr^{6+} and Mn^{2+} from AMD by using sisal/chitosan composite as adsorbent, have been

analysed. These conditions include: the initial concentration of Cr (VI), pH, the dose of adsorbent, contact time and co-existing ions effects. The optimum mass was reached at 1.5 g dosage of sisal/chitosan composite and for adsorption study; 0.1 g of the adsorbent was used. For the maximum adsorption capacity of sisal/chitosan composite (SC3) for Cr (VI) ion in the aqueous solutions, the removal level was found to be 153.3 mg/g and this resulted in a high maximum adsorption capacity of ~200 mg/g for heavy metals (manganese and chromium), in AMD, at 25 ^{o}C respectively. The research confirmed the fact that sisal/chitosan composite is an effective adsorbent for the removal of Cr^{6+} ions (in aqueous solutions) and Cr^{6+} and Mn^{2+} from AMD. The SC3 has been proven to have good affinity towards manganese and chromium. An average of 97% removal is achieved in all the metals. The adsorption of Cr^{6+} ions (in aqueous solutions) and Cr^{6+} and Mn^{2+} from AMD by sisal/chitosan composite was an exothermic process. The maximum Cr^{6+} and Mn^{2+} removal from AMD occurred at pH 2.0. The analysis of ICP revealed that there are 14.01 mg/L of manganese and 80 mg/L chromium present in the AMD sample. In the AMD sample for Cr^{6+} and Mn^{2+} removal, sorption kinetics were well fitted by pseudo-second order kinetic model.

The SEM analysis was performed in order to confirm the homogeneity of the blend of sisal and chitosan composite and it is confirmed that chitosan is firmly embedded in the sisal fibre layers, even though some gaps (pores) between the fibre and chitosan were still noticed. The application for this material will be “pilot planting adsorption technique” for acid mine drainage.

Key words: Adsorption, Heavy metals, Waste water; Chromium (VI), Manganese (Mn^{2+}), Kinetics, Sisal fibre, Chitosan