Removal of Chromium in aqueous solutions using Powdered Activated Carbon treated with Humic Acid.

By

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Declaration

I do hereby declare that the work reported in this thesis was exclusively carried out by me under the supervision of Dr. J. M. A. Manatunge and Dr. R. Weerasooriya. It describes the results of my own independent research except where due reference has been made in text. No part of this thesis has been submitted earlier or concurrently for the same or any other degree.

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Abstract

Because of its toxicity, Chromium (VI) causes water pollution and threatens to the environment. Its solubility in nature is strongly influenced by adsorption process. Relatively few studies have focused on adsorption properties onto the Powdered Activated Carbon (PAC). In this work, the PAC and humic acid treated PAC adsorption properties were compared.

This study proposed humic acid treated Powdered Activated Carbon as a low cost adsorbent for removal of Chromium from aqueous solution. Adsorption of Cr (VI) by PAC was conducted using batch tests. The influence of pH, contact time, initial Chromium concentration on removal of Chromium (VI) was investigated. This test was also repeated with humic acid treated PAC. The optimum initial pH for maximum adsorption of Cr (VI) from aqueous solution was found to be 4.0. The removal efficiency was found to be correlated with the initial Cr (VI) concentration, ionic strength, as well as the contact time between the Chromium (VI) and the adsorbent. For humic acids treated PAC, the optimum adsorption also was found at 4.0. Therefore acidic medium is favorable to the Chromium removal.

According to the experimental data obtained from this study, the percentage metal removal increased with increasing PAC dosage at the same initial metal concentration. After using humic acid treated PAC increased the metal removal percentage with same adsorbent dosage.

When the effluent is in acidic medium, the PAC is more suitable as the adsorbent while the humic acid treated PAC is more suitable for basic effluent.

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Nomenclature

Concentration (C)	mole/L, ppm, mg/L
Volume (V)	mL
Weight (W)	g, mg
Acidic constant (Ka)	
Temperature	K, ^{o}C
Mass	g/mol
Density	$g.cm^{-3}$
Radius	nm
Energy	$kJ.mol^{-1}$
Potential (volt)	V
Faraday constant (F)	$C.mol^{-1}$
Surface charge density (σH)	$C.m^{-2}$
Specific Surface area(S)	$m^2.g^{-1}$
Morality (M)	mol/dm^{-3}
Freundlich coefficient	k_f
Ionic strength	I

Abbreviation

AAS	Atomic Absorption Spectrophotometer
PAC	Powdered Activated Carbon
GAC	Granular Activated Carbon

FTIR	Furious Transformation Infrared Spectroscopy.
XRD	X-Ray Diffraction Analysis
XRF	X- Ray Fluorescence
CEA	Central Environmental Authority
SEM	Scanning Electron Microcopy
HA	Humic Acid
PZC	Point of Zero Charge
CDA	Coconut Development Authority
WHO	World Health Organization
USA	United State of America
EPA	Environmental Protection Agency
MCL	Maximum Contaminant Level