

ADSORPTION STUDIES ON IMMOBILIZED CHITOSAN AND POLYANILINE COATED CHITOSAN AS BIOSORBENT MATERIAL FOR REMOVAL OF CHROMIUM FROM EFFLUENTS

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Introduction:

Heavy metal pollution has become one of the most serious environmental problems today. The environment quality is deteriorating day by day due to the rapid development of industries. In wastewater, contaminants can include heavy metals, organic and inorganic compounds. When released into the environment, they can produce harmful effects to human beings and the environment. Therefore, in recent years, increasing emphasis has been placed on heavy metals removal from wastewater.

We are interested in removal/extraction of Chromium (VI) specifically which is affecting the health and environment by causing carcinogenic, cytotoxicity, and Geno toxicity in marine organisms as well as human beings. (Chromium-Cr)

In order to remove these Cr (VI) involved in the ecosystem, we have adopted the idea to synthesize Bio Adsorbents that are eco-friendly, reusable, and efficient in order to be used in industries to minimize the discharge of Chromium (VI) into the environment.

As the raw material chitosan has some good adsorption capacity, we can enhance its adsorption capacity by modifying its structure and thus addition of amine groups to enhance adsorption using polyaniline coated chitosan and using the functionalization technique.

Immobilization is another technique well known for avoiding dispersion of sample and wastage and thus we can also reuse the bio adsorbent. The chitosan is immobilized to enhance its reusability.

We then use different models of analysis like Freundlich, Langmuir and kinetic models to explore the static factors which can be varied in order to enhance its adsorption capacity.

Objectives:

1. Comparative Adsorption study of Cr(VI) btw P.C.C & Immobilized chitosan.
2. Reusable Biopolymer.
3. Analysis of Adsorption efficiency by varying PH and concentration in Effluent.

Methodology of Synthesis:

Polyaniline-Coated-Chitosan

1. A Beaker of 1M HCL of 100 ml stirred with chitosan overnight.
2. Prepared 1M of HCl and Divided 0.5M in two Beakers ,1st Beaker containing 50ml of HCl onto which A.P.S was dissolved.
3. 2nd Beaker containing 50ml HCL onto which 1ml Aniline was dissolved and chitosan was transferred and both the Beakers were kept in the Ice bath at 0°C.
4. Then from the 2nd beaker dropwise aniline-HCl solution was added to 1st Beaker which was kept at stirring. Then after a while the solution turns to blue then green this signifies the Polymerization reaction has taken place.



Figure: Polyaniline coated chitosan

Immobilization of Chitosan

A beaker in which 1% Chitosan,2% chitosan & 5% CaCl₂ in DDW in w/v ratio were prepared. Then chitosan and Sodium alginate were mixed in the same beaker and kept for stirring. Then dried for 2hours at 60°C in a hot air oven.



Figure: Immobilization of Chitosan

Results and Conclusions:

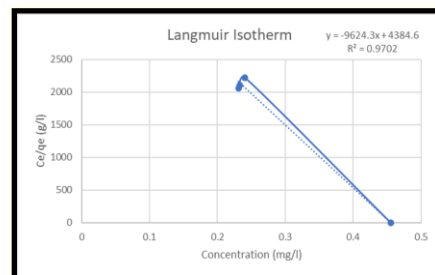


Figure: Langmuir Adsorption

The R²=0.9702 proves langmuir monolayer adsorption

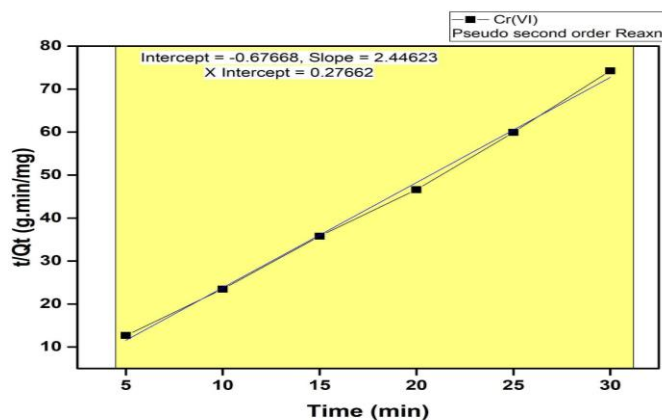


Figure: Pseudo 2nd order Reaction graph

The Adsorption of Cr(VI) follows pseudo 2nd order Reaction

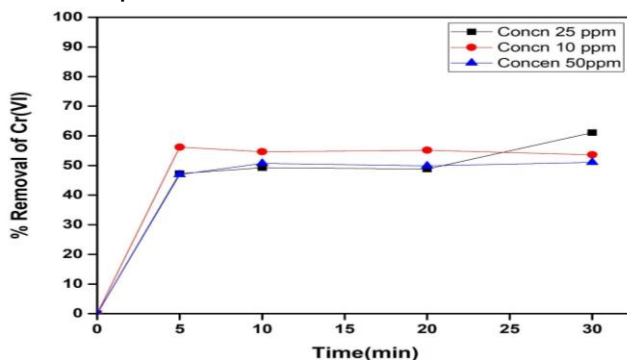


Figure: Percentage Removal of chromium in different concentrations

1. The UV-vis readings shows that maximum efficiency of PCC is 61%.
2. The adsorption rate of the chitosan was utmost maximum 15%.
3. Thus from SEM report it's clear the surface elation was done on PCC.
4. The reaction proceeds with color change from Yellow to Green & then to Blue, this proves that the substance is undergoing Redox Reaction from Cr(VI) to Cr(III).

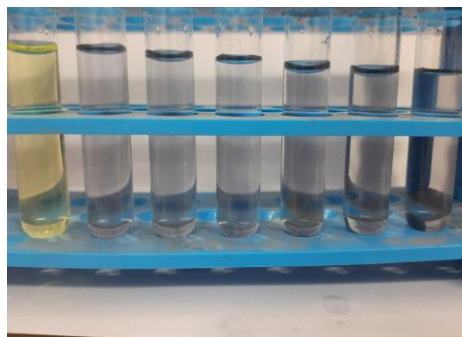


Figure: Redox Reaction

The adsorption rate of the PCC synthesized substance depicts that the rate is instantaneous and follows Pseudo 2nd order reaction.

Future Work:

1. Comparative study
2. Packed bed column trials
3. Interference analysis of different ions in adsorption process
4. Cost-Beneficial Study