COIR DUST AS A LOW COST ADSORBENT TO REMOVE Cu^{2+}, Zn^{2+} AND Pb^{2+}

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Water is an essential component for the life on earth. Out of the total water content, only 0.01% of is available as drinking water. As a result of industrialization accelerated during the last three decades, different kinds of pollutants, such as inorganic compounds, synthetic organic compounds, heavy metals, dyes, fertilizers and pesticides, were released to the natural water bodies resulting in extensive water pollution. Among these pollutants, heavy metals, which are extensively in many industries due to their unique properties, play a major role in pollution. Heavy metals, such as copper, cadmium and lead are widely used in industries leading to alarming health conditions and environmental risk. Among treatment processes available for the removal of heavy metals, adsorption is a state-of-the-art, efficient, cheap and widely used method. The major bottle neck of this method is lack of the availability of cheap adsorbents, and thus, natural adsorbents are becoming increasingly popular. Coir dust is fallen off from coconut husk when it is shredded during coir processing. Although it has been reported that coir dust can be used as a sorbent to remove heavy metal ions, detailed mechanistic and kinetics studies have not been reported. Hence, characterization and evaluation of the efficiency in heavy metal ion removal by coir dust was done during this study. Surface titration and methylene blue test were carried to determine the surface charge of coir dust and the surface area of coir dust, respectively. Stirring time, settling time and solution pH were optimized to evaluate the efficiency of heavy metal removal. Isotherm Studies and kinetics studies were done for further investigation of metal ion-coir dust interaction.

FTIR spectroscopy reveals the presence of functional groups, such as carboxylic acid, alcohols and amine groups. According to the surface characterization, the PZC of coir dust occurs at pH 5 and the specific surface area is 285.3 $m^2 g^{-1}$. Neutral pH values are more favourable for the metal ion removal. Coir dust shows adsorption capacities of 34.60 mg g^{-1}, 27.02 mg g^{-1} and 96.15 mg g^{-1} for Cu, Zn and Pb, respectively. All the three metal ions obey the Langmuir adsorption isotherm. Kinetics study show that the interaction of Cu^{2+}, $Zn^{2+}$and Pb^{2+} with coir dust obey pseudo second order and intra-particle diffusion, which reveals that intra-particle diffusion is the rate limiting step. By considering all the experimental data, it can be concluded that coir dust is an effective adsorbent to remove heavy metal ions effectively and economically.