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Feasibility of *Terminalia catappa L.* fruit shells (TCF) to treat nickel-laden water

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Introduction: In recent years, research interest in nickel has grown due to its increasing industrial significance and the growing environmental concerns regarding industrial effluents. Nickel (Ni^{2+}) contamination of water bodies have led to efforts for the development of various treatment technologies for its removal. This paper characterized and utilized *Terminalia catappa L.* Fruit Shells (TCF) in adsorbing Ni^{2+} in synthetic wastewater at varying pH conditions.

Experimental Detail: TCF preparation involved drying at 100°C for 12 hours. The obtained powder was then sieved to 149 microns and was characterized using a scanning electron microscope (SEM) and Fourier-transform infrared spectroscopy (FTIR).

Batch adsorption was employed using 25 ppm Ni^{2+} solutions, which were adjusted to pH 2, 4, 6, and 8. A constant 120 rpm rate was maintained for 3 hours. Effluents were then characterized using inductively coupled plasma optical emission spectrometry (ICP-OES) to determine Ni^{2+} concentrations.

Results and Discussion: FTIR analysis revealed the presence of ideal adsorption sites such as hydroxyl (3360.44 cm^{-1}), methyl (2920.20 cm^{-1}), carboxylic (1736.27 cm^{-1}), and aromatic (1649.01 cm^{-1}) groups on the surface of TCF. The SEM image (Figure 1) at 500x reveals the non-homogenous distribution of particle size and the fibrous nature of the TCF shells.

From Fig. 2, it can be seen that Ni^{2+} removal increases as the solution pH increases. At lower pH, the surface charge of TCF is positive due to the excess protons thereby inhibiting the adsorption of Ni (II) ions. The reported increase in removal at pH 8 is due to its decreased solubility and precipitation at pH greater than 7.

Conclusions: TCF was found to have a fibrous structure with functional groups suitable as adsorption sites. It has been shown to be effective in the adsorption of Ni(II) in aqueous solution yielding a maximum removal of 77.70% at pH 8, which is attributed to both adsorption and precipitation.

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