



Natural coagulants derived from *Cassia fistula* and tamarind seed for the removal of copper ions

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ABSTRACT

Coagulants derived from plants have shown great potential in wastewater treatment, with good coagulation–flocculation performance, economic benefits and high environmental friendliness. Therefore, the coagulation–flocculation processes conducted by coagulants prepared from *Cassia fistula* and tamarind seeds were studied for the removal of Cu²⁺ ions. Fourier-transform infrared spectra, scanning electron microscopy images and nitrogen adsorption–desorption analysis of the synthesized coagulants indicated the presence of many important functional groups along with preferable surface characteristics for the removal of heavy metal ions. The effects of different variables, including initial solution pH and coagulant dosage, were also estimated to reveal the optimal conditions for Cu²⁺ removal as pH 5.0 and a dosage of 0.6 g/L of *C. fistula* seed-derived coagulant and 1.5 g/L of tamarind seed-derived coagulant. A further pilot-scale study at a volume of 30 L revealed the great efficiency of *C. fistula* coagulant for removing Cu²⁺ ions from real wastewater, with 89.45% removal at a dosage of 0.884 g/L. The obtained results have proved the great potential of these bio-coagulants.

Keywords: Coagulation; Flocculation; Natural coagulant; *Cassia fistula* seeds; Tamarind seeds; Copper removal

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