



# Green-synthesized copper nano-adsorbents for the removal of pharmaceutical pollutants from real wastewater samples

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## Abstract:

The release of Non-Steroidal Anti-Inflammatory drugs (NSAIDs) such as Ibuprofen (Ibu), Naproxen (Nab) and Diclofenac (Dic) to the aquatic system cause serious environmental problems. In this study, green-synthesized copper nanoparticles (Cu NPs) have been used as nano-adsorbent for the removal of Ibu, Nab, and Dic from wastewater samples. Formation of Cu NPs was confirmed by different analytical techniques. The adsorption parameters such as temperature, pH, adsorbate concentration, adsorbent dose and contact time were studied. The best removal results were obtained at these conditions: temperature 298 K, pH 4.5, 10.0 mg Cu NPs, 60 min. At these conditions, the removal percentage of Ibu, Nap, and Dic were found to be 74.4, 86.9 and 91.4% respectively. The maximum monolayer adsorption capacities were calculated as 36.0, 33.9 and 33.9 mg/g for Dic, Nap, and Ibu respectively. The kinetic studies conducted that the sorption process obeyed the second order kinetic model, while the thermodynamic results revealed that the adsorption process was spontaneous, endothermic ( $\Delta H$  23.8,  $\Delta H$  40.8 and  $\Delta H$  38.3 kJ/mol for Ibu, Nap and Dic respectively). The results revealed that green-synthesized copper nanoadsorbent may be used for the removal of the anti-inflammatory drugs from real wastewater efficiently.

## Keywords:

Green-synthesized copper nano-adsorbent, pharmaceutical pollutants

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