# Removal of copper(II) from aqueous solution using spent tea leaves (STL) as a potential sorbent

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## Abstract

In this work spent tea leaves were used as a non-conventional, cost-effective sorbent for removal of Cu(II) from aqueous solutions in batch systems. The sorbent was characterised with respect to surface area, pore volume, density, etc. The equilibrium sorption data were applied to various sorption isotherm models, and the order of fitness was: Langmuir > Temkin > Freundlich. The maximum sorption capacity $Q_o$ was found to be almost 90.9 and 68.4, as evaluated using Langmuir isotherms at 27ºC and 37ºC respectively. The observed decrease in sorption capacity with temperature indicated the exothermic nature of the uptake process. The kinetic uptake data were best interpreted by a pseudo second-order kinetic model with values of rate constants of adsorption of 1.47 x $10^{-2}$ and 3.01 x $10^{-2}$ g/mg·min, respectively, for the initial sorbate concentrations of 10 and 20 mg·$\ell^{-1}$ at 27ºC. The sorption mean free energy was determined from the Dubinin Radushkevich (DR) isotherm model and was found to be 9.91 kJ·$mol^{-1}$, indicating ion exchange/chemisorption nature of uptake process. The Cu(II) uptake was found to increase with the pH of the sorbate solution and maximum sorption was observed in the pH range of 1.0 to 4.8. Finally, thermodynamic parameters like $\Delta G^o$, $\Delta H^o$, $\Delta S^o$ were also evaluated.

**Keywords**: Spent tea leaves, copper(II), adsorption, Langmuir model