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USE OF COMPISITE SORBENT ZEOLITE – HUMIC ACIDS FOR COPPER REMOVAL FROM WATER

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Abstract

Zeolite is a natural alumosilicate material widely used as an inorganic ion-exchanger but having relatively low sorption capacity to heavy metal ions. The authors tried to improve its sorption properties via impregnation by humic acids solution. Humic acids themselves can bind metal ions in complexes but their application in pure form is not practical as they are in colloid form.

The composite sorbent was obtained in the result of sorption of humates by zeolite at pH 9.5 followed by precipitation in acidic conditions. A range of concentrations of humates used for sorbent synthesis – 100-200 mg/dm^3 - was determined for maximal removal of Cu^{2+}ions from model metal solutions. The lower concentrations did not provide a significant amount of active sited with a good affinity to heavy metals. The higher concentrations resulted in the worsening of copper sorption due to the filling of pore volume by humic acids and the reduction of sorption surface area. The application of composite sorbent provided 20% lower residual copper concentration compared to non-treated zeolite at sorption from 60 mg/l metal solution.

Sorption process followed pseudo-first (Lagergren) and pseudo-second kinetic models. Calculated specific sorption values were close to experimental numbers. As defined from Weber-Morris diffusion model, the sorption process was limited by intraparticle diffusion. The improved sorption capacity could be attributed to humic acids were precipitated in macropores and provided additional sorption sites. Humic acids due to their large size did not penetrate to micropores of zeolite that's why diffusion coefficients for non-treated and modified sorption materials were equal.

The impact of the presence of Ca^{2+} and Na^{+} ions on sorption efficiency of Cu^{2+} sorption from model solutions was also studied.

Keywords

Zeolites, Humic Acids, Composite Sorbent, Sorption, Heavy Metals, Kinetics, Diffusion, Weber-Morris Model