DEVELOPMENT AND APPLICATION OF MAGNETIC MICRO ION EXCHANGERS FOR HEAVY METAL REMOVAL BY COMPLEXATION

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ABSTRACT

In an international cooperation project, weakly basic magnetic micro ion exchangers have been synthesised for selective heavy metal removal. The exchangers are considered for use in a continuous process with batch regeneration.

Seven different amines have been selected to functionalise resins with different properties in capacity and heavy metal adsorption. Based on their characterisation by means of adsorption equilibria, kinetics and capacities, the resin with the best adsorption properties has been chosen for the synthesis of a larger batch. The particles from this batch have a diameter ranging from 100 µm to 250.

A continuous process installation has been installed for flow rates between 100 and 400 L/h. It consists of a CSTR (120 L) for contacting the metal bearing water with the resin and a conical settler (35 L) for fluid-solid separation. Regeneration is carried out in a further vessel. The process is controlled fully automatically and pH and conductivity in all vessels are recorded permanently during an experiment.

Experiments with the pilot plant comprised the removal of copper and zinc at different flow rates and resin concentrations (1 – 5 mg/L in tap water). Depending on the conditions metal concentrations were decreased to 0.5 – 2 mg/L.

To evaluate the process design and the resin performance, a theoretical model was developed. Parameters that influence the calculations are derived from the equilibrium experiments. Furthermore a simplified linear kinetic approach for the pore diffusion and physical reactor parameters from the pilot plant is used. Experimental and calculated results are in excellent agreement. As a consequence of the experiments, magnetic weakly basic exchangers with improved properties have been synthesised.