Removal of toxic heavy metal ions from metal finishing industry effluents by micellar enhanced ultrafiltration technology

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The objective of this research project is to combine the advantages of aqueous micellar enhanced ultrafiltration (MEUF) and commercially available polymeric and ceramic ultrafiltration (UF)/reverse osmosis (RO) membranes to develop an efficient and commercially economic process to separate organic and dissolved metal complexes from metal finishing industries' waste solvents and streams by using natural biodegradable surfactants such as phospholipids.

MEUF is a recently proposed method for the removal of toxic substances from aqueous wastestreams. The surfactant is added to the wastestream at levels well above its critical micelle concentration (CMC). Toxic substances, which often are too small for removal by conventional ultrafiltration concentrate, in micelles that are retained when passed through a membrane with appropriate pore size. The resulting permeate contains very low concentrations of the surfactant and often requires no additional treatment. The retentate, which now occupies a significantly smaller volume, can be treated further economically by various processes including electrochemical, chemical, thermal and physical methods.

This paper will summarize preliminary results obtained during in laboratory-scale evaluations and discuss the effectiveness of MEUF for removing dissolved organic (2,4-dimethylphenol and dioctyl phthalate) and heavy or toxic metals, (zinc, lead, cadmium and nickel) from aqueous and nonaqueous wastestreams, using surfactants such as sodium dodecyl sulfate and lecithin. Effects of temperature, pressure, mixing speed, surfactant type and concentration, and membrane type and size, are correlated with the rejection rates of the toxic substances. Design details of the pilot scale ceramic membrane systems are given.