PVDF MEMBRANE CHROMATOGRAPHY FOR GOLD RECOVERY

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Gold is one of the most coveted metals that not only pleases jewellery lovers and finance sectors, but also finds applications in medicine, electronics, aerospace and manufacturing industries. With its growing demand, gold mining from primary resources becomes limited that low-content secondary sources must be exploited. The methods for gold recovery range from solvent extraction and ion exchange to chemical precipitation and adsorption. Adsorption has drawn particular attention because of its ability to separate and recover even trace quantities of metals. In this work, we took a membrane chromatographic approach to adsorb dilute gold from both lab simulated wastewater and industrial wastewater, and demonstrated the capability of a group of synthetic PVDF membranes grafted with thiourea groups for such an application. First, thin, hydrophilic and thiosemicarbazide grafted PVDF membranes were prepared with an internal morphology of small resin particles connected by smaller resin fibers via 2-stage coagulation. Membrane chromatography constructed with these membranes had a maximum gold uptake of 17.2 mg/g at feed gold concentration of 2 mg/L. It was not only selective but also re-generable, and was able to recover gold from complex industrial wastewater as well.

Second, 4 times thicker PVDF membranes with narrower pore size distribution were prepared and grafted with thiourea for gold adsorption. The effect of pore size distribution on membrane chromatography made of these membranes was separated from the mean pore size. The narrower distribution indeed helped enhance the membrane bed utilization efficiency. The breakthrough behavior was well predicted by a mathematical model considering both mass transfer and pore polydispersity without any adjustable parameters.