INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This thesis aims at exploring the efficacy of liquid membrane (LM) based technology in order to separate Cr(VI), Ni(II) and Zn(II) from wastewater. A suitable LM that can extract the said solutes is identified through equilibrium study. The processes include the techniques based on bulk liquid membrane (BLM), flat sheet-supported liquid membrane (FS-SLM), FS-SLM assisted precipitation of Cr(VI) in stripping chamber and FS-SLM assisted electrodeposition of Ni(II) and Zn(II) on the cathode plate placed in the stripping chamber. The possibility of using environmentally benign solvent in a LM setup in order to separate Cr(VI), Ni(II) and Zn(II) from wastewater have been explored. Additionally an extractant Aliquat 336 has been used to enhance the efficiency of separation as it showed very good carrier property for transport of Cr(VI). Di-sodium ethylene-di-amine-tetra-acetic acid (or Na_2-EDTA) was selected as stripping agent for its affinity towards metal. An initial two-phase study followed by elaborate three-phase BLM study were confirmed by critically more industry-friendly SLM study. In addition, new type of SLM setup has been developed which includes SLM technology with *in situ* electrochemical reactor in stripping section. SLM with *in situ* electrochemical reaction in stripping section helps to reduce hexavalent chromium to trivalent chromium by forming chromium-iron complex. Iron plate acts as anode in stripping section. The chromium-iron complex is an useful value added product and has immense commercial value that can be used for various purposes. Further, a new type of design mechanism has been implemented for extraction and recovery with deposition/electroplating of Ni(II) and Zn(II). The setup consist of an in situ electrodeposition unit in strip phase which helps "stripped" Ni(II) and Zn(II) from synthetic wastewater get electrodeposited on the cathode surface. This type of separation technique not only helps to separate toxic heavy metals from wastewater but also yields an useful end product in the form of electroplated material. Two types of carrier, i.e., TOA and D2EHPA, have been used in the organic phase to separate Ni(II) and Zn(II). The prime physico-chemical parameters affecting the system performance were identified for experimental optimization through response surface methodology using central composite design rule. A regression model along with analysis of variance evaluates whether the chosen parameters were of good agreement with experimental results.