OPTIMIZATION OF CU(II) EXTRACTION FROM AQUEOUS SOLUTIONS USING SOYBEAN OIL-BASED ORGANIC SOLVENT BY RESPONSE SURFACE METHODOLOGY

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Y. Bhg. Prof.,

LAPORAN AKHIR PENYELIDIKAN "OPTIMIZATION OF CU(II) EXTRACTION FROM AQUEOUS SOLUTIONS USING SOYBEAN OIL-BASED ORGANIC SOLVENT BY RESPONSE SURFACE METHODOLOGY"

Merujuk kepada perkara di atas, bersama-sama in disertakan 4 (empat) naskah Laporan Akhir Penyelidikan dan 1 (satu) CD bertajuk "Optimization Of Cu(II) Extraction from Aqueous Solutions Using Soybean Oil-Based Organic Solvent by Response Surface Methodology" oleh kumpulan penyelidik dari Fakulti Kejuruteraan Kimia, UiTM Pulau Pinang dan School of Industrial Technology, Universiti Sains Malaysia untuk makluman pihak tuan.

Sekian, terima kasih.

Yang benar,

CHANG SIU HUA
Ketua
Projek Penyelidikan

5. Report

5.1 Proposed Executive Summary

Organic solvents are important liquids used to extract heavy metals from aqueous solutions in solvent extraction. A wide variety of organic solvents have been applied in this technique but they are most of petroleum-based (e.g. kerosene, hexane, toluene, chloroform, etc.) which are non-ecofriendly, non-renewable and expensive. Recently, vegetable oils have created a great deal of interest as greener replacement for the conventional organic solvents as alternative solvents in solvent extraction on account of their salient features such as non-volatility, non-flammability and biodegradability.

In our previous works, various vegetable oils have been found to extract Cu(II) effectively from aqueous solutions (Chang et al., 2010; Chang et al., 2011). In this work, optimization of factors affecting Cu(II) extraction from aqueous solutions using a soybean oil-based organic solvent (soybean oil (diluent), di-2-ethylhexylphosphoric acid (D2EHPA) (extractant) and tributylphosphate (TBP) (phase modifier)) will be conducted by a multivariate statistical technique, called Response Surface Methodology. A regression model for *%E* will be developed and its adequacy will be examined. The optimum conditions will be determined and the predicted *%E* under the optimum conditions will be verified with experimental data.

5.2 Enhanced Executive Summary

Organic solvents are important liquids used to extract heavy metals from aqueous solutions in solvent extraction. A wide variety of organic solvents have been applied in this technique but most of them are petroleum-based (e.g. kerosene, hexane, toluene, chloroform, etc.) which are non-ecofriendly, non-renewable and expensive. Recently, vegetable oils have created a great deal of interest as greener replacement for the conventional organic solvents as alternative solvents in solvent extraction on account of their salient features such as non-volatility, non-flammability and biodegradability.

In our previous works, various vegetable oils like corn, canola, sunflower and soybean oils have been found to extract Cu(II) effectively from aqueous solutions (Chang et al., 2010). In this work, optimization of factors (mixing time (t), extractant concentration, phase modifier concentration, inert salt concentration, organic to aqueous phase (O:A) ratio and equilibrium pH (pH_{eq})) affecting Cu(II) extraction from aqueous solutions using a soybean oil-based organic solvent was conducted by a multivariate statistical technique, called Response Surface Methodology. The soybean oil-based organic solvent was composed of di-2-ethylhexylphosphoric acid (D2EHPA) (extractant) and tributylphosphate (TBP) (phase modifier) diluted in soybean oil (diluent). Factors that are influential to Cu(II) extraction were first investigated in screening experiments based on a two fractional factorial design, followed by optimization of these factors in optimization experiments based on central composite design (CCD). A regression model correlating the response and factors was developed and its adequacy was examined. The optimum conditions for maximum Cu(II) extraction were determined and the predicted and experimental percentage extraction obtained under the optimum conditions were compared.