EXTRACTION OF CU(II) FROM AQUEOUS PHASE USING COOKING PALM OIL AS AN ORGANIC SOLVENT

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Contents

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Y.Bhg.Prof,

FINAL RESEARCH REPORT "EXTRACTION OF CU(II) FROM AQUEOUS PHASE USING COOKING PALM OIL AS AN ORGANIC SOLVENT"

Referring to the above matter, attached herewith 4 (four) copies of final research reports and a CD entitled "Extraction of cu(ii) from aqueous phase using cooking palm oil as an organic solvent" by our group of researcher from Faculty of Chemical Engineering, UiTM Cawangan Pulau Pinang and UiTM Shah Alam for your kind attention.

Thank you,

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5.2 Enhanced Executive Summary

Heavy metal is a source of contaminants in the industries effluents. It can be released into the environment in gaseous, particulate and transportation, microelectronic product and finally waste disposal (Bradl, 2005). For instance, generation of heavy metal waste has been estimated to be 4000 and 150,000 tonne/year alone in Portugal and European countries (Silva et al., 2005). This show that amount of waste being generated annually is respectively a huge amount. Therefore, heavy metal needed to remove from the sources to avoid contaminations to the environment and human health.

Solvent extraction is one of the effective techniques to remove Cu(II) from aqueous solution. The common conventional solvents used are petroleum- base such as such as kerosene, chloroform, dichloromethane, ndodecane, isododecane, n-decanol, n-heptane, n-hexane and cumene. These petroleum-based diluents, which form the bulk components in the organic phase, are usually toxic, non-renewable, non biodegradable, flammable and volatile in nature (Venkareswaran et al., 2007). They are difficult to handle and will result in ecological hazard to the aquatic systems in the case of solvent loss due to entrainment in the aqueous phase. Hence, it is essential to find a greener replacement for the conventional petroleum-based organic solvents in order to curb the environmental problem.

Cooking palm oil which has a great potential as greener substitutes for the conventional solvents owing to their outstanding characteristics such as nontoxicity, inflammability, nonvolatility, renewability and biodegradability. The unlimited bioresources, as well as relatively simpler processing steps and technologies involved, ensure the use of cooking palm oils as solvent substitutes cheaper than the conventional organic solvents.

5.3 Introduction

Copper contamination of various water resources is of great concern because of the toxic effect to the human beings and other animals and plants in the environment. Copper is discharged by various industries such as electroplating, metal finishing, textile, storage batteries, mining, ceramic and glass. Removal of toxic copper or decreasing its concentrations to the permitted levels before discharge is important and is becoming more important with an increase in industrial activities (Sarioglu et al., 2005). Removal of Cu(II) from wastewaters has been performed by numerous technique or method. The treatment methods that are widely used are chemical precipitation (Janin et al., 2009), ion exchange (Liu & Bai et al., 2006), membrane filtration (Molinari et al., 2009), adsorption and flotation (Rubio et al., 2002). The application of the solvent extraction process is considered as an attractive option for the removal and recovery of Cu(II) from aqueous solution.

Solvent extraction consists of two liquid, an aqueous solution and organic solvent. The organic phase consist extractant, modifier and diluents (Rydberg et al., 2004). Extractants generally have low solubility in water, but greatly dissolve under some conditions. During extraction, extractant (i.e., metal carriers) may depart the organic solvent phase (i.e., diluent) entering aqueous phase (Kumar et al., 2009). An extraction mechanism called 'Big carrousel' model was proposed which involves diffusion of extractant into aqueous phase, followed by formation of metal/extractant complexes, and then transportation of metal/extractant complexes back into solvent phase. The formation of metal-organic complex during extraction of the metal ion, a dimer state of D2EHPA has been considered as reported by various author. Thus the extraction mechanism of the metal ion (in this case cadmium) with D2EHPA in kerosine can express as follows (Kumar et al., 2009):

$$M_{aq} + (n-p)/2(H_2A_2)_{org} \overset{K_{ex}}{\leftrightarrow} (MA_n(HA)_p)_{org} + nH_{aq} \qquad (1)$$

where (H_2A_2) extractant in dimeric form, M is metal, n is valence of the metal or metal complex ion and p number of molecules of extractant engaged in reaction. The equilibrium constant of the extraction reaction K_{ex}, can be given as a function of molar concentration, provided that the ionic strength of the aqueous solution is constant.