

**EXTRACTION BEHAVIOR OF Cu(II) AND Fe(III) FROM CHLORIDE
MEDIUM TO THE HYDROPHOBIC IONIC LIQUIDS USING 1,10-
PHENANTHROLINE**

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**FACULTY OF SCIENCE
UNIVERSITY OF MALAYA
KUALA LUMPUR**

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ORIGINAL LITERARY WORK DECLARATION

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Field of Study: Analytical Chemistry

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EXTRACTION BEHAVIOR OF Cu(II) AND Fe(III) FROM CHLORIDE MEDIUM TO THE HYDROPHOBIC IONIC LIQUIDS USING 1,10-PHENANTHROLINE

ABSTRACT

The study of liquid-liquid extraction of Cu(II) and Fe(III) ion was carried out using a series of hydrophobic ionic liquid; 1-butyl-3-methylimidazolium hexafluorophosphate ($[C_4mimPF_6]$), 1-hexyl-3-methylimidazolium hexafluorophosphate ($[C_6mimPF_6]$), 1-butyl-3-methylimidazolium bistrifluoromethylsulfonyl imide ($[C_4mimNTf_2]$) and 1-hexyl-3-methylimidazolium bistrifluoromethylsulfonyl imide ($[C_6mimNTf_2]$) as the extraction phase. Cu(II) showed a preferential extraction into less hydrophobic ionic liquid, $[C_4mimPF_6]$. The extraction behavior of Cu(II) ions depend on the type of counter ion present. The extraction process of Cu(II) ion in ionic liquid proceeded via similar mechanism to that of a molecular organic solvent. From the results obtained, an ion pair mechanism is proposed for the extraction of Cu complexes from chloride medium. Fe(III) favors extraction into $[C_6mimNTf_2]$, the most hydrophobic ionic liquid. Anion exchange is the mode of extraction of Fe complexes from chloride medium.

PERANGAI PENGEKSTRAKAN Cu(II) DAN Fe(III) DARIPADA MEDIA KLORIDA KEPADA CECAIR IONIK HIDROFOBİK MENGGUNAKAN 1,10-PHENANTHROLINE

ABSTRAK

Kajian pengekstrakan pelarut untuk Cu(II) dan Fe(III) ion dijalankan dengan menggunakan satu siri cecair ionik yang hidrofobik di mana 1-butyl-3-methylimidazolium hexafluorophosphate ($[C_4mimPF_6]$), 1-hexyl-3-methylimidazolium hexafluorophosphate ($[C_6mimPF_6]$), 1-butyl-3-methylimidazolium bistrifluoromethylsulfonyl imide ($[C_4mimNTf_2]$) dan 1-hexyl-3-methylimidazolium bistrifluoromethylsulfonyl imide ($[C_6mimNTf_2]$) sebagai fasa pengekstrakan. Pengekstrakan Cu(II) mencapai tahap tertinggi oleh $[C_4mimPF_6]$ iaitu cecair ionik yang paling kurang hidrofobik. Pengekstrakan Cu(II) ion bergantung kepada jenis ion Lawan yang hadir. Pengekstrakan ion Cu(II) dalam sistem cecair ionik berlaku melalui mekanisme yang sama seperti dalam pelarut organik molekul. Daripada keputusan yang diperolehi, mekanisme yang dicadangkan untuk pengekstrakan kompleks Cu daripada media klorida adalah mekanisme ion berpasangan. Fe(III) lebih berminat untuk ekstrak ke dalam $[C_6mimNTf_2]$ iaitu cecair ionik yang paling hidrofobik. Penukar anion dikenalpasti sebagai mod pengekstrakan kompleks Fe daripada media klorida.

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LIST OF ABBREVIATIONS

BF_4^-	Tetrafluoroborate
C_4mimBr	1-butyl-3-methylimidazolium Bromide
$\text{C}_4\text{mimNTf}_2$	1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide
C_4mimPF_6	1-butyl-3-methylimidazolium hexafluorophosphate
C_6mimCl	1-hexyl-3-methylimidazolium Chloride
$\text{C}_6\text{mimNTf}_2$	1-hexyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide
C_6mimPF_6	1-hexyl-3-methylimidazolium hexafluorophosphate
FAAS	Flame Atomic Absorption Spectroscopy
F-NMR	Fluorin-Nuclear Magnetic Resonance
H NMR	Proton –Nuclear Magnetic Resonance
H_2SO_4	Sulfuric Acid
HCl	Hydrochloric Acid
HNO_3	Nitric Acid
IC	Ion Chromatography
ILs	Ionic Liquids
KBr	Potassium Bromide
KCl	Potassium Chloride

KPF ₆	Potassium hexafluorophosphate
LiBr	Lithium Bromide
LiNTf ₂	Lithium bis(trifluoromethylsulfonyl)imide
mins	minutes
Na ₂ CO ₃	Sodium Carbonate
NaHCO ₃	Sodium Hydrogen Carbonate
NO ₃ ⁻	Nitrate
NTf ₂ ⁻	Bis(trifluoromethylsulfonyl)imide
OAc ⁻	Acetate
PF ₆ ⁻	Hexafluorophosphate
Phen	1,10-phenanthroline
TfO ⁻	Trifluoromethylsulfonate
UV-VIS	Ultra Violet-Visible Spectroscopy
X ⁻	Halide