List of Figures

Figure	Title	Page
2.1	Preparation of emulsion liquid membranes.	8
2.2	Schematic of an emulsion liquid membrane system	9
2.3	Flow sheet of an emulsion liquid membrane process.	10
2.4	Schematic representation of a concentration profile through an emulsion liquid membrane.	11
2.5	Transport mechanisms of liquid membrane permeation.	13
2.6	The ultimate fates of emulsions related to colloidal stability.	25
2.7	Osmotic pressure effects leading to swelling and rupture of W/O emulsion droplets.	31
2.8	Schematic diagram of solute permeation and emulsion breakage.	33
2.9	Schematic of the two facilitated transport mechanisms.	40
2.10	Schematic of liquid membrane system for phenol removal.	42
2.11	Copper transfer in emulsion liquid membrane globule.	50
3.1	Batch extraction assembly.	83
3.2	Impeller and vessel dimensions	84
4.1	Internal drop size distribution	
	(a) $\phi = 0.45$, $C_{10} = 0.3$ M	91
	(b) $\phi = 0.6$, $C_{10} = 0.3$ M	91
	(c) $\phi = 0.69$, $C_{10} = 0.3$ M	92
	(d) $\phi = 0.45$, $C_{10} = 0.5$ M	92
4.2	Photomicrographs of internal phase droplets at different ϕ.	93

4.3	Effect of ϕ on viscosity at different shear rates (Cio = 0).	97
4.4	Effect of ϕ on viscosity at different shear rates(Cio = 0.3M)	98
4.5	Effect of C_{10} on ηat different values of ϕ.	99
4.6	Effect of ϕ on σ.	103
4.7	Effect of C_{10} on σ	103
4.8	Snapshots showing dispersion history of emulsion globules.	106
4.9	Globules size distribution (a) 1 min (b) 3 min (c) 30 min	107
4.10	Effect of stirring speed on emulsion globule dispersion	108
4.11	Effect of stirring speed on globule size distribution. (a) 135 rpm (b) 155 rpm (c) 185 rpm	109
4.12	Effect of volume fraction of internal phase (ϕ) on emulsion globule dispersion.	111
4.13	Effect of ϕ on globule size distribution (a) ϕ=0.45 (b) ϕ=0.5 (c) ϕ=0.69	112
4.14	Effect of initial NaOH concentration (C_{10}) in the internal phase on emulsion globule dispersion.	114
4.15	Effect of initial NaOH concentration (C_{10}) on globule size distribution (a) 0.15 M (b) 0.5 M (c) 0.5 M	115
4.16	Effect of treat ratio (TR) on emulsion globule dispersion.	117
4.17	Effect of treat ratio (TR) on emulsion globule size distribution (a) 1:15 (b) 1:6	118
4.18	Partition coefficient of phenols.	122
4.19	Effect of Stirring speed on extraction of phenol.	126

4.20	Effect of ϕ on extraction of phenol.	128
4.21	(a)Effect of surfactant concentration on extraction of phenol ($\phi = 0.45$).	131
	(b)Effect of surfactant concentration on extraction of phenol ($\phi = 0.5$).	132
4.22	Effect of C_{10} on extraction of phenol. (a) $\phi = 0.45$, (b) $\phi = 0.5$	134
4.23	(a)Effect of Treat ratio on extraction of phenol. (ϕ=0.45)	137
	(b)Effect of Treat ratio on extraction of phenol. (ϕ=0.50)	138
4.24	(a)Effect of initial phenol concentration on extraction(ϕ=0.45)	140
	(b)Effect of initial phenol concentration on extraction(ϕ=0.5)	141
4.25	(a)Effect of Treat ratio at M=1.7	144
	(b)Effect of Treat ratio at M=1.88	144
4.26	(a)Effect of initial phenol concentration on extraction at M=1.7	147
	(b) Effect of initial phenol concentration on extraction at M=1.88	148
4.27	Effect of Temperature on extraction of phenol.	149
4.28	Effect of membrane material on extraction of phenol.	151
4.29	Effect of delayed addition of solute on extraction.	152
4.30	(a)Effect of stirring speed on extraction of o-cresol. (Span 80=3%)	154
	(b)Effect of stirring speed on extraction of o-cresol. (Span 80=4.7%)	156
4.31	Effect of ϕ on extraction of o-cresol.	158
4.32	Effect of ϕ on extraction of o-cresol at M=2.	158

4.33	(a)Effect of Surfactant concentration on extraction of o-cresol(ϕ=0.45)	160
	(b)Effect of Surfactant concentration on extraction of c-cresol(ϕ=0.50): (c) (ϕ = 0.55)	161
4.34	(a)Effect of C_{10} on extraction of o-cresol(ϕ=0.45).	162
	(b)Effect of C_{10} on extraction of o-cresol(ϕ=0.5).	164
4.35	(a)Effect of Treat ratio on extraction of o-cresol (ϕ=0.45)	165
	(b)Effect of Treat ratio on extraction of o-cresol (ϕ=0.5)	165
4.36	Effect of Treat ratio on extraction of o-cresol at *M*=2.	166
4.37	Effect of initial o-cresol concentration of extraction.	167
4.38	Effect of initial o-cresol concentration on extraction at *M*=2.	168
4.39	Effect of temperature on extraction of o-cresol.	169
4.40	Effect of membrane material on extraction of o-cresol.	170
4.41	Effect of C_{10} using Acrylate resin 505 emulsifier.	171
4.42	Effect of ϕ using Acrylate resin 505 emulsifier on extraction of o-cresol.	172
4.43	Effect of ϕ on extraction of p-cresol.	173
4.44	Effect of ϕ on extraction of p-cresol at *M*=2.	174
4.45	Effect of C_{10} on extraction of p-cresol.	175
4.46	Effect of Treat ratio on extraction of p-cresol.	177
4.47	Effect of Treat ratio on extraction of p-cresol at *M*=2	178
4.48	Effect of initial p-cresol concentration on extraction.	179
4.49	Effect of initial p-cresol concentration on extraction at *M*=2.	179
4.50	Effect of ϕ on extraction of 2-chlorophenol.	181
4.51	Effect of ϕ on extraction of 2-chlorophenol at *M*=2.	182

4.52	Effect of C_{10} on extraction of 2-chlorophenol.	183
4.53	Effect of Treat ratio on extraction of 2-chlorophenol at M=2.	184
4.54	Effect of initial 2-chlorophenol concentration on extraction.	185
4.55	Photomicrographs showing the morphological change of W/O emulsion with time	188
4.56	Effect of internal phase reagent concentration on emulsion stability.	191
4.57	Effect of surfactant concentration (Span 80) on emulsion stability.	192
4.58	Comparative extraction of phenols.	193
4.59	(a)Effect of ϕ on extraction of phenols at M=2. (ϕ=0.45)	194
	(b)Effect of ϕ on extraction of phenols at M=2. (ϕ=0.5)	195
	(c)Effect of ϕ on extraction of phenols at M=2. (ϕ=0.6)	196
	(d)Effect of ϕ on extraction of phenols at M=2. (ϕ=0.69)	197
4.60	(a)Effect of TR on extraction of phenol at M=2. (TR=1:20)	198
	(b)Effect of TR on extraction of phenol at M=2. (TR=1:10)	199
	(c)Effect of TR on extraction of phenol at M=2. (TR=1:6)	199
4.61	(a)Effect of initial concentration of phenols on extraction at M=2. (C_{eo}=400mg/dm^3)	201
	(b)Effect of initial concentration of phenols on extraction at M=2. (C_{eo}=600mg/dm^3 & 800mg/dm^3)	201
5.1	Internal drop size distribution.	208

5.2	Photomicrograph showing the morphological structure containing 10% LIX 984 NC as carrier	209
5.3	Effect of percentage LIX 84 on viscosity η at different shear rates.	210
5.4	Effect of percentage LIX 984 NC on viscosity η different shear rates.	211
5.5	Snapshots showing dispersion history of emulsion globules containing LIX 84 as carrier	213
5.6	Globule size distribution for extraction of copper with LIX 84 in Sulfate media.	214
5.7	Snapshots showing dispersion history of emulsion Globules containing 10% LIX 984 NC as carrier	215
5.8	Globule size distribution for extraction of copper with LIX 984 NC in Sulfate media.	216
5.9	Snapshots showing dispersion history of emulsion globules containing LIX 84 I as carrier	217
5.10	Globule size distribution for extraction of copper with LIX 84 I in ammoniacal media	218
5.11	Effect of stirring speed on extraction of copper from sulfate media using LIX 84	219
5.12	Effect of C_{10} on extraction of copper from sulfate media using LIX 84	221
5.13	Effect of surfactant concentration on extraction of copper from sulfate media using LIX 84	222
5.14	Effect of ϕ on extraction of copper from sulfate Media using LIX 84	223
5.15	Effect of ϕ and stirring speed on extraction of copper From sulfate media using LIX 84	224
5.16	Effect of % LIX concentration on extraction of copper From sulfate media using LIX 84 and LIX 984 NC	225
5.17	Effect of Treat ratio on extraction of copper from sulfate	

	Media using LIX 84	227
5.18	Effect of initial concentration on extraction of phenol from sulfate media using LIX 84 and LIX 984 NC	228
5.19	Effect of pH on extraction of copper from sulfate media using different carriers	231
5.20	Effect of C_{10} on extraction of copper from sulfate media at pH = 1 using LIX 84 and LIX 984 NC	234
5.21	Effect of pH on extraction of copper and nickel from Ammoniacal media using LIX 84 I	237
5.22	Simultaneous extraction of copper and nickel from ammoniacal media using LIX 84 I	239
6.1	Schematic diagram of the advancing front model	244
6.2	Comparison of experimental and predicted values using AFM (o-cresol)	251
6.3	comparison of experimental and predicted values using AFM (2-chlorophenol)	252
6.4	Comparison of experimental and predicted values using AFM (p-cresol)	252
6.5	Comparison of experimental and predicted values using AFM (phenol)	253
6.6	Concentration profile within the ELM globule: case 1	259
6.7	Concentration profile within the ELM globule: case 2	260
6.8	Concentration profile within the ELM globule: case 3	260
6.9	Concentration profile within the ELM globule: case 4	261
6.10	Concentration profile within the ELM globule: case 5	262