Appendix F

Table F.1: Effect of stirring speed on extraction of copper from sulfate media using LIX 84
(ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1M, TR = 1:6, LIX 84 = 10%, pH = 2)

Run no.		1	2
Stirring speed (rpm)		**160**	**190**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.9060	0.7839
3	5	0.6980	0.5905
4	10	0.5689	0.4270
5	15	0.4487	0.2940
6	20	0.3439	0.2213
7	25	0.2535	0.1745
8	30	0.2260	0.1195
9	35	0.1624	0.0868
10	40	0.1340	0.0545
11	45	0.0989	0.0397
12	50	0.0781	0.0392
13	60	0.0500	0.0265

Table F.2:Effect of internal phase reagent concentration (C_{io}) on extraction of copper from sulfate media using LIX 84
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, TR = 1:6, LIX 84 = 10%, pH = 2)

Run no.		1	3	4
C_{io} (M)		**1**	**1.5**	**2**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.9060	0.8195	0.7186
3	5	0.6980	0.5680	0.4857
4	10	0.5687	0.4148	0.2674
5	15	0.4487	0.2671	0.1653
6	20	0.3439	0.1823	0.1043
7	25	0.2535	0.1043	0.0521
8	30	0.2260	0.1047	0.0255
9	35	0.1624	0.0496	0.0186
10	40	0.1340	0.0342	0.0198
11	45	0.0989	0.0229	0.0141
12	50	0.0781	0.0187	0.0135
13	60	0.0500	0.0144	0.0248

Table F.3: Effect of surfactant concentration on extraction of copper from sulfate media using LIX 84
(N = 160 rpm, ϕ = 0.5, C_{io} = 1 M, TR = 1:6, LIX 84 = 10%, pH = 2)

Run no.		1	5
W_{surf} %		3	4.7
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.9060	0.8944
3	5	0.6980	0.7114
4	10	0.5689	0.5577
5	15	0.4487	0.4774
6	20	0.3439	0.4005
7	25	0.2535	0.3604
8	30	0.2260	0.3202
9	35	0.1624	0.2661
10	40	0.1340	0.2413
11	45	0.0989	0.2289
12	50	0.0781	0.2139
13	60	0.0500	0.1911

Table F.4:Effect of internal phase volume fraction (ϕ) on extraction of copper from sulfate media using LIX 84
(N = 160 rpm,$W_{surf.}$ = 3%, C_{io} = 1M, TR = 1:6, LIX 84 = 10%, pH = 2)

Run no.		6	1	7
ϕ		0.4	0.5	0.6
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.8315	0.9060	0.7708
3	5	0.6520	0.6980	0.5271
4	10	0.4883	0.5687	0.4171
5	15	0.4552	0.4487	0.4273
6	20	0.3657	0.3439	0.2474
7	25	0.3171	0.2535	0.1951
8	30	0.2431	0.2260	0.1579
9	35	0.1904	0.1624	0.1132
10	40	0.1526	0.1340	0.0815
11	45	0.1053	0.0989	0.0670
12	50	0.0900	0.0781	0.0601
13	60	0.0513	0.0500	0.0407

Table F.5:Effect of LIX 84 concentration on extraction of copper from sulfate media ($N = 160$ rpm, $\phi = 0.5$, $W_{surf.} = 3\%$, $C_{io} = 1.5$ M, TR = 1:6, pH = 2)

Run no.		8	9	3	10	11
%LIX 84		**5**	**7.5**	**10**	**15**	**20**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1	1	1
2	2	0.8614	0.7923	0.8195	0.8650	0.8270
3	5	0.8008	0.6749	0.5680	0.7205	0.6423
4	10	0.6168	0.4988	0.4148	0.5270	0.4623
5	15	0.4575	0.3363	0.2671	0.3890	0.3304
6	20	0.3486	0.3021	0.1823	0.2768	0.2321
7	25	0.3069	0.2326	0.1043	0.2058	0.1627
8	30	0.2709	0.1755	0.1047	0.1495	0.1402
9	35	0.2557	0.1538	0.0496	0.1160	0.0758
10	40	0.2295	0.1083	0.0342	0.0730	0.0536
11	45	0.2189	0.0900	0.0229	0.0670	0.0395
12	50	0.1972	0.0773	0.0187	0.0530	0.0278
13	60	0.1772	0.0639	0.0144	0.0400	0.0197

Table F.6:Effect of initial copper concentration on extraction from sulfate media using LIX 84
($N = 160$ rpm, $\phi = 0.5$, $W_{surf.} = 3\%$, $C_{io} = 2M$, TR = 1:6, LIX = 84 =10%, pH = 2)

Run no.		4	12
C_{eo} (mg/dm^3)		**460**	**1880**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.7186	0.9719
3	5	0.4857	0.8959
4	10	0.2674	0.8091
5	15	0.1653	0.7489
6	20	0.1043	0.6061
7	25	0.0521	0.5086
8	30	0.0255	0.4846
9	35	0.0186	0.4557
10	40	0.0198	0.3967
11	45	0.0141	0.3659
12	50	0.0135	0.3109
13	60	0.0248	0.2862

Table F.7:Effect of Treat ratio on extraction of copper from sulfate media using LIX 84

(N = 160 rpm, ϕ = 0. 5, $W_{surf.}$ = 3%, C_{io} = 1.5M, LIX 84 = 10%, pH = 2)

Run no.		13	3	14
Treat ratio		**1:4**	**1:6**	**1:10**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.8531	0.8195	0.8140
3	5	0.6956	0.5680	0.7849
4	10	0.5070	0.4148	0.5850
5	15	0.3926	0.2671	0.5030
6	20	0.2782	0.1823	0.3740
7	25	0.2348	0.1043	0.3941
8	30	0.2159	0.1047	0.3390
9	35	0.1408	0.0496	0.2770
10	40	0.1166	0.0342	0.2648
11	45	0.1029	0.0229	0.2330
12	50	0.0988	0.0187	0.2190
13	60	0.0782	0.0144	0.2010

Table F.8:Effect of pH on extraction of copper from sulfate media using LIX 84

(N = 160 rpm, ϕ = 0.45, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6, LIX 84 = 10%)

Run no.		15	3	16
pH		**1**	**2**	**5**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.9781	0.8195	0.7628
3	5	0.9563	0.5680	0.3540
4	10	0.9602	0.4148	0.0728
5	15	0.9165	0.2671	0.0479
6	20	0.8807	0.1823	0.0134
7	25	0.8827	0.1043	0.0206
8	30	0.8648	0.1047	0.0138
9	35	0.8429	0.0496	0.0141
10	40	0.7912	0.0342	0.0142
11	45	0.7733	0.0229	0.0127
12	50	0.7753	0.0187	0.0117
13	60	0.7197	0.0144	0.0165

Table F.9:Effect of pH on extraction of copper from sulfate media using LIX 984 NC
(N = 160rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6, LIX 984 NC =10%)

Run no.		17	18	19
pH		**1**	**2**	**5**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.9878	0.6400	0.3693
3	5	0.8485	0.4050	0.1882
4	10	0.7049	0.1796	0.0327
5	15	0.5764	0.0790	0.0046
6	20	0.4703	0.0277	0.0041
7	25	0.4070	0.0167	0.0035
8	30	0.3640	0.0111	0.0037
9	35	0.3162	0.0111	0.0058
10	40	0.2959	0.0111	0.0043
11	45	0.2512	0.0108	0.0038
12	50	0.2293	0.0017	0.0060
13	60	0.1971	0.0159	0.0144

Table F.10: Effect of internal phase reagent concentration (C_{io}) on extraction of copper from sulfate media using LIX 984 NC
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, TR = 1:6, LIX 984 NC = 10%, pH = 1)

Run no.		20	17
C_{io} (M)		**2**	**1.5**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.9490	0.9878
3	5	0.8370	0.8485
4	10	0.6742	0.7049
5	15	0.6045	0.5764
6	20	0.4864	0.4703
7	25	0.4218	0.407
8	30	0.3385	0.357
9	35	0.2904	0.3162
10	40	0.2527	0.28
11	45	0.2292	0.2512
12	50	0.1997	0.2293
13	60	0.1752	0.1971

Table F.11: Effect of LIX 984 NC concentration on extraction of copper from sulfate media

(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6)

Run no.		22	23	18
% LIX 984 NC		**5**	**7.5**	**10**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1	1
2	2	0.6860	0.6428	0.6400
3	5	0.4426	0.3708	0.4050
4	10	0.2358	0.2276	0.1796
5	15	0.1242	0.0214	0.0790
6	20	0.0556	0.0202	0.0277
7	25	0.0189	0.0022	0.0167
8	30	0.0223	0.0056	0.0111
9	35	0.0096	0.0056	0.0111
10	40	0.0070	0.0057	0.0111
11	45	0.0054	0.0080	0.0108
12	50	0.0479	0.0097	0.0017
13	60	0.0737	0.0118	0.0159

Table F.12:Effect of initial concentration of copper on extraction from sulfate media using LIX 984 NC

(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} =2M, TR = 1:6, LIX 984 NC = 10%)

Run no.		24	25
C_{eo} (mg/dm^3)		**465**	**1903**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.7500	0.7556
3	5	0.4820	0.5725
4	10	0.2525	0.3549
5	15	0.1284	0.2245
6	20	0.0660	0.1642
7	25	0.0419	0.1179
8	30	0.0251	0.0881
9	35	0.0168	0.0573
10	40	0.0161	0.0490
11	45	0.0142	0.0443
12	50	0.0168	0.0423
13	60	0.0213	0.0429

Table F.13: Effect of pH on extraction of copper from sulfate media using LIX 84 I
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6, LIX 84 I = 10%)

Run no.		26	27
pH		**2**	**5**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.8962	0.5022
3	5	0.7500	0.3103
4	10	0.6240	0.1741
5	15	0.5454	0.1014
6	20	0.4704	0.0620
7	25	0.4402	0.0361
8	30	0.4216	0.0203
9	35	0.4120	0.0155
10	40	0.4031	0.0155
11	45	0.4062	0.0184
12	50	0.4019	0.0212
13	60	0.4007	0.0219

Table F.14: Effect of pH on extraction of copper from ammoniacal media using LIX 84 I
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6, LIX 84 I = 10%)

Run no.		28	29
pH		**8.1**	**9.1**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.0062	0.1903
3	5	0.0108	0.0255
4	10	0.0250	0.0259
5	15	0.0450	0.0367
6	20	0.0750	0.0581
7	25	0.0835	0.0614
8	30	0.1124	0.0833
9	35	0.1132	0.0892
10	40	0.1139	0.1001
11	45	0.1302	0.1193
12	50	0.1406	0.1285
13	60	0.1584	0.1656

Table F.15: Effect of pH on extraction of nickel from ammoniacal media using LIX 84 I
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5 M, TR = 1:6, LIX 84 I = 10%)

Run no.		30	31
pH		**8.1**	**9.1**
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.6265	0.8755
3	5	0.5270	0.8321
4	10	0.4830	0.7811
5	15	0.5140	0.7740
6	20	0.5410	0.7280
7	25	0.5700	0.7390
8	30	0.5790	0.7070
9	35	0.6073	
10	40	0.623	

Table F.16: Separation of copper and nickel from ammoniacal media using LIX 84 I
(N = 160 rpm, ϕ = 0.5, $W_{surf.}$ = 3%, C_{io} = 1.5M, TR = 1:6, LIX 84 I = 10%)

Run no.		33	
		copper	nickel
S.No.	Time (min)	C_e/C_{eo}	C_e/C_{eo}
1	0	1	1
2	2	0.0035	0.8162
3	5	0.0035	0.6183
4	10	0.0037	0.5291
5	15	0.0126	0.5691
6	20	0.0690	0.5843
7	25	0.1450	0.6181
8	30	0.2140	0.6711
9	35	0.3320	0.7272
10	40	0.3129	0.7471

Table F.17: Extraction of copper from sulfate media using CYANEX 302 (N = 160 rpm, $\phi = 0.5$, $W_{surf.} = 3\%$, $C_{io} = 1.5M$, TR = 1:6, CYANEX 302 = 10%, pH = 2)

Run no.		33
S.No.	Time (min)	C_e/C_{eo}
1	1	0.6182
2	2	0.3856
3	5	0.2387
4	10	0.1501
5	15	0.1150
6	20	0.0963
7	25	0.0788
8	30	0.0712
9	35	0.0665
10	40	0.0658
11	45	0.0586
12	50	0.0580
13	60	0.0514