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Appendix 3-1: Magnetic field profile along the length of a 45 mm coil

Coil length [mm]	Magnetic field strength	
	Centreline [Gauss]	radius = 20mm [Gauss]
45	945	938
40	962	985
30	985	1038
23	1000	1064
15	985	1041
5	967	990
0	951	941

Appendix 3-2: Magnetic field profile along the length of a 100 mm coil

Coil length [mm]	Magnetic field strength	
	Centreline [Gauss]	radius = 20mm [Gauss]
100	964	938
80	979	1002
60	995	1048
50	1000	1053
40	998	1045
20	983	1007
0	959	949

Appendix 3-3: Magnetic field profile along the length of 2 parallel magnetic plates

Coil length [mm]	Magnetic field strength	
	Centreline [Gauss]	radius = 20mm [Gauss]
45	980	1019
40	990	1014
30	995	1016
23	998	1017
15	998	1013
5	991	1006
0	979	1023

Appendix 3-4: Magnetic Retention and Rotation as function of frequency and magnetic field strength

Frequency [Hz]	Rotation observed at Magnetic flux (Gauss) [Gauss]	Retention at Magnetic flux (Gauss) [Gauss]
3	130	
5	165	
10	217	1600
20	286	
30	360	
40	470	
50	551	1300
70	641	
104	840	1200
150	1200	1200

Appendix 3-5: Effect of magnetic field strength and frequency on Pyrrhotite Flotation**Experimental Conditions**

Flotation Device	Hallimond Tube
Flotation Time	60 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	
Xanthate Concentration	10 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	Gauss
Magnetic Field Type	

Test Results

Test Nr	Type	Magnetic Field		Xanthate Concentration [ppm]	Mass Conc [g]	Mass Tail [g]	Recovery [%]
		Frequency [Hz]	Strength [Gauss]				
1	Coil	10	0	10	0.76	0.1	88.4
2	Coil	10	200	10	0.78	0.1	88.6
3	Coil	10	200	10	0.78	0.13	85.7
4	Coil	10	500	10	0.7	0.33	68.0
5	Coil	10	800	10	0.5	0.37	57.5
6	Coil	10	1200	10	0.44	0.41	51.8
7	Coil	10	1200	10	0.48	0.43	52.7
8	Coil	50	0	10	0.76	0.1	88.4
9	Coil	50	200	10	0.75	0.17	81.5
10	Coil	50	500	10	0.69	0.18	79.3
11	Coil	50	800	10	0.53	0.33	61.6
12	Coil	50	800	10	0.44	0.44	50.0
13	Coil	50	1200	10	0.3	0.58	34.1
14	Coil	50	1200	10	0.38	0.52	42.2
15	Coil	50	1200	10	0.34	0.52	39.5
16	Coil	50	1200	10	0.34	0.68	33.3
17	Coil	100	0	10	0.76	0.1	88.4
18	Coil	100	200	10	0.64	0.12	84.2
19	Coil	100	200	10	0.64	0.26	71.1
20	Coil	100	500	10	0.61	0.26	70.1
21	Coil	100	500	10	0.64	0.12	84.2
22	Coil	100	800	10	0.7	0.3	70.0
23	Coil	100	1200	10	0.48	0.46	51.1
24	Coil	0	0	10	0.76	0.1	88.4
25	Coil	140	500	10	0.79	0.12	86.8
26	Coil	140	1200		0.71	0.16	81.6

Appendix 3-6: Effect Of Magnetic field orientation on Pyrrhotite Flotation**Experimental Conditions**

Flotation Device	Hallimond Tube
Flotation Time	30 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Xanthate Concentration	10 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	Variable Gauss
Magnetic Field Type	Variable

Test Results

Test Nr	Magnetic Field Type	Magnetic Field		Xanthate Concentration [ppm]	Mass Conc [g]	Mass Tail [g]	Recovery [%]
		Frequency [Hz]	Strength [Gauss]				
1	Horizontal	50	0	10	0.93	0.05	94.9
2	Horizontal	50	0	10	0.9	0.04	95.7
3	Horizontal	50	400	10	0.91	0.09	91.0
4	Horizontal	50	400	10	0.83	0.15	84.7
5	Horizontal	50	1200	10	0.72	0.35	67.3
6	Horizontal	50	1200	10	0.75	0.32	70.1
7	Vertical	50	0	10	0.88	0.08	91.7
8	Vertical	50	0	10	0.91	0.05	94.8
9	Vertical	50	400	10	0.86	0.13	86.9
10	Vertical	50	400	10	0.79	0.2	79.8
11	Vertical	50	1200	10	0.48	0.43	52.7
12	Vertical	50	1200	10	0.4	0.44	47.6

Appendix 3-7: Effect of magnetic field positioning on Pyrrhotite Flotation

Experimental Conditions

Flotation Device	Flotation column
Flotation Time	30 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.074 l/min
Xanthate Concentration	8 ppm
Aerofroth 615	20 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	800 Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field Type	Magnetic Field			Coil Length [mm]	Xanthate Concentration [ppm]	Mass Conc [g]	Mass Tail [g]	Recovery [%]
		Frequency [Hz]	Strength [Gauss]	Position					
		1	None	No Magnetic field					
2	None	No Magnetic field			8	49	43	53.3	
5	Coil	50	800	Middle	100	8	44	60	42.3
6	Coil	50	800	Middle	100	8	44	50	46.8
7	Coil	50	800	Bottom	100	8	79	11	87.8
8	Coil	50	800	Bottom	100	8	80	8	90.9

Appendix 3-8: Effect Of collector concentration and a magnetic field on Pyrrhotite flotation**Experimental Conditions**

Flotation Device	Hallimond tube
Flotation Time	60 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.037 l/min
Xanthate Concentration	Variable ppm
Aerofroth 615	0 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	800 Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field			Xanthate Concentration [ppm]	Mass Conc [g]	Mass Tail [g]	Recovery [%]	
	Type	Frequency	Strength					
		[Hz]	[Gauss]					
1	None			0	0.82	0.84	49.4	
2	None			1	1.2	0.58	67.4	
3	None			2.5	1.6	0.16	90.9	
4	None			5	1.62	0.2	89.0	
5	Coil	100	800	Middle	0	0.34	1.58	17.7
6	Coil	100	800	Middle	1	1	1.02	49.5
7	Coil	100	800	Middle	2.5	1.6	0.34	82.5
8	Coil	100	800	Middle	5	1.6	0.24	87.0

Appendix 3-9: Effect Of Residence Time in a Magnetic field on Pyrrhotite Flotation

Experimental Conditions

Flotation Device	Hallimond tube
Flotation Time	30 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.037 l/min
Xanthate Concentration	8 ppm
Aerofroth 615	0 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	800 Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field			Coil Length [mm]	Length of Hallimond tube [mm]	Bubble rising time [sec]	Time in magnetic field [sec]	Xanthate Concentration [ppm]	Mass Conc [g]	Mass Tail [g]	Recovery [%]	
	Type	Frequency [Hz]	Strength [Gauss]									Position
1	None				230	0.84	0	8	79	11	87.8	
2	None				230	0.84	0	8	88	10	89.8	
3	Coil	50	800	Middle	45	230	0.84	0.16	8	68	31	68.7
4	Coil	50	800	Middle	45	230	0.84	0.16	8	60	33	64.5
5	Coil	50	800	Middle	100	230	0.84	0.37	8	44	60	42.3
6	Coil	50	800	Middle	100	230	0.84	0.37	8	44	50	46.8

Appendix 4-1: Effect of a Magnetic field on Pyrrhotite and pyrite flotation**Experimental Conditions**

Flotation Device	Flotation Column
Flotation Time	30 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.74 l/min
Xanthate Concentration	10 ppm
Amine Collector	0 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	Variable Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field		Conc Mass [g]	Pyrite		Conc Mass [g]	Pyrrhotite	
	Frequency [Hz]	Strength [Gauss]		Tail Mass [g]	Recovery [%]		Tail Mass [g]	Recovery [%]
1		0	0.90	0.04	95.7	0.84	0.13	86.6
2		0	0.83	0.02	97.6	0.92	0.08	92.0
3	50	500	0.89	0.06	93.7	0.79	0.17	82.3
4	50	500	0.93	0.03	96.9	0.86	0.13	86.9
5	50	1200	0.94	0.02	97.9	0.89	0.30	74.8
6	50	1200	0.92	0.05	94.8	0.89	0.27	76.7

Appendix 4-2: Effect of a Magnetic field on Pyrrhotite and Quartz flotation**Experimental Conditions**

Flotation Device	Hallimond Tube
Flotation Time	60 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.032 l/min
Xanthate Concentration	20 ppm
Amine Collector	3 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	Variable Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field		Quartz Content [g]	Conc Mass [g]	Quartz		Grade [% quartz]	Conc Mass [g]	Pyrrhotite	
	Frequency [Hz]	Strength [Gauss]			Tail Mass [g]	Recovery [%]			Tail Mass [g]	Recovery [%]
1		0	0.5	0.1	0.3	25.0	22.7	0.34	0.05	87.2
2		0	0.5	0.1	0.38	20.8	20.4	0.39	0.05	88.6
3	50	400	0.5	0.07	0.37	15.9	20.0	0.28	0.07	80.0
4	50	400	0.5	0.07	0.32	17.9	16.7	0.35	0.08	81.4
5	50	800	0.5	0.04	0.4	9.1	11.8	0.3	0.07	81.1
6	50	800	0.5	0.04	0.48	7.7	10.5	0.34	0.07	82.9
7	50	1200	0.5	0.02	0.39	4.9	6.5	0.29	0.07	80.6
8	50	1200	0.5	0.02	0.5	3.8	5.9	0.32	0.07	82.1

Appendix 4-3: Effect of chrysotile and a Magnetic field on Pyrrhotite and pyrite flotation**Experimental Conditions**

Flotation Device	Flotation column
Flotation Time	30 sec
Conditioning Time	10 min
Conditioning Temperature	20 °C
pH	7.4
Airflow rate	0.074 l/min
Xanthate Concentration	8 ppm
Aerofroth 615	20 ppm
Magnetic Field Frequency	50 Hz
Magnetic Field Strength	800 Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Magnetic Field		Chrysotile Content [%]	Pyrite			Pyrrhotite		
	Frequency [Hz]	Strength [Gauss]		Conc Mass [g]	Tail Mass [g]	Recovery [%]	Conc Mass [g]	Tail Mass [g]	Recovery [%]
1			0	0.98	0.01	99.0	0.89	0.14	86.4
2			3	0.93	0.04	95.9	0.72	0.2	78.3
3			3	0.96	0.02	98.0	0.74	0.12	86.0
4			6	0.85	0.27	75.9	0.38	0.46	45.2
5			6	0.77	0.20	79.4	0.31	0.53	36.9
6	50	800	0	1.01	0.02	98.1	0.59	0.23	72.0
7	50	800	0	1.00	0.03	97.1	0.6	0.27	69.0
8	50	800	3	0.84	0.08	91.3	0.17	0.78	17.9
9	50	800	3	0.90	0.03	96.8	0.13	0.8	14.0
10	50	800	6	0.90	0.33	73.2	0.06	0.81	6.9
11	50	800	6	0.92	0.28	76.7	0.03	0.8	3.6

Appendix 5-1: UV Spectra for Xanthate conditioning solutions.

Xanthate Solution		Standard Conditioning Solution		Magnetic Conditioning Solution	
Wavelength	Absorbance	Wavelength	Absorbance	Wavelength	Absorbance
[nm]		[nm]		[nm]	
202.6846	0.433817	202.6846	1.375	200	1.348144
204.4743	0.426702	203.5794	1.367898	200	1.348144
204.9217	0.418165	204.9217	1.328838	200.4474	1.341042
205.3691	0.412473	205.8166	1.275574	200.8949	1.341042
205.8166	0.409627	206.7114	1.250718	201.3423	1.33394
205.8166	0.403935	206.7114	1.236514	201.7897	1.33394
206.264	0.401089	206.7114	1.229413	202.2371	1.326838
206.7114	0.39682	206.7114	1.222311	202.2371	1.319736
206.7114	0.392551	206.7114	1.215209	202.6846	1.312634
207.1588	0.389705	206.7114	1.204556	203.132	1.305533
207.1588	0.385436	206.7114	1.193903	203.132	1.29488
207.6063	0.38259	207.1588	1.183251	203.5794	1.287778
208.0537	0.376898	207.1588	1.176149	203.5794	1.280676
208.0537	0.374052	207.1588	1.165496	203.5794	1.277125
208.5011	0.369783	207.6063	1.147742	204.0268	1.266473
208.5011	0.366937	207.6063	1.129987	204.0268	1.259371
208.9485	0.362668	208.0537	1.119334	204.4743	1.248718
208.9485	0.3584	208.5011	1.090927	204.4743	1.245167
209.396	0.352708	208.9485	1.06607	204.9217	1.234514
209.396	0.351285	208.9485	1.041214	204.9217	1.227413
209.8434	0.345593	208.9485	1.034112	205.3691	1.206107
210.2908	0.342747	209.396	1.02346	205.3691	1.206107
210.7383	0.339901	209.396	1.012807	205.8166	1.199005
210.7383	0.337055	210.2908	0.9843995	205.8166	1.191903
211.1857	0.334209	210.2908	0.9737467	205.8166	1.1777
211.6331	0.32994	210.2908	0.963094	206.264	1.167047
212.0805	0.325671	210.2908	0.9559922	206.264	1.163496
212.0805	0.322825	210.2908	0.9488903	206.7114	1.152843
212.528	0.319979	210.7383	0.9382376	206.7114	1.135089
212.528	0.317133	210.7383	0.9275848	206.7114	1.127987
213.4228	0.314287	211.1857	0.9133812	206.7114	1.124436
213.8702	0.312864	211.1857	0.9062794	206.7114	1.106681
214.7651	0.311441	211.6331	0.8991776	207.1588	1.110232
215.2125	0.311441	211.6331	0.8885248	207.1588	1.103131
216.1074	0.311441	211.6331	0.8743212	207.1588	1.09958
216.5548	0.312864	212.0805	0.8601175	207.1588	1.092478
217.4497	0.314287	212.0805	0.8459138	207.1588	1.085376
217.4497	0.31571	212.0805	0.838812	207.1588	1.078274
218.3445	0.319979	212.0805	0.8281593	207.6063	1.049867
219.2394	0.324248	212.9754	0.8068538	207.6063	1.042765
219.2394	0.325671	212.9754	0.7962011	207.6063	1.085376
220.1342	0.331363	213.4228	0.7819974	207.6063	1.06407
221.4765	0.335632	213.4228	0.7713447	207.6063	1.053418
221.9239	0.339901	213.4228	0.7642428	208.0537	1.035663
222.8188	0.347016	213.4228	0.757141	208.0537	1.02501
223.7136	0.348439	213.8702	0.7500392	208.0537	1.014358
224.6085	0.348439	214.3177	0.7393864	208.0537	1.007256
225.5034	0.349862	214.3177	0.7287337	208.5011	1.003705
226.3982	0.348439	214.7651	0.7216318	208.5011	0.9966031
226.8456	0.348439	215.66	0.6861227	208.5011	0.9788486
227.7405	0.345593	215.66	0.6790209	208.5011	0.9681959
228.1879	0.342747	215.66	0.6683682	208.5011	1.000154
228.6353	0.338478	216.1074	0.6577154	208.5011	0.9930522
229.5302	0.331363	216.1074	0.6506135	208.5011	0.9895013
229.5302	0.328517	216.1074	0.6435117	208.5011	0.9823995
229.9776	0.325671	216.5548	0.632859	208.5011	0.9717467
230.425	0.322825	216.5548	0.6257572	208.9485	0.9681959
230.8725	0.317133	217.0022	0.6186553	208.9485	0.961094
231.3199	0.311441	217.4497	0.6080026	208.9485	0.9575431
231.3199	0.308595	217.8971	0.5795953	208.9485	0.9504413
231.3199	0.305749	218.3445	0.5760444	209.396	0.9468904
231.7673	0.302903	218.7919	0.5618407	209.396	0.9397885
232.2148	0.297212	218.7919	0.5547389	209.8434	0.9291358
232.2148	0.294366	219.2394	0.547637	209.8434	0.918483
232.6622	0.290097	219.2394	0.5334334	209.8434	0.9113812
232.6622	0.287251	219.6868	0.5263316	209.8434	0.9007285
232.6622	0.282982	220.1342	0.5192298	210.2908	0.8900757
233.1096	0.278713	220.5816	0.508577	210.2908	0.8723212
233.5571	0.275867	220.5816	0.5014752	210.7383	0.8616684
234.0045	0.270175	221.0291	0.4837206	210.7383	0.8545666
234.0045	0.265906	221.4765	0.4766188	210.7383	0.840363
234.0045	0.26306	221.9239	0.469517	211.1857	0.8332611
234.4519	0.260214	222.3714	0.4588642	211.1857	0.8297102
234.4519	0.257368	222.8188	0.4517624	211.1857	0.8190575
234.4519	0.253099	223.2662	0.4411097	211.6331	0.8155065
234.8993	0.24883	223.7136	0.4340078	211.6331	0.8119556
235.3468	0.237447	224.1611	0.4162532	211.6331	0.8048538
235.3468	0.234601	224.6085	0.4056005	211.6331	0.797752
235.7942	0.231755	225.0559	0.4020496	212.0805	0.7906501
235.7942	0.226063	225.5034	0.3913969	212.0805	0.7799974
236.2416	0.216102	225.5034	0.3913969	212.528	0.7622429
237.1365	0.208987	225.9508	0.3807441	212.528	0.755141
237.1365	0.206141	226.8456	0.3665405	212.528	0.7373865
237.5839	0.199028	227.2931	0.3558877	213.4228	0.7373865
237.5839	0.19618	228.1879	0.345235	213.4228	0.7231828

Appendix 5-1: UV Spectra for Xanthate conditioning solutions.

Xanthate Solution		Standard Conditioning Solution		Magnetic Conditioning Solution	
Wavelength	Absorbance	Wavelength	Absorbance	Wavelength	Absorbance
[nm]		[nm]		[nm]	
238.0313	0.189065	228.6353	0.3381332	213.4228	0.7231828
238.4787	0.184796	228.6353	0.3310313	213.4228	0.716081
238.9262	0.179104	229.0828	0.3274804	213.8702	0.7089791
241.6107	0.14353	229.5302	0.3203786	213.8702	0.7018773
243.4005	0.1293	229.9776	0.3097258	213.8702	0.6983264
244.2953	0.125031	230.425	0.3061749	214.3177	0.6876736
244.2953	0.122185	230.8725	0.302624	214.3177	0.6770209
245.1902	0.116494	230.8725	0.2955222	214.7651	0.6699191
246.085	0.113648	231.7673	0.2848694	215.2125	0.6592664
246.5324	0.109379	231.7673	0.2848694	215.2125	0.6488136
247.8747	0.100841	232.2148	0.2777676	215.66	0.63441
249.217	0.096572	232.6622	0.2742167	216.1074	0.6166553
250.1118	9.23E-02	233.1096	0.263564	216.1074	0.6095535
250.5593	8.95E-02	233.5571	0.260013	216.1074	0.6060026
251.4541	8.66E-02	234.0045	0.2529112	216.5548	0.5989008
252.349	8.38E-02	234.4519	0.2458094	217.0022	0.5846971
252.7964	7.95E-02	234.8993	0.2387076	217.0022	0.5882481
253.6913	7.95E-02	235.7942	0.2245039	217.0022	0.5953499
254.5861	7.52E-02	237.5839	0.2103003	217.0022	0.5882481
255.9284	7.10E-02	238.4787	0.2031984	217.4497	0.5811462
256.8233	6.95E-02	238.4787	0.2031984	217.4497	0.5704935
257.7181	6.67E-02	238.4787	0.1960966	217.8971	0.5633917
259.0604	6.38E-02	239.3736	0.1889948	218.7919	0.5385352
259.5078	6.10E-02	239.821	0.1854438	218.7919	0.5349844
260.4027	5.96E-02	240.2684	0.1747911	219.6868	0.5172298
261.2975	5.96E-02	240.7159	0.1676893	219.6868	0.510128
262.1924	5.96E-02	241.1633	0.1605874	219.6868	0.506577
263.5347	5.82E-02	242.0582	0.1570365	220.5816	0.4959243
264.4295	5.82E-02	242.5056	0.1499347	220.5816	0.4888225
265.3244	5.82E-02	243.8479	0.139282	221.0291	0.4817206
266.2192	5.82E-02	243.8479	0.1357311	221.4765	0.4746188
267.1141	5.82E-02	244.7427	0.1321801	221.9239	0.467517
268.4564	5.96E-02	245.1902	0.1286292	222.3714	0.4533133
269.7986	6.24E-02	246.5324	0.1215274	222.3714	0.4497624
271.1409	6.81E-02	246.9799	0.1144256	222.8188	0.4426606
272.0358	0.072381	247.4273	0.1144256	223.2662	0.4320078
273.8255	0.078073	248.3221	0.1108747	223.7136	0.424906
274.7204	8.52E-02	248.7696	0.1108747	223.7136	0.4142533
275.1678	8.95E-02	249.6644	0.1073237	224.6085	0.4071515
276.5101	9.80E-02	250.1118	0.1002219	225.0559	0.3964987
276.9575	0.10511	251.0067	0.1002219	225.5034	0.3964987
277.8524	0.113648	251.4541	0.096671	225.9508	0.385846
278.2998	0.117916	252.349	9.31E-02	226.3982	0.3751932
278.7472	0.122185	253.6913	9.31E-02	226.8456	0.3716423
279.1946	0.133569	254.1387	8.96E-02	227.2931	0.3645405
280.0895	0.139261	255.0336	8.96E-02	228.1879	0.3538877
280.0895	0.143353	255.9284	8.60E-02	228.1879	0.3503368
280.5369	0.152068	256.8233	8.60E-02	229.0828	0.343235
280.9843	0.156337	257.7181	8.25E-02	229.0828	0.3396841
281.4318	0.160606	258.613	8.25E-02	229.5302	0.3290313
281.8792	0.166298	259.5078	8.25E-02	229.9776	0.3219295
281.8792	0.176259	260.4027	8.25E-02	230.425	0.3148277
282.774	0.183373	261.745	7.89E-02	230.8725	0.3112768
282.774	0.189065	262.6398	7.89E-02	231.3199	0.300624
283.6689	0.197603	263.9821	7.54E-02	231.7673	0.2899713
283.6689	0.203295	264.4295	0.0718146	232.2148	0.2935222
284.1163	0.207564	265.3244	6.83E-02	232.2148	0.2864204
284.1163	0.211833	266.2192	6.83E-02	232.6622	0.2793185
284.1163	0.214679	267.5615	6.47E-02	233.1096	0.2722167
284.5638	0.218948	268.9038	6.83E-02	233.5571	0.2651149
285.0112	0.226063	270.2461	0.0718146	234.0045	0.2580131
285.0112	0.230332	271.1409	7.54E-02	234.4519	0.2509112
285.4586	0.236024	273.3781	8.25E-02	234.4519	0.2438094
285.4586	0.240292	274.7204	8.25E-02	234.8993	0.2402585
285.906	0.244561	276.0626	8.25E-02	234.8993	0.2367076
286.3535	0.24883	277.4049	8.25E-02	235.3468	0.2296057
286.8009	0.260214	278.2998	8.60E-02	236.2416	0.2225039
286.8009	0.264483	279.1946	8.96E-02	236.689	0.2154021
286.8009	0.268752	280.0895	0.096671	237.1365	0.2083003
287.2483	0.275867	280.5369	0.1002219	237.1365	0.2011984
287.2483	0.282982	281.4318	0.1073237	237.5839	0.2011984
287.2483	0.284405	282.3266	0.1144256	238.0313	0.1940966
288.1432	0.292943	283.2215	0.1250783	238.9262	0.1869948
288.5906	0.298635	283.6689	0.1321801	238.9262	0.1905457
288.5906	0.308595	284.5638	0.1357311	238.9262	0.179893
289.038	0.317133	285.4586	0.1428329	239.3736	0.176342
289.4854	0.322825	286.3535	0.1499347	239.821	0.1692402
289.9329	0.331363	287.2483	0.1570365	240.7159	0.1585875
290.8277	0.345593	288.1432	0.1676893	241.1633	0.1585875
290.8277	0.352708	289.4854	0.1818929	243.8479	0.137282
291.2752	0.372629	290.3803	0.1925457	244.7427	0.1301802
291.7226	0.378321	291.2752	0.2031984	245.6376	0.1266292
292.6174	0.389705	291.7226	0.2103003	246.9799	0.1195274
292.6174	0.398243	292.6174	0.2245039	247.8747	0.1159765
293.0649	0.409627	293.0649	0.2351566	248.3221	0.1124256

Appendix 5-1: UV Spectra for Xanthate conditioning solutions.

Xanthate Solution		Standard Conditioning Solution		Magnetic Conditioning Solution	
Wavelength	Absorbance	Wavelength	Absorbance	Wavelength	Absorbance
[nm]		[nm]		[nm]	
293.5123	0.41105	294.4072	0.2493603	248.7696	0.1088747
293.5123	0.415319	295.302	0.2564621	249.6644	0.1017729
293.5123	0.425279	295.7495	0.260013	252.7964	9.47E-02
293.5123	0.430971	296.1969	0.2671149	253.6913	9.47E-02
294.4072	0.443778	297.0917	0.2742167	255.481	9.11E-02
294.4072	0.440932	297.9866	0.2777676	255.9284	0.0875692
294.4072	0.445201	298.8814	0.2813185	256.8233	8.40E-02
295.302	0.452316	299.3289	0.2813185	257.7181	8.40E-02
295.302	0.460854	300.2237	0.2848694	258.613	8.05E-02
295.302	0.470815	300.6711	0.2848694	259.9553	8.05E-02
295.7495	0.47793	302.0134	0.2706658	260.4027	8.40E-02
296.1969	0.486467	302.9083	0.2706658	260.4027	8.05E-02
296.6443	0.496428	302.9083	0.2706658	261.2975	8.05E-02
297.0917	0.500697	303.3557	0.263564	262.1924	8.05E-02
297.5392	0.503543	303.8031	0.260013	263.0872	8.05E-02
297.5392	0.509235	304.2505	0.2529112	263.9821	7.69E-02
297.9866	0.514927	304.698	0.2458094	264.877	7.34E-02
298.434	0.526311	305.5928	0.2280548	265.7718	7.69E-02
298.8814	0.533426	305.5928	0.2387076	266.2192	7.34E-02
299.3289	0.537695	306.0403	0.2316057	267.1141	7.34E-02
300.2237	0.549078	306.4877	0.2138512	268.4564	8.05E-02
300.2237	0.556193	306.4877	0.2245039	269.3512	8.40E-02
300.6711	0.560462	306.9351	0.2138512	270.6935	8.40E-02
301.566	0.564731	307.3825	0.1996475	271.5883	0.0875692
302.0134	0.569	307.3825	0.1960966	272.4832	0.0875692
303.3557	0.569	307.83	0.1925457	272.9306	9.11E-02
303.3557	0.563308	308.7248	0.1854438	274.7204	9.47E-02
304.2505	0.556193	309.1722	0.1712402	275.6152	9.47E-02
304.2505	0.551924	310.0671	0.1605874	276.0626	9.82E-02
304.698	0.549078	310.5145	0.1534856	276.5101	0.1053238
304.698	0.546232	311.4094	0.1428329	277.4049	0.1088747
304.698	0.540541	312.3043	0.1321801	277.8524	0.1195274
305.5828	0.524888	312.7517	0.1286292	279.1946	0.1266292
306.4877	0.50212	313.6465	0.1179765	280.0895	0.1301802
306.4877	0.489313	314.5414	0.1037728	280.5369	0.137282
306.9351	0.479353	315.4362	9.31E-02	281.4318	0.1443838
306.9351	0.476507	315.8837	8.60E-02	282.3266	0.1514857
307.3825	0.469392	316.7785	7.89E-02	283.2215	0.1550366
307.3825	0.466546	317.226	0.0718146	283.6689	0.1621384
307.3825	0.460854	317.6734	6.83E-02	284.1163	0.1656893
307.3825	0.458008	318.1208	6.12E-02	284.5638	0.176342
307.83	0.450893	318.5682	5.76E-02	285.906	0.1834439
308.2774	0.442355	319.4631	5.05E-02	286.8009	0.1869948
308.2774	0.43524	320.3579	4.34E-02	287.6957	0.2011984
308.2774	0.432394	321.2528	4.34E-02	287.6957	0.2047494
308.2774	0.428125	321.7002	3.28E-02	288.5906	0.2154021
308.2774	0.41105	322.5951	3.63E-02	289.038	0.2296057
308.7248	0.42101	323.0425	3.63E-02	289.4854	0.2331567
308.7248	0.416742	323.9373	3.63E-02	290.3803	0.2544622
308.7248	0.402512	323.9373	3.63E-02	290.8277	0.2580131
308.7248	0.393974	324.8322	2.92E-02	291.7228	0.2651149
309.1722	0.401089	325.2796	2.92E-02	292.17	0.2757676
309.1722	0.391128	326.1745	2.92E-02	293.0649	0.2864204
309.1722	0.388282	326.1745	2.57E-02	293.9597	0.2935222
309.1722	0.385436	326.6219	2.21E-02	294.4072	0.304175
309.1722	0.381167	327.0693	2.57E-02	295.302	0.3112768
309.6197	0.378321	328.859	2.21E-02	295.7495	0.3219295
309.6197	0.372629	329.7539	2.57E-02	296.6443	0.3254804
309.6197	0.361245	331.0962	2.21E-02	297.0917	0.3290313
310.0671	0.351285	331.9911	2.21E-02	297.5392	0.3325823
310.0671	0.34417	332.8859	2.21E-02	297.9866	0.3361332
310.0671	0.339901	333.3333	2.21E-02	298.434	0.3361332
310.0671	0.335632	334.6756	2.21E-02	299.3289	0.3325823
310.962	0.328517	336.0179	2.21E-02	299.7763	0.3325823
310.962	0.318556	337.8076	2.21E-02	300.2237	0.3290313
310.962	0.311441	339.5973	2.21E-02	300.6711	0.3254804
311.4094	0.304328	340.4922	2.21E-02	301.1186	0.3183786
311.4094	0.297212	342.2819	2.21E-02	302.0134	0.3183786
311.8568	0.292943	343.1767	2.21E-02	302.4608	0.3148277
311.8568	0.284405	344.0716	2.21E-02	302.9083	0.3077258
311.8568	0.280136	345.8613	2.57E-02	303.8031	0.300624
311.8568	0.271598	348.5459	2.21E-02	304.698	0.2899713
312.3043	0.261637	349.4407	2.21E-02	305.1454	0.2828695
312.7517	0.254522	350.3356	2.21E-02	305.5928	0.2722167
312.7517	0.247407	351.6779	2.57E-02	306.0403	0.2651149
312.7517	0.241715	353.0201	2.21E-02	306.4877	0.2580131
313.1991	0.234601	354.8098	2.21E-02	306.9351	0.2473603
313.1991	0.227486	358.3893	2.21E-02	307.83	0.2331567

Appendix 5-2: Absorbance at 301 nm with time for standard and solutions in the presence of a magnetic field.

Time [minutes]	Standard conditioning solution Absorbance	Conditioning solution in a magnetic field Absorbance
0	0.596	0.596
2.5	0.421	0.437
5	0.412	0.428
10	0.347	0.407
15	0.309	0.338
20	0.284	0.306

Appendix 5-3: Effect Of Conditioning in a magnetic field on pyrite Flotation**Experimental Conditions**

Flotation Device	Hallimond Tube
Flotation Time	60 sec
Conditioning Time	Variable min
Conditioning Temperature	20 °C
pH	7.4
Xanthate Concentration	10 ppm
Magnetic Field Frequency	100 Hz
Magnetic Field Strength	1000 Gauss
Magnetic Field Type	Coil

Test Results

Test Nr	Type	Magnetic Field		Xanthate Concentration [ppm]	Conditioning Time [min]	Mass Conc [g]	Mass Tail [g]	Recovery [%]
		Frequency [Hz]	Strength [Gauss]					
1				10	0	0.19	0.74	20.4
2				10	2.5	0.53	0.41	56.4
3				10	5	0.78	0.14	84.8
4				10	10	0.81	0.09	90.0
5				10	15	0.89	0.08	91.8
6				10	20	0.87	0.1	89.7
7	Coil	100	1000	10	0	0.18	0.74	19.6
8	Coil	100	1000	10	2.5	0.48	0.48	50.0
9	Coil	100	1000	10	5	0.84	0.1	89.4
10	Coil	100	1000	10	10	0.83	0.14	85.6
11	Coil	100	1000	10	15	0.81	0.14	85.3
12	Coil	100	1000	10	20	0.77	0.15	83.7

Appendix 6-1: Nickel and Copper recoveries and grades for standard column flotation and flotation in a magnetic field.

Test Number	Airflow [l/min]	Magnetic field		Feed		Concentrate		Tail		Recovery		
		Strength [Gauss]	Frequency [Hz]	Ni [%]	Cu [%]	Ni [%]	Cu [%]	Ni [%]	Cu [%]	Ni [%]	Cu [%]	Mass [%]
Test 1	3.1	1000	15	7.29	1.80	12.7	3.19	3.44	0.823	72.3	73.3	41.5
Test 2	2.65	1000	15	7.30	1.80	14.6	4.58	4.75	0.828	51.8	65.9	25.9
Test 3	2.2	1000	15	7.30	1.80	10.8	10.62	6.89	0.755	15.6	62.5	10.6
Test 4	3.1			7.32	1.80	11.2	2.96	3.75	0.737	73.2	78.6	47.7
Test 5	2.65			7.29	1.80	12.9	3.57	4.45	0.905	59.5	66.6	33.6
Test 6	2.2			7.31	1.80	13.0	5.43	5.79	0.822	37.6	64.0	21.2

Combined Nickel and Copper Recoveries and grades

Test Number	Airflow [l/min]	Magnetic field		Feed	Concentrate	Tails	Recovery	Mass [%]
		Strength [Gauss]	Frequency [Hz]	Ni + Cu [%]	Ni + Cu [%]	Ni + Cu [%]	Ni + Cu [%]	
Test 1	3.1	1000	15	9.09	15.9	4.27	72.5	41.5
Test 2	2.65	1000	15	9.10	19.2	5.57	54.6	25.9
Test 3	2.2	1000	15	9.10	21.4	7.64	24.9	10.6
Test 4	3.1			9.11	14.2	4.49	74.2	47.7
Test 5	2.65			9.10	16.5	5.35	60.9	33.6
Test 6	2.2			9.11	18.4	6.61	42.8	21.2

Appendix 6-2: Results from test with magnetic field applied and an airflow rate of 3.1

" SysCAD/MB v1.2 "
 " (c) Kenwalt Systems, 1994 "
 " 339 Rivonia Boulevard "
 " Johannesburg, South Africa "

" Time of run 21:21:12 "
 " Date of run 1999/10/12 "

" Magnetic field with high airflow "

" Converged in 2 iterations "
 " Maximum iterations : 50 "
 " Tolerance required : 0.001000 "
 " Tolerance obtained : 0.000619 "

" FLOWS "
 " ===== "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1	1	0	0	100	0.01
2	" Concn	0	0.415	0	0	41.49	0
3	" Tails	0	0.585	0	0	58.51	0

" ASSAYS "
 " ===== "

" Assay Number 1 Ni "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	7.3	7.2863	0.1883	0.1883	100	0.073
2	" Concn	12.3	12.7041	0.657	3.285	72.35	0.615
3	" Tails	3.4	3.4437	0.2568	1.2839	27.65	0.17

" Assay Number 2 Cu "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1.8	1.8033	0.1822	0.1822	100	0.018
2	" Concn	3.3	3.1858	0.692	3.4601	73.31	0.165
3	" Tails	0.833	0.8227	0.247	1.2349	26.69	0.0417

" Assay Residuals per stream "

		Average	Average "
		S.S.	No. Std. Devs "
Stream			
1	" Feed	0.0001	0.1852
2	" Concn	0.0881	0.6745
3	" Tails	0.001	0.2519

" Assay Residuals per assay "

		Average	Average "
		S.S.	No. Std. Devs "
Assay			
1	" Ni	0.0551	0.3673
2	" Cu	0.0044	0.3737

" Overall S.S. of standard analysis residuals for assays 0.1785 "

" Overall sum of Std. Devs. of analysis residuals for assays 2.2233 "

Appendix 6-3: Results from test with magnetic field applied and an airflow rate of 2.6

" SysCAD/MB v1.2 "
 " (c) Kenwalt Systems, 1994 "
 " 339 Rivonia Boulevard "
 " Johannesburg, South Africa "

" Time of run 20:29:25 "
 " Date of run 1999/10/12 "

" Magnetic field with Med airflow "

" Converged in 2 iterations "
 " Maximum iterations : 50 "
 " Tolerance required : 0.001000 "
 " Tolerance obtained : 0.000030 "

" FLOWS "
 " ===== "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1	1	0	0	100	0.01
2	" Concen	0	0.259	0	0	25.93	0
3	" Tails	0	0.741	0	0	74.07	0

" ASSAYS "
 " ===== "

" Assay Number 1 Ni "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	7.3	7.2967	0.0446	0.0446	100	0.073
2	" Concen	14.5	14.5834	0.115	0.5749	51.83	0.725
3	" Tails	4.72	4.7452	0.1069	0.5345	48.17	0.236

" Assay Number 2 Cu "

		Adjustment "					
		No. of	Smoothed	Measured "			
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1.8	1.8005	0.0289	0.0289	100	0.018
2	" Concen	4.6	4.578	0.0957	0.4786	65.94	0.23
3	" Tails	0.83	0.828	0.0493	0.2466	34.06	0.0415

" Assay Residuals per stream "

		Average "	
Stream	Average S.S.	Average No.	Std. Devs "
1	" Feed	0	0.0368
2	" Concen	0.0037	0.1054
3	" Tails	0.0003	0.0781

" Assay Residuals per assay "

		Average "	
Assay	Average S.S.	Average No.	Std. Devs "
1	" Ni	0.0025	0.0888
2	" Cu	0.0002	0.058

" Overall S.S. of standard analysis residuals for assays 0.0081 "

" Overall sum of Std. Devs. of analysis residuals for assays 0.4405 "

Appendix 6-4: Results from test with magnetic field applied and an airflow rate of 2.2 l/min

" SysCAD/MB v1.2 "
 " (c) Kenwalt Systems, 1994 "
 " 339 Rivonia Boulevard "
 " Johannesburg, South Africa "

" Time of run 20:03:25 "
 " Date of run 1999/10/12 "

" Magnetic field with Low airflow "

" Converged in 2 iterations "
 " Maximum iterations : 50 "
 " Tolerance required : 0.001000 "
 " Tolerance obtained : 0.000052 "

" FLOWS "
 " ===== "

		Adjustment "					
		No. of		Smoothed		Measured "	
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	1	1	0	0	100	0.01
2	" Concen	0	0.106	0	0	10.6	0
3	" Tails	0	0.894	0	0	89.4	0

" ASSAYS "
 " ===== "

" Assay Number 1 Ni "

		Adjustment "					
		No. of		Smoothed		Measured "	
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	7.3	7.2961	0.0538	0.0538	100	0.073
2	" Concen	10.73	10.7525	0.0419	0.2095	15.62	0.5365
3	" Tails	6.81	6.8864	0.2245	1.1223	84.38	0.3405

" Assay Number 2 Cu "

		Adjustment "					
		No. of		Smoothed		Measured "	
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	1.8	1.8001	0.0052	0.0052	100	0.018
2	" Concen	10.63	10.6214	0.0163	0.0813	62.52	0.5315
3	" Tails	0.755	0.7546	0.0098	0.0488	37.48	0.0378

" Assay Residuals per stream "

		Average "	
Stream	Average S.S.	Average No. Std. Devs "	
1	" Feed	0	0.0295
2	" Concen	0.0003	0.0291
3	" Tails	0.0029	0.1171

" Assay Residuals per assay "

		Average "	
Assay	Average S.S.	Average No. Std. Devs "	
1	" Ni	0.0021	0.1067
2	" Cu	0	0.0104

" Overall S.S. of standard analysis residuals for assays 0.0064 "
 " Overall sum of Std. Devs. of analysis residuals for assays 0.3514 "

Appendix 6-5: Results from standard test and an airflow rate of 3.1 l/min

" SysCAD/MB v1.2 "
 " (c) Kenwalt Systems, 1994 "
 " 339 Rivonia Boulevard "
 " Johannesburg, South Africa "

" Time of run 20:05:29 "
 " Date of run 1999/10/12 "

" Standard test with high airflow "

" Converged in 3 iterations "
 " Maximum iterations : 50 "
 " Tolerance required : 0.001000 "
 " Tolerance obtained : 0.000047 "

" FLOWS "
 " ===== "

		Adjustment "					
		No. of		Smoothed	Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1	1	0	0	100	0.01
2	" Concnent	0	0.477	0	0	47.73	0
3	" Tails	0	0.523	0	0	52.27	0

" ASSAYS "
 " ===== "

" Assay Number 1 Ni "

		Adjustment "					
		No. of		Smoothed	Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	7.3	7.3158	0.2163	0.2163	100	0.073
2	" Concen	11.7	11.2159	0.8274	4.1372	73.18	0.585
3	" Tails	3.81	3.7538	0.2951	1.4754	26.82	0.1905

" Assay Number 2 Cu "

		Adjustment "					
		No. of		Smoothed	Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev.	"
1	" Feed	1.8	1.7968	0.1793	0.1793	100	0.018
2	" Concen	2.86	2.9572	0.6799	3.3993	78.56	0.143
3	" Tails	0.73	0.7369	0.19	0.9502	21.44	0.0365

" Assay Residuals per stream "

		Average	Average "
Stream		S.S.	No. Std. Devs "
1	" Feed	0.0001	0.1978
2	" Concen	0.1219	0.7537
3	" Tails	0.0016	0.2426

" Assay Residuals per assay "

		Average	Average "
Assay		S.S.	No. Std. Devs "
1	" Ni	0.0792	0.4463
2	" Cu	0.0032	0.3497

" Overall S.S. of standard analysis residuals for assays 0.2472 "

" Overall sum of Std. Devs. of analysis residuals for assays 2.3881 "

Appendix 6-6: Results from standard test and an airflow rate of 2.65 l/min

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" SysCAD/MB v1.2 "
" (c) Kenwalt Systems, 1994 "
" 339 Rivonia Boulevard "
" Johannesburg, South Africa "

" Time of run 20:07:06 "
" Date of run 1999/10/12 "

" Standard test with med airflow "

" Converged in 2 iterations "
" Maximum iterations : 50 "
" Tolerance required : 0.001000 "
" Tolerance obtained : 0.000118 "

" FLOWS "
" ===== "

" Adjustment "
" No. of Smoothed Measured "
" Stream Meas. Smooth. Std.Dev. % of Meas Rec.(%) Std.Dev. "
" 1 " Feed 1 1 0 0 100 0.01
" 2 " Concn 0 0.336 0 0 33.62 0
" 3 " Tails 0 0.664 0 0 66.38 0

" ASSAYS "
" ===== "

" Assay Number 1 Ni "
" Adjustment "
" No. of Smoothed Measured "
" Stream Meas. Smooth. Std.Dev. % of Meas Rec.(%) Std.Dev. "
" 1 " Feed 7.3 7.2939 0.0829 0.0829 100 0.073
" 2 " Concn 12.76 12.9154 0.2436 1.2182 59.53 0.638
" 3 " Tails 4.41 4.4467 0.1663 0.8316 40.47 0.2205

" Assay Number 2 Cu "
" Adjustment "
" No. of Smoothed Measured "
" Stream Meas. Smooth. Std.Dev. % of Meas Rec.(%) Std.Dev. "
" 1 " Feed 1.8 1.8012 0.065 0.065 100 0.018
" 2 " Concn 3.61 3.5704 0.2191 1.0957 66.65 0.1805
" 3 " Tails 0.91 0.905 0.1091 0.5455 33.35 0.0455

" Assay Residuals per stream "
" Average Average "
" Stream S.S. No. Std. Devs "
" 1 " Feed 0 0.074
" 2 " Concn 0.0129 0.2314
" 3 " Tails 0.0007 0.1377

" Assay Residuals per assay "
" Average Average "
" Assay S.S. No. Std. Devs "
" 1 " Ni 0.0085 0.1643
" 2 " Cu 0.0005 0.1311

" Overall S.S. of standard analysis residuals for assays 0.0271 "
" Overall sum of Std. Devs. of analysis residuals for assays 0.8861 "

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Appendix 6-7: Results from standard test and an airflow rate of 2.2 l/min

" SysCAD/MB v1.2 "
 " (c) Kenwalt Systems, 1994 "
 " 339 Rivonia Boulevard "
 " Johannesburg, South Africa "

" Time of run 20:08:28 "
 " Date of run 1999/10/12 "

" Standard test with low airflow "

" Converged in 2 iterations "
 " Maximum iterations : 50 "
 " Tolerance required : 0.001000 "
 " Tolerance obtained : 0.000155 "

" FLOWS "
 " ===== "

		Adjustment "					
		No. of	Smoothed		Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	1	1	0	0	100	0.01
2	" Concenter	0	0.212	0	0	21.22	0
3	" Tails	0	0.788	0	0	78.78	0

" ASSAYS "
 " ===== "

" Assay Number 1 Ni "

		Adjustment "					
		No. of	Smoothed		Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	7.3	7.3059	0.0806	0.0806	100	0.073
2	" Concenter	13.05	12.9502	0.1529	0.7644	37.62	0.6525
3	" Tails	5.86	5.7853	0.255	1.275	62.38	0.293

" Assay Number 2 Cu "

		Adjustment "					
		No. of	Smoothed		Measured "		
Stream	Meas.	Smooth.	Std.Dev.	% of Meas	Rec.(%)	Std.Dev. "	
1	" Feed	1.8	1.7994	0.031	0.031	100	0.018
2	" Concenter	5.4	5.4266	0.0985	0.4927	64	0.27
3	" Tails	0.82	0.8223	0.0556	0.2779	36	0.041

" Assay Residuals per stream "

		Average "	
Stream	Average S.S.	Average No. Std. Devs "	
1	" Feed	0	0.0558
2	" Concenter	0.0053	0.1257
3	" Tails	0.0028	0.1553

" Assay Residuals per assay "

		Average "	
Assay	Average S.S.	Average No. Std. Devs "	
1	" Ni	0.0052	0.1628
2	" Cu	0.0002	0.0617

" Overall S.S. of standard analysis residuals for assays 0.0163 "

" Overall sum of Std. Devs. of analysis residuals for assays 0.6736 "