

# **APPENDIX**

Table A1: Removal of phosphate by paper mill sludge at various pH at 30minutes kinetics time

No	Concentration NaOH (mL)	Ultrapure water (mL)	Stock (mL)	Total volume (L)	pH	Weight of adsorbent (g)	Initial concentration of phosphate (mg/L)	Final concentration of phosphate (mg/L)	Percentage removal (%)	Adsorption capacity (mg/g)
1	1(0.001M)	22	2	0.025	<b>7.23</b>	0.5005	80.11	68.91	13.98	0.56
2	2(0.001M)	21	2	0.025	<b>8.16</b>	0.5009	80.21	66.07	17.63	0.71
3	3(0.001M)	20	2	0.025	<b>9.81</b>	0.5025	80.16	63.41	20.90	0.83
4	2(0.01M)	22	2	0.025	<b>10.66</b>	0.5012	80.23	58.24	27.41	1.10
5	2(0.1M)	22	2	0.025	<b>11.88</b>	0.5003	80.15	35.98	55.11	2.21

Table A2: Removal of phosphate at various weight of paper mill sludge adsorbent at 30minutes kinetic time

No	Weight of adsorbent (g)	pH	Volume of phosphate solution (L)	Initial phosphate concentration (mg/L)	Final phosphate concentration (mg/L)	Percentage removal of phosphate (%)	Adsorption capacity (mg/g)
1	<b>0.2096</b>	12.01	0.02	95.74	50.94	46.7934	4.2748
2	<b>0.5020</b>	12.01	0.02	95.74	27.76	71.0048	2.7084
3	<b>0.8015</b>	12.01	0.02	95.74	18.38	80.8022	1.9304
4	<b>1.0051</b>	12.01	0.02	95.74	14.08	85.2935	1.6249

Table A3 : Adsorption kinetic of phosphate by paper mill sludge at 70°C

No	Weight of adsorbent (g)	pH	Time (min)	Volume of phosphate solution (L)	Initial phosphate solution (mg/L)	Final solution (mg/L)	Adsorption capacity (mg/g)
1	0.5016	12.01	<b>15</b>	0.02	95.74	20.81	2.9876
2	0.5035	12.01	<b>30</b>	0.02	95.74	23.05	2.8874
3	0.5063	12.01	<b>60</b>	0.02	95.74	18.76	3.0409
4	0.5011	12.01	<b>120</b>	0.02	95.74	3.99	3.6619
5	0.5	12.01	<b>240</b>	0.02	95.74	2.73	3.7204
6	0.5	12.01	<b>1440</b>	0.02	95.74	0.42	3.8128

No	Time (min)	Adsorption capacity(q)	q <sub>e</sub>	q <sub>e</sub> -q	ln (q <sub>e</sub> -q)	t/q
1	15	2.9876	3.8128	0.8252	-0.1922	5.0207
2	30	2.8874	3.8128	0.9254	-0.0775	10.3900
3	60	3.0409	3.8128	0.7719	-0.2589	19.7311
4	120	3.6619	3.8128	0.1509	-1.8914	32.7695
5	240	3.7204	3.8128	0.0924	-2.3816	64.5092
6	1440	3.8128	3.8128	0.0000		377.6752

Table A4 : Adsorption kinetic of phosphate by paper mill sludge at 45°C

No	Weight of adsorbent (g)	pH	Time (min)	Volume of phosphate solution (L)	Initial phosphate solution (mg/L)	Final solution (mg/L)	Adsorption capacity (mg/g)
1	0.5054	12.01	<b>15</b>	0.02	95.74	37.75	2.29482
2	0.5077	12.01	<b>30</b>	0.02	95.74	35.1	2.38881
3	0.5064	12.01	<b>60</b>	0.02	95.74	33.74	2.44866
4	0.5011	12.01	<b>120</b>	0.02	95.74	23.81	2.87088
5	0.5066	12.01	<b>240</b>	0.02	95.74	22.12	2.90644
6	0.5021	12.01	<b>1440</b>	0.02	95.74	2.72	3.70524

No	Time (min)	Adsorption capacity(q)	q <sub>e</sub>	q <sub>e</sub> -q	ln (q <sub>e</sub> -q)	t/q
1	15	2.2948	3.70524	1.4104	0.34389	6.53647
2	30	2.3888	3.70524	1.3164	0.27492	12.5585
3	60	2.4487	3.70524	1.2566	0.22839	24.5032
4	120	2.8709	3.70524	0.8344	-0.1811	41.799
5	240	2.9064	3.70524	0.7988	-0.2246	82.5754
6	1440	3.7052	3.70524	0.0000	-	388.639

Table A5 : Adsorption kinetic of phosphate by paper mill sludge at 30°C

No	Weight of adsorbent (g)	pH	Time (min)	Volume of phosphate solution (L)	Initial phosphate solution (mg/L)	Final solution (mg/L)	Adsorption capacity (mg/g)
1	0.5048	12.01	<b>15</b>	0.02	95.74	45.08	2.00713
2	0.5009	12.01	<b>30</b>	0.02	95.74	45.35	2.01198
3	0.5053	12.01	<b>60</b>	0.02	95.74	41.71	2.13853
4	0.5023	12.01	<b>120</b>	0.02	95.74	39.31	2.24686
5	0.5037	12.01	<b>240</b>	0.02	95.74	33.53	2.47012
6	0.5	12.01	<b>1440</b>	0.02	95.74	5.53	3.6084

No	Time (min)	Adsorption capacity(q)	q <sub>e</sub>	q <sub>e</sub> -q	ln (q <sub>e</sub> -q)	t/q
1	15	2.0071	3.6084	1.6013	0.4708	7.47335
2	30	2.0120	3.6084	1.5964	0.46776	14.9107
3	60	2.1385	3.6084	1.4699	0.38517	28.0566
4	120	2.2469	3.6084	1.3615	0.30861	53.4078
5	240	2.4701	3.6084	1.1383	0.12952	97.1612
6	1440	3.4212	3.6084	0.1872	-	420.905

Table A6: Adsorption isotherm of Phosphate by paper mill sludge at room temperature

No	Initial phosphate solution (mg/L)	Final solution (mg/L) $C_e$	Adsorption capacity (mg/g) $q_e$	$C_e/q_e$	$\log C_e$	$\log q_e$	Weight of adsorbent (g)	Volume of phosphate solution (L)
1	54.43	2.54	2.0686	1.2279	0.4048	0.3157	0.5017	0.02
2	73.82	3.73	2.7991	1.3326	0.5717	0.4470	0.5008	0.02
3	89.81	4.53	3.3754	1.3421	0.6561	0.5283	0.5053	0.02
4	217.53	22.21	7.6747	2.8939	1.3465	0.8851	0.509	0.02
5	301.25	48.52	9.9795	4.8620	1.6859	0.9991	0.5065	0.02