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APPENDIX A

TABLE A1 : EXPERIMENTAL DATA OF CHROMATE REJECTION STUDIES

$[QUAT]:[CrO_4^{2-}]$ =   5: 1

Solution Flux $(l/m^2 \cdot hr)$ =   (volume of permeate (ml)$\cdot 100^2(cm^2) \cdot 3600(s)) \cdot$ (time interval(s) $\cdot 38.5(cm^2) \cdot 100(ml))$

Relative Flux   =   (solution flux)/(water flux)

Table A.1a   Feed Specification: $[CrO_4^{2-}]$ 2.76E-02   M   Water Flux Rate   =   52.65 $l/m^2 *hr$
                                        $[QUAT]$ 1.19E-01   M   Filtration Area   =   38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux $(l/m^2 *hr)$ | Relative Flux | Permeate | | Retentate | | $[CrO_4^{2-}]$ Rejection, % |
					$[CrO_4^{2-}]$, (M)	[QUAT], (M	$[CrO_4^{2-}]$, (M)	[QUAT], (M)	
1	25.5013	987	24.159	1.000	1.80E-03	7.66E-05	3.00E-02	1.30E-01	94.00
2	26.8600	1081	23.234	0.962	2.12E-03	5.63E-05	3.32E-02	1.45E-01	93.63
3	24.8967	1073	21.696	0.898	2.93E-03	6.50E-05	3.69E-02	1.61E-01	92.06
4	24.8697	1189	19.558	0.810	2.62E-03	5.87E-05	4.15E-02	1.82E-01	94.00
5	24.8785	1284	18.118	0.750	2.66E-03	5.91E-05	4.75E-02	2.07E-01	94.40
6	24.6569	1438	16.033	0.664	2.44E-03	6.18E-05	5.54E-02	2.41E-01	95.60
7	24.7905	1661	13.956	0.578	2.66E-03	6.64E-05	6.65E-02	2.90E-01	96.00
8	25.7406	2098	11.472	0.475	2.29E-03	6.73E-05	8.41E-02	3.08E-01	97.28

Table A.1b   Feed Specification: [CrO$_4^{2-}$]   2.59E-02   M   Water Flux Rate   =   52.65   l/m^2*h

[QUAT]   1.12E-01   M   Filtration Area   =   38.5   cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[CrO$_4^{2-}$] Rejection, %
					[CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$], (M)	[QUAT], (M)	
1	24.912	967	24.089	0.458	2.39E-03	6.98E-05	2.81E-02	1.22E-01	91.47
2	24.9376	1019	22.883	0.435	2.65E-03	5.95E-05	3.08E-02	1.34E-01	91.41
3	24.9694	1066	21.902	0.416	2.62E-03	5.96E-05	3.43E-02	1.49E-01	92.36
4	24.9621	1168	19.984	0.380	3.34E-03	5.85E-05	3.84E-02	1.68E-01	91.31
5	25.0621	1285	18.237	0.346	3.07E-03	6.04E-05	4.40E-02	1.91E-01	93.02
6	24.8802	1416	16.430	0.312	2.70E-03	6.40E-05	5.13E-02	2.23E-01	94.74
7	24.9321	1609	14.489	0.275	2.96E-03	7.81E-05	6.15E-02	2.67E-01	95.18
8	24.493	1716	13.346	0.253	2.83E-03	7.67E-05	7.64E-02	2.75E-01	96.30

Table A.1c   Feed Specification: [CrO$_4^{2-}$]   1.92E-02   M   Water Flux Rate   =   55.5143   l/m^2*hr

[QUAT]   9.95E-02   M   Filtration Area   =   38.5   cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[CrO$_4^{2-}$] Rejection, %
					[CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$], (M)	[QUAT], (M)	
1	26.9624	1092	23.088	0.458	1.94E-03	7.30E-05	2.09E-02	1.09E-01	90.74
2	25.1107	1045	22.469	0.435	1.72E-03	5.73E-05	2.31E-02	1.20E-01	92.56
3	24.9335	1100	21.195	0.416	1.92E-03	6.12E-05	2.56E-02	1.34E-01	92.52
4	24.9225	1195	19.501	0.380	1.92E-03	6.38E-05	2.89E-02	1.51E-01	93.36
5	24.9261	1309	17.806	0.346	1.90E-03	6.78E-05	3.30E-02	1.72E-01	94.24
6	22.8925	1644	13.021	0.312	1.91E-03	7.03E-05	3.81E-02	1.99E-01	94.98
7	24.9847	1768	13.214	0.275	1.83E-03	7.01E-05	4.57E-02	2.38E-01	95.99
8	24.9906	1932	12.095	0.253	1.79E-03	7.70E-05	5.71E-02	2.49E-01	96.86

Table A.1d Feed Specification: $[CrO_4^{2-}]$ 3.44E-02 M Water Flux Rate = 55.5143 l/m^2*hr

$[QUAT]$ 1.62E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.5382	1301	17.636	0.439	4.15E-03	1.21E-04	3.71E-02	1.76E-01	88.82
2	24.9066	1311	17.765	0.427	4.37E-03	9.88E-05	4.08E-02	1.94E-01	89.28
3	24.9547	1482	15.745	0.403	4.30E-03	9.80E-05	4.53E-02	2.15E-01	90.50
4	24.8645	1665	13.964	0.370	4.51E-03	1.02E-04	5.09E-02	2.43E-01	91.13
5	24.9613	1823	12.803	0.338	4.42E-03	1.09E-04	5.81E-02	2.76E-01	92.39
6	24.7813	2089	11.092	0.247	4.11E-03	1.22E-04	6.77E-02	3.22E-01	93.92
7	24.9612	2503	9.325	0.251	4.26E-03	1.35E-04	8.11E-02	3.86E-01	94.74
8	25.0561	3172	7.386	0.230	4.06E-03	1.37E-04	1.01E-01	4.15E-01	95.99

Table A.1e Feed Specification: $[CrO_4^{2-}]$ 3.08E-02 M Water Flux Rate = 60.056 l/m^2*hr

$[QUAT]$ 1.54E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9381	1212	19.240	0.320	3.75E-03	1.24E-04	3.33E-02	1.68E-01	88.72
2	24.9561	1273	18.331	0.305	3.89E-03	9.39E-05	3.66E-02	1.85E-01	89.36
3	25.7190	1435	16.759	0.279	4.74E-03	1.37E-04	4.07E-02	2.06E-01	88.35
4	25.3002	1541	15.352	0.256	4.51E-03	1.01E-04	4.59E-02	2.34E-01	90.17
5	25.2440	1710	13.804	0.230	4.52E-03	1.08E-04	5.25E-02	2.66E-01	91.39
6	24.8829	1903	12.227	0.204	4.08E-03	1.16E-04	6.14E-02	3.11E-01	93.36
7	25.0411	2306	10.154	0.169	4.04E-03	1.38E-04	7.38E-02	3.73E-01	94.52
8	24.0758	2684	8.388	0.140	3.87E-03	1.51E-04	9.17E-02	3.78E-01	95.77

Table A.1f — Feed Specification: $[CrO_4^{2-}]$ 3.23E-02 M; [QUAT] 1.48E-01 M; Water Flux Rate = 56.9775 l/m^2*hr; Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[CrO_4^{2-}]$, (M)	Permeate [QUAT], (M)	Retentate $[CrO_4^{2-}]$, (M)	Retentate [QUAT], (M)	$[CrO_4^{2-}]$ Rejection, %
1	24.9446	1190	19.601	0.229	6.79E-03	3.14E-04	5.08E-02	2.70E-01	86.64
2	24.9697	1275	18.312	0.214	6.04E-03	3.56E-04	5.60E-02	2.97E-01	89.22
3	24.9272	1420	16.414	0.192	6.46E-03	2.60E-04	6.21E-02	3.30E-01	89.61
4	24.9722	1582	14.760	0.173	6.52E-03	2.33E-04	6.99E-02	3.73E-01	90.67
5	24.9698	1795	13.007	0.152	6.79E-03	2.37E-04	7.98E-02	4.24E-01	91.49
6	24.8672	2103	11.057	0.129	6.68E-03	2.46E-04	9.30E-02	4.94E-01	92.82
7	24.8746	2623	8.867	0.104	6.53E-03	3.11E-04	1.12E-01	5.92E-01	94.14
8	23.4858	3602	6.097	0.071	6.75E-03	3.34E-04	1.37E-01	6.04E-01	95.08

Table A.1g — Feed Specification: $[CrO_4^{2-}]$ 4.72E-02 M; [QUAT] 2.48E-01 M; Water Flux Rate = 85.4725 l/m^2*hr; Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[CrO_4^{2-}]$, (M)	Permeate [QUAT], (M)	Retentate $[CrO_4^{2-}]$, (M)	Retentate [QUAT], (M)	$[CrO_4^{2-}]$ Rejection, %
1	24.9446	1190	19.601	0.229	6.79E-03	3.14E-04	5.08E-02	2.70E-01	86.64
2	24.9697	1275	18.312	0.214	6.04E-03	3.56E-04	5.60E-02	2.97E-01	89.22
3	24.9272	1420	16.414	0.192	6.46E-03	2.60E-04	6.21E-02	3.30E-01	89.61
4	24.9722	1582	14.760	0.173	6.52E-03	2.33E-04	6.99E-02	3.73E-01	90.67
5	24.9698	1795	13.007	0.152	6.79E-03	2.37E-04	7.98E-02	4.24E-01	91.49
6	24.8672	2103	11.057	0.129	6.68E-03	2.46E-04	9.30E-02	4.94E-01	92.82
7	24.8746	2623	8.867	0.104	6.53E-03	3.11E-04	1.12E-01	5.92E-01	94.14
8	23.4858	3602	6.097	0.071	6.75E-03	3.34E-04	1.37E-01	6.04E-01	95.08

Table A.1h   Feed Specification: $[CrO_4^{2-}]$ 5.13E-02 M   Water Flux Rate = 72.0813 l/m^2*hr
                                  $[QUAT]$ 2.33E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[CrO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M	Retentate $[CrO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[CrO_4^{2-}]$ Rejection, %
1	25.1552	1190	19.766	0.274	6.75E-03	2.64E-04	5.53E-02	2.54E-01	87.80
2	25.0672	1275	18.384	0.255	7.89E-03	1.74E-04	6.08E-02	2.80E-01	87.02
3	24.9319	1420	16.418	0.228	7.90E-03	1.78E-04	6.75E-02	3.11E-01	88.29
4	24.9252	1582	14.732	0.204	8.52E-03	2.02E-04	7.58E-02	3.51E-01	88.77
5	24.9654	1795	13.005	0.180	8.39E-03	2.06E-04	8.67E-02	3.99E-01	90.33
6	24.9297	2103	11.085	0.154	8.21E-03	2.37E-04	1.01E-01	4.66E-01	91.88
7	25.0217	2623	8.920	0.124	7.80E-03	2.75E-04	1.21E-01	5.59E-01	93.58
8	24.7148	3602	6.416	0.089	7.82E-03	3.79E-04	1.51E-01	5.90E-01	94.84

Table A.1i   Feed Specification: $[CrO_4^{2-}]$ 3.80E-02 M   Water Flux Rate = 69.0703 l/m^2*hr
                                  $[QUAT]$ 1.97E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[CrO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M	Retentate $[CrO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[CrO_4^{2-}]$ Rejection, %
1	25.1178	1225	19.173	0.278	5.41E-03	2.46E-04	4.10E-02	2.15E-01	86.82
2	25.1458	1284	18.312	0.265	6.00E-03	1.68E-04	4.51E-02	2.37E-01	86.71
3	26.4496	1449	17.068	0.247	5.77E-03	1.73E-04	5.04E-02	2.65E-01	88.56
4	24.9070	1528	15.242	0.221	5.24E-03	1.83E-04	5.69E-02	2.99E-01	90.79
5	25.0753	1734	13.522	0.196	6.85E-03	1.99E-04	6.49E-02	3.41E-01	89.43
6	24.7725	1971	11.752	0.170	6.39E-03	2.29E-04	7.58E-02	3.98E-01	91.57
7	24.9499	2442	9.554	0.138	6.40E-03	2.67E-04	9.11E-02	4.78E-01	92.97
8	27.6229	3734	6.917	0.100	5.86E-03	3.72E-04	1.17E-01	5.16E-01	95.00

APPENDIX A

TABLE A2 : EXPERIMENTAL DATA OF CHROMATE REJECTION STUDIES

$$[QUAT]:[CrO_4^{2-}] \quad = \quad 10:1$$

Table A.2a   Feed Specification: $[CrO_4^{2-}]$ 1.38E-02 M   Water Flux Rate = 75.6255 $l/m^2 *hr$

[QUAT] 1.11E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux $(l/m^2 *hr)$	Relative Flux	Permeate $[CrO_4^{2-}]$, (M)	Permeate [QUAT], (M	Retentate $[CrO_4^{2-}]$, (M)	Retentate [QUAT], (M)	$[CrO_4^{2-}]$ Rejection, %
1	25.1117	689	34.080	0.451	2.73E-04	1.05E-04	1.51E-02	1.21E-01	98.19
2	24.8540	709	32.779	0.433	2.91E-04	4.50E-05	1.66E-02	1.33E-01	98.24
3	25.0035	757	30.885	0.408	2.89E-04	4.16E-05	1.84E-02	1.48E-01	98.43
4	25.0215	835	28.020	0.371	2.74E-04	4.68E-05	2.07E-02	1.67E-01	98.68
5	25.0769	917	25.571	0.338	2.73E-04	4.74E-05	2.37E-02	1.90E-01	98.85
6	24.9438	1037	22.492	0.297	2.59E-04	5.02E-05	2.76E-02	2.22E-01	99.06
7	25.1371	1234	19.048	0.252	2.39E-04	5.64E-05	3.32E-02	2.66E-01	99.28
8	25.1780	1593	14.779	0.195	2.16E-04	6.64E-05	4.16E-02	2.88E-01	99.48

Table A.2b   Feed Specification: $[CrO_4^{2-}]$ 1.26E-02   M   Water Flux Rate = 70.9623 l/m^2*hr

[QUAT]   1.06E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$
					$[CrO_4^{2-}]$, (M)	[QUAT], (M)	$[CrO_4^{2-}]$, (M)	[QUAT], (M)	Rejection, %
1	24.9052	675	34.501	0.486	2.60E-04	8.23E-05	1.37E-02	1.15E-01	98.10
2	25.1289	690	34.054	0.480	2.80E-04	8.31E-05	1.51E-02	1.27E-01	98.14
3	25.8451	786	30.747	0.433	2.72E-04	4.06E-05	1.68E-02	1.41E-01	98.38
4	24.8632	827	28.112	0.396	2.70E-04	4.08E-05	1.89E-02	1.60E-01	98.57
5	24.9338	906	25.734	0.363	2.58E-04	4.29E-05	2.16E-02	1.82E-01	98.80
6	24.9722	1023	22.826	0.322	2.47E-04	5.07E-05	2.52E-02	2.12E-01	99.02
7	25.0209	1205	19.416	0.274	2.29E-04	5.29E-05	3.03E-02	2.55E-01	99.24
8	25.2347	1579	14.944	0.211	2.01E-04	5.88E-05	3.80E-02	2.62E-01	99.47

TABLE A.2c   Feed Specification: $[CrO_4^{2-}]$ 1.37E-02   M   Water Flux Rate = 63.2463 l/m^2*hr

[QUAT]   1.14E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$
					$[CrO_4^{2-}]$, (M)	[QUAT], (M)	$[CrO_4^{2-}]$, (M)	[QUAT], (M)	Rejection, %
1	24.9988	706	33.110	0.524	2.77E-04	8.19E-05	1.49E-02	1.24E-01	98.14
2	23.9657	737	30.406	0.481	2.85E-04	7.77E-05	1.63E-02	1.36E-01	98.26
3	24.9636	785	29.736	0.470	2.80E-04	3.99E-05	1.81E-02	1.51E-01	98.46
4	25.0246	847	27.626	0.437	2.74E-04	4.12E-05	2.04E-02	1.71E-01	98.66
5	24.9850	929	25.148	0.398	2.84E-04	4.51E-05	2.33E-02	1.94E-01	98.78
6	24.9583	1051	22.205	0.351	2.57E-04	5.22E-05	2.71E-02	2.26E-01	99.05
7	26.2902	1294	18.998	0.300	2.38E-04	5.29E-05	3.29E-02	2.74E-01	99.28
8	25.1967	1554	15.161	0.240	2.06E-04	5.59E-05	4.12E-02	2.83E-01	99.50

TABLE A.2d   Feed Specification: $[CrO_4^{2-}]$ 2.18E-02 M   Water Flux Rate = 67.0586 l/m^2*hr
    $[QUAT]$ 1.48E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	Rejection, %
1	24.9638	907	25.736	0.384	5.46E-04	8.69E-05	2.37E-02	1.62E-01	97.70
2	24.9510	962	24.252	0.362	5.64E-04	5.80E-05	2.61E-02	1.78E-01	97.84
3	25.0068	1030	22.702	0.339	5.83E-04	6.57E-05	2.90E-02	1.97E-01	97.99
4	28.1262	1330	19.774	0.295	5.94E-04	6.37E-05	3.31E-02	2.27E-01	98.21
5	24.9298	1348	17.293	0.258	5.71E-04	7.09E-05	3.79E-02	2.58E-01	98.49
6	24.8895	1548	15.034	0.224	5.38E-04	7.97E-05	4.43E-02	3.02E-01	98.79
7	24.9497	2044	11.414	0.170	5.03E-04	8.95E-05	5.34E-02	3.64E-01	99.06
8	27.2566	3001	8.493	0.127	4.31E-04	1.15E-04	6.87E-02	3.93E-01	99.37

TABLE A.2e   Feed Specification: $[CrO_4^{2-}]$ 1.94E-02 M   Water Flux Rate = 80.2791 l/m^2*hr
    $[QUAT]$ 1.51E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	Rejection, %
1	24.9284	923	25.254	0.315	5.30E-04	9.90E-05	2.11E-02	1.64E-01	97.50
2	25.0208	1013	23.096	0.288	6.32E-04	6.43E-05	2.33E-02	1.81E-01	97.28
3	25.0443	1089	21.504	0.268	6.10E-04	6.59E-05	2.58E-02	2.01E-01	97.64
4	24.9599	1229	18.990	0.237	5.98E-04	6.70E-05	2.91E-02	2.27E-01	97.94
5	24.9633	1404	16.626	0.207	5.56E-04	7.52E-05	3.32E-02	2.58E-01	98.33
6	24.8850	1632	14.258	0.178	5.28E-04	8.36E-05	3.87E-02	3.01E-01	98.64
7	24.9675	2102	11.107	0.138	4.87E-04	1.02E-04	4.65E-02	3.61E-01	98.95
8	25.0325	3033	7.717	0.096	4.00E-04	1.32E-04	5.81E-02	3.72E-01	99.31

TABLE A.2f   Feed Specification: $[CrO_4^{2-}]$ 2.18E-02   M   Water Flux Rate   =   72.0454 l/m^2*hr
                                      $[QUAT]$ 1.95E-01   M   Filtration Area   =   38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[CrO_4^{2-}]$ Rejection, % |
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.2931	936	24.269	0.337	8.82E-04	1.52E-04	2.36E-02	2.12E-01	96.26
2	25.8052	1005	24.009	0.333	8.74E-04	9.39E-05	2.61E-02	2.34E-01	96.65
3	25.2687	1076	21.959	0.305	8.69E-04	9.69E-05	2.90E-02	2.60E-01	97.00
4	26.2272	1267	19.356	0.269	8.42E-04	1.05E-04	3.28E-02	2.96E-01	97.43
5	26.7101	1404	17.789	0.247	8.03E-04	1.23E-04	3.79E-02	3.40E-01	97.88
6	25.1534	1669	14.092	0.196	7.30E-04	1.52E-04	4.45E-02	3.98E-01	98.36
7	25.1330	2185	10.756	0.149	6.84E-04	1.91E-04	5.37E-02	4.81E-01	98.73
8	25.3564	3406	6.961	0.097	5.83E-04	1.88E-04	6.79E-02	4.80E-01	99.14

TABLE A.2g   Feed Specification: $[CrO_4^{2-}]$ 2.31E-02   M   Water Flux Rate   =   65.7201 l/m^2*hr
                                      $[QUAT]$ 2.30E-01   M   Filtration Area   =   38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[CrO_4^{2-}]$ Rejection, % |
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9549	1217	19.174	0.292	5.44E-04	6.35E-05	2.51E-02	2.51E-01	97.83
2	25.0640	1293	18.126	0.276	5.11E-04	1.03E-04	2.76E-02	2.76E-01	98.15
3	25.0933	1420	16.524	0.251	5.18E-04	6.59E-05	3.07E-02	3.07E-01	98.31
4	24.9678	1630	14.323	0.218	4.94E-04	6.60E-05	3.46E-02	3.47E-01	98.57
5	25.0576	2046	11.452	0.174	4.93E-04	8.65E-05	3.95E-02	3.94E-01	98.75
6	25.3288	2426	9.763	0.149	4.48E-04	8.59E-05	4.62E-02	4.61E-01	99.03
7	24.9777	3368	6.935	0.106	4.06E-04	1.03E-04	5.55E-02	5.54E-01	99.27
8	24.2874	3650	6.222	0.095	3.39E-04	1.45E-04	6.90E-02	5.65E-01	99.51

TABLE A.2h   Feed Specification: $[CrO_4^{2-}]$ 2.47E-02   M   Water Flux Rate = 62.2583 l/m^2*hr
$[QUAT]$ 1.84E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	25.3105	1135	20.852	0.335	9.02E-04	1.58E-04	2.69E-02	2.01E-01	96.64
2	24.9431	1189	19.616	0.315	9.78E-04	9.59E-05	2.95E-02	2.21E-01	96.69
3	24.9339	1281	18.200	0.292	9.56E-04	9.66E-05	3.28E-02	2.46E-01	97.09
4	24.8973	1462	15.924	0.256	9.59E-04	1.06E-04	3.69E-02	2.78E-01	97.40
5	27.0284	1867	13.537	0.217	8.97E-04	1.19E-04	4.27E-02	3.19E-01	97.90
6	24.3073	2122	10.711	0.172	8.63E-04	1.48E-04	4.97E-02	3.72E-01	98.26
7	24.9147	2780	8.380	0.135	7.97E-04	1.81E-04	5.97E-02	4.46E-01	98.67
8	24.9343	4527	5.150	0.083	6.97E-04	2.69E-04	7.48E-02	4.59E-01	99.07

TABLE A.2i   Feed Specification: $[CrO_4^{2-}]$ 2.46E-02   M   Water Flux Rate = 62.3587 l/m^2*hr
$[QUAT]$ 1.92E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	22.9682	1086	19.776	0.317	9.63E-04	1.94E-04	2.66E-02	2.08E-01	96.38
2	24.8789	1152	20.194	0.324	9.88E-04	9.49E-05	2.92E-02	2.29E-01	96.62
3	21.7083	1256	16.161	0.259	9.87E-04	9.75E-05	3.20E-02	2.50E-01	96.92
4	25.4833	1437	16.582	0.266	9.54E-04	1.00E-04	3.60E-02	2.83E-01	97.35
5	28.4954	1624	16.407	0.263	9.30E-04	1.15E-04	4.18E-02	3.27E-01	97.77
6	24.9241	1954	11.927	0.191	8.87E-04	1.34E-04	4.86E-02	3.81E-01	98.18
7	23.1645	2539	8.531	0.137	8.12E-04	1.67E-04	5.75E-02	4.49E-01	98.59
8	27.5370	4227	6.092	0.098	7.06E-04	2.47E-04	7.31E-02	5.10E-01	99.03

APPENDIX A

TABLE A3 : EXPERIMENTAL DATA OF CHROMATE REJECTION STUDIES

$$[QUAT] : [CrO42-] \quad = \quad 20: 1$$

TABLE A.3a   Feed Specification: $[CrO_4^{2-}]$ 6.03E-03 M   Water Flux Rate = 69.3374 l/m^2*hr

$[QUAT]$ 9.98E-02 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9815	660	35.393	0.510	4.14E-05	6.28E-05	6.58E-03	1.09E-01	99.37
2	25.2407	691	34.156	0.493	4.29E-05	2.99E-05	7.24E-03	1.20E-01	99.41
3	24.9190	722	32.273	0.465	4.14E-05	2.86E-05	8.05E-03	1.33E-01	99.49
4	28.1026	831	31.622	0.456	3.91E-05	3.11E-05	9.19E-03	1.53E-01	99.58
5	26.2312	881	27.841	0.402	3.72E-05	3.03E-05	1.06E-02	1.76E-01	99.65
6	24.8751	997	23.330	0.336	3.40E-05	3.25E-05	1.24E-02	2.06E-01	99.73
7	24.8893	1182	19.690	0.284	2.98E-05	4.49E-05	1.50E-02	2.48E-01	99.80
8	24.9737	1516	15.404	0.222	2.43E-05	5.21E-05	1.89E-02	2.45E-01	99.87

TABLE A.3b   Feed Specification: [CrO$_4^{2-}$]   5.76E-03 M   Water Flux Rate = 63.0973 l/m2*hr
              [QUAT]   9.63E-02 M   Filtration Area = 38.5 cm2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m²*hr)	Relative Flux	Permeate [CrO$_4^{2-}$], (M)	[QUAT], (M)	Retentate [CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$] Rejection, %
1	24.8738	667	34.870	0.553	3.99E-05	5.82E-05	6.28E-03	1.05E-01	99.36
2	25.0523	695	33.706	0.534	4.02E-05	4.28E-05	6.91E-03	1.16E-01	99.42
3	25.0502	726	32.264	0.511	4.05E-05	3.36E-05	7.68E-03	1.28E-01	99.47
4	25.0502	806	29.061	0.461	3.88E-05	2.96E-05	8.64E-03	1.45E-01	99.55
5	25.0274	878	26.654	0.422	3.64E-05	4.50E-05	9.88E-03	1.65E-01	99.63
6	24.9807	1007	23.196	0.368	3.29E-05	4.49E-05	1.15E-02	1.93E-01	99.71
7	25.0301	1191	19.651	0.311	2.90E-05	3.69E-05	1.38E-02	2.31E-01	99.79
8	25.4554	1571	15.151	0.240	2.36E-05	4.56E-05	1.74E-02	2.51E-01	99.86

TABLE A.3c   Feed Specification: [CrO$_4^{2-}$]   4.68E-03 M   Water Flux Rate = 57.76 l/m2*hr
              [QUAT]   1.02E-01 M   Filtration Area = 38.5 cm2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m²*hr)	Relative Flux	Permeate [CrO$_4^{2-}$], (M)	[QUAT], (M)	Retentate [CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$] Rejection, %
1	24.8800	726	32.045	0.555	3.67E-05	1.25E-04	5.10E-03	1.11E-01	99.28
2	25.4708	759	31.379	0.543	3.88E-05	6.40E-05	5.62E-03	1.22E-01	99.31
3	25.4113	790	30.077	0.521	3.72E-05	2.36E-05	6.26E-03	1.36E-01	99.40
4	24.9937	862	27.112	0.469	3.47E-05	4.53E-05	7.04E-03	1.54E-01	99.51
5	26.0251	995	24.457	0.423	3.29E-05	6.42E-05	8.10E-03	1.77E-01	99.59
6	25.2384	1152	20.486	0.355	2.79E-05	5.70E-05	9.48E-03	2.07E-01	99.71
7	24.8863	1358	17.136	0.297	2.49E-05	5.24E-05	1.14E-02	2.48E-01	99.78
8	24.2872	1801	12.610	0.218	3.78E-05	3.24E-04	1.42E-02	2.50E-01	99.73

TABLE A.3d   Feed Specification: $[CrO_4^{2-}]$ 7.49E-03   M   Water Flux Rate = 63.0572 l/m^2*hr
                                      $[QUAT]$ 1.50E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9749	949	24.608	0.390	1.26E-04	1.26E-04	8.16E-03	1.63E-01	98.46
2	24.9146	1001	23.273	0.369	1.55E-04	4.75E-05	8.97E-03	1.80E-01	98.27
3	26.9241	1111	22.660	0.359	1.13E-04	4.55E-05	1.01E-02	2.01E-01	98.88
4	24.8196	1196	19.405	0.308	8.44E-05	3.50E-05	1.13E-02	2.28E-01	99.25
5	24.7675	1442	16.060	0.255	7.74E-05	3.81E-05	1.29E-02	2.59E-01	99.40
6	24.7824	1763	13.144	0.208	6.41E-05	4.75E-05	1.51E-02	3.02E-01	99.58
7	24.9018	2374	9.808	0.156	5.16E-05	6.62E-05	1.81E-02	3.63E-01	99.72
8	25.0319	4043	5.789	0.092	4.10E-05	5.34E-05	2.27E-02	3.68E-01	99.82

TABLE A.3e   Feed Specification: $[CrO_4^{2-}]$ 1.00E-02   M   Water Flux Rate = 94.4101 l/m^2*hr
                                      $[QUAT]$ 1.54E-01   M   Filtration Area = 38.5 cm2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9647	867	26.925	0.285	7.84E-05	5.03E-05	1.09E-02	1.68E-01	99.28
2	24.8952	920	25.303	0.268	7.88E-05	3.33E-05	1.20E-02	1.85E-01	99.34
3	24.905	1001	23.265	0.246	7.56E-05	3.52E-05	1.33E-02	2.05E-01	99.43
4	24.9386	1140	20.455	0.217	7.30E-05	3.48E-05	1.50E-02	2.32E-01	99.51
5	24.899	1314	17.719	0.188	6.53E-05	3.73E-05	1.71E-02	2.63E-01	99.62
6	24.8732	1584	14.683	0.156	5.62E-05	3.89E-05	2.00E-02	3.07E-01	99.72
7	26.5564	2256	11.007	0.117	4.67E-05	4.95E-05	2.42E-02	3.73E-01	99.81
8	25.1315	3647	6.444	0.068	3.43E-05	5.98E-05	3.04E-02	4.00E-01	99.89

TABLE A.3f   Feed Specification: $[CrO_4^{2-}]$ 9.80E-03 M   Water Flux Rate = 69.822 $l/m^2{*}hr$

$[QUAT]$ 1.48E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux $(l/m^2{*}hr)$	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8331	891	26.061	0.373	8.69E-05	7.18E-05	1.07E-02	1.61E-01	99.19
2	24.8627	956	24.318	0.348	1.23E-04	3.73E-05	1.17E-02	1.77E-01	98.95
3	24.8775	1034	22.497	0.322	1.05E-04	3.89E-05	1.30E-02	1.97E-01	99.20
4	24.7719	1187	19.514	0.279	9.46E-05	4.01E-05	1.46E-02	2.22E-01	99.35
5	24.7762	1355	17.098	0.245	8.27E-05	4.52E-05	1.67E-02	2.52E-01	99.51
6	25.1244	1669	14.076	0.202	6.97E-05	6.26E-05	1.95E-02	2.94E-01	99.64
7	23.8326	2148	10.375	0.149	5.64E-05	5.49E-05	2.32E-02	3.50E-01	99.76
8	25.0425	3493	6.704	0.096	4.12E-05	7.74E-05	2.89E-02	3.66E-01	99.86

TABLE A.3g   Feed Specification: $[CrO_4^{2-}]$ 1.01E-02 M   Water Flux Rate = 72.2338 $l/m^2{*}hr$

$[QUAT]$ 2.20E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux $(l/m^2{*}hr)$	Relative Flux	Permeate		Retentate		$[CrO_4^{2-}]$ Rejection, %
					$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M	$[CrO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8513	1146	20.277	0.281	2.04E-04	9.77E-05	1.10E-02	2.39E-01	98.14
2	24.8128	1243	18.666	0.258	1.86E-04	5.75E-05	1.21E-02	2.63E-01	98.46
3	24.8360	1470	15.798	0.219	1.85E-04	6.31E-05	1.34E-02	2.92E-01	98.61
4	24.8767	1649	14.106	0.195	1.65E-04	6.82E-05	1.50E-02	3.30E-01	98.90
5	24.7606	2012	11.507	0.159	1.14E-04	8.01E-05	1.72E-02	3.75E-01	99.34
6	24.8387	2597	8.943	0.124	1.27E-04	1.01E-04	2.00E-02	4.36E-01	99.36
7	24.8823	4137	5.624	0.078	1.10E-04	1.48E-04	2.39E-02	5.22E-01	99.54
8	13.6373	-	-	-	8.17E-05	2.79E-04	2.68E-02	4.94E-01	99.70

TABLE A.3h   Feed Specification: [CrO$_4^{2-}$]   9.48E-03 M   Water Flux Rate   =   65.3155 l/m^2*hr
                                       [QUAT]   1.99E-01 M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [CrO$_4^{2-}$], (M)	[QUAT], (M	Retentate [CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$] Rejection, %
1	24.8164	1130	20.535	0.314	1.60E-04	1.04E-04	1.03E-02	2.17E-01	98.45
2	24.9754	1233	18.940	0.290	1.69E-04	6.35E-05	1.14E-02	2.39E-01	98.51
3	24.8596	1363	17.055	0.261	1.63E-04	6.68E-05	1.26E-02	2.65E-01	98.70
4	26.9546	1622	15.539	0.238	1.50E-04	7.18E-05	1.43E-02	3.03E-01	98.95
5	24.8781	1963	11.851	0.181	1.45E-04	9.05E-05	1.64E-02	3.44E-01	99.11
6	24.5925	2577	8.923	0.137	1.35E-04	1.08E-04	1.91E-02	4.01E-01	99.29
7	24.8388	3812	6.093	0.093	1.12E-04	1.64E-04	2.29E-02	4.81E-01	99.51
8	24.2276	-	-	-	9.10E-05	4.68E-04	2.85E-02	5.21E-01	99.68

TABLE A.3i   Feed Specification: [CrO$_4^{2-}$]   7.86E-03 M   Water Flux Rate   =   60.1381 l/m^2*hr
                                       [QUAT]   1.93E-01 M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [CrO$_4^{2-}$], (M)	[QUAT], (M	Retentate [CrO$_4^{2-}$], (M)	[QUAT], (M)	[CrO$_4^{2-}$] Rejection, %
1	26.2644	1214	20.230	0.336	2.19E-04	1.04E-04	8.59E-03	2.11E-01	97.46
2	24.9004	1243	18.732	0.311	1.86E-04	6.35E-05	9.46E-03	2.32E-01	98.03
3	25.0074	1398	16.726	0.278	1.39E-04	6.68E-05	1.05E-02	2.58E-01	98.67
4	24.8234	1658	14.000	0.233	1.58E-04	7.18E-05	1.18E-02	2.92E-01	98.66
5	24.9069	2005	11.616	0.193	1.28E-04	9.05E-05	1.35E-02	3.32E-01	99.05
6	26.4288	2799	8.829	0.147	1.13E-04	1.08E-04	1.59E-02	3.91E-01	99.29
7	24.8891	4483	5.191	0.086	8.77E-05	1.64E-04	1.92E-02	4.71E-01	99.54
8	16.4023	-	-	-	7.18E-05	4.68E-04	2.22E-02	4.51E-01	99.68

APPENDIX B

TABLE 1B : EXPERIMENTAL DATA OF SULPHATE REJECTION STUDIES

$[QUAT]:[SO_4^{2-}]$ $=$ 5:1

Solution Flux $(l/m^2 \cdot hr)$ $=$ (volume of permeate (ml)$*100^2(cm^2)*3600(s)$)$*$(time interval(s)$*38.5(cm^2)*100(ml)$)

Relative Flux $=$ (solution flux)/(water flux)

TABLE B.1a Feed Specification: $[SO_4^{2-}]$ 1.94E-02 M Water Flux Rate $=$ 83.4667 l/m^2*hr

$[QUAT]$ 9.85E-02 M Filtration Area $=$ 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.8769	688	33.810	0.405	1.25E-03	4.93E-05	2.10E-02	1.07E-01	94.06
2	24.8464	725	32.046	0.384	1.35E-03	2.50E-05	2.31E-02	1.18E-01	94.14
3	24.9295	762	30.591	0.367	1.39E-03	5.95E-05	2.56E-02	1.31E-01	94.58
4	24.8174	819	28.334	0.339	1.35E-03	2.67E-05	2.88E-02	1.48E-01	95.32
5	24.7570	894	25.894	0.310	1.40E-03	2.85E-05	3.28E-02	·1.68E-01	95.75
6	24.8122	1008	23.017	0.276	1.62E-03	2.97E-05	3.82E-02	1.96E-01	95.77
7	24.8869	1134	20.521	0.246	1.34E-03	3.30E-05	4.58E-02	2.34E-01	97.07
8	25.0027	1438	16.258	0.195	1.19E-03	4.01E-05	5.72E-02	2.43E-01	97.91

TABLE B.1b Feed Specification: $[SO_4^{2-}]$ 1.92E-02 M Water Flux Rate = 75.1063 l/m^2*hr

$[QUAT]$ 1.14E-01 M Filtration Area = 38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[SO_4^{2-}]$ Rejection, % |
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	25.2731	803	29.430	0.392	1.06E-03	6.35E-05	2.09E-02	1.24E-01	94.93
2	24.9608	819	28.498	0.379	1.31E-03	3.62E-05	2.30E-02	1.37E-01	94.31
3	24.9893	861	27.139	0.361	1.29E-03	3.60E-05	2.55E-02	1.52E-01	94.94
4	25.0654	898	26.100	0.348	1.29E-03	3.40E-05	2.87E-02	1.72E-01	95.52
5	24.8236	1055	22.002	0.293	1.30E-03	3.71E-05	3.28E-02	1.95E-01	96.04
6	25.2799	1187	19.914	0.265	1.39E-03	3.97E-05	3.83E-02	2.28E-01	96.36
7	24.9725	1377	16.958	0.226	1.17E-03	4.28E-05	4.61E-02	2.74E-01	97.46
8	26.1353	1788	13.668	0.182	1.09E-03	7.46E-05	5.83E-02	2.92E-01	98.13

TABE B.1c Feed Specification: $[SO_4^{2-}]$ 2.02E-02 M Water Flux Rate = 69.8912 l/m^2*hr

$[QUAT]$ 1.16E-01 M Filtration Area = 38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[SO_4^{2-}]$ Rejection, % |
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9974	775	30.160	0.432	1.14E-03	5.56E-05	2.20E-02	1.27E-01	94.83
2	24.9491	788	29.605	0.424	1.32E-03	3.30E-05	2.41E-02	1.39E-01	94.52
3	24.8515	832	27.930	0.400	1.32E-03	3.73E-05	2.68E-02	1.55E-01	95.07
4	24.9861	874	26.732	0.382	1.33E-03	3.37E-05	3.02E-02	1.75E-01	95.59
5	24.9038	1005	23.171	0.332	1.41E-03	4.70E-05	3.44E-02	1.99E-01	95.89
6	25.1701	1151	20.448	0.293	1.36E-03	5.58E-05	4.02E-02	2.32E-01	96.61
7	24.8449	1345	17.273	0.247	1.19E-03	4.38E-05	4.82E-02	2.78E-01	97.54
8	26.8868	1729	14.541	0.208	1.02E-03	1.00E-04	6.14E-02	2.91E-01	98.35

TABLE B.1d   Feed Specification: [SO_4^{2-}]   2.54E-02   M   Water Flux Rate = 67.4972 l/m^2*hr
                                     [QUAT]   1.53E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[SO_4^{2-}] Rejection, %
					[SO_4^{2-}], (M)	[QUAT], (M)	[SO_4^{2-}], (M)	[QUAT], (M)	
1	24.8060	1027	22.585	0.432	2.93E-03	1.05E-04	2.74E-02	1.67E-01	89.31
2	24.8852	1075	21.646	0.424	3.18E-03	6.53E-05	3.01E-02	1.83E-01	89.44
3	25.9473	1209	20.068	0.400	3.15E-03	6.53E-05	3.36E-02	2.05E-01	90.63
4	24.8948	1312	17.743	0.382	2.87E-03	6.94E-05	3.79E-02	2.31E-01	92.42
5	24.7502	1488	15.553	0.332	2.86E-03	7.74E-05	4.32E-02	2.63E-01	93.38
6	24.8511	1778	13.069	0.293	2.72E-03	9.02E-05	5.04E-02	3.06E-01	94.60
7	24.8700	2324	10.006	0.247	2.53E-03	1.11E-04	6.05E-02	3.67E-01	95.81
8	25.4402	3493	6.810	0.208	2.41E-03	1.57E-04	7.60E-02	3.79E-01	96.83

TABLE B.1e   Feed Specification: [SO_4^{2-}]   2.64E-02   M   Water Flux Rate = 59.5729 l/m^2*hr
                                     [QUAT]   1.37E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[SO_4^{2-}] Rejection, %
					[SO_4^{2-}], (M)	[QUAT], (M)	[SO_4^{2-}], (M)	[QUAT], (M)	
1	24.9081	1033	22.547	0.378	3.04E-03	1.71E-04	2.85E-02	1.50E-01	89.34
2	24.9966	1085	21.542	0.362	3.11E-03	9.26E-05	3.13E-02	1.65E-01	90.06
3	24.9406	1175	19.848	0.333	3.17E-03	8.05E-05	3.48E-02	1.83E-01	90.89
4	25.0546	1333	17.575	0.295	3.04E-03	9.19E-05	3.92E-02	2.07E-01	92.25
5	25.3031	1524	15.525	0.261	3.03E-03	1.20E-04	4.48E-02	2.36E-01	93.25
6	24.9424	1781	13.095	0.220	2.87E-03	1.29E-04	5.23E-02	2.75E-01	94.52
7	24.8955	2276	10.228	0.172	2.46E-03	1.45E-04	6.28E-02	3.30E-01	96.08
8	25.7271	3505	6.863	0.115	2.39E-03	2.18E-04	7.91E-02	3.60E-01	96.99

TABLE B.1f Feed Specification: $[SO_4^{2-}]$ 2.26E-02 M Water Flux Rate = 60.0466 l/m^2*hr

$[QUAT]$ 1.81E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8373	1028	22.592	0.376	2.34E-03	1.47E-04	2.44E-02	1.97E-01	90.41
2	27.9489	1159	22.549	0.376	2.60E-03	8.34E-05	2.71E-02	2.20E-01	90.43
3	24.9798	1184	19.728	0.329	2.66E-03	8.65E-05	3.02E-02	2.45E-01	91.19
4	24.9049	1350	17.250	0.287	2.59E-03	9.42E-05	3.40E-02	2.77E-01	92.37
5	25.4503	1542	15.433	0.257	2.45E-03	1.11E-04	3.91E-02	3.16E-01	93.73
6	25.1307	1613	14.568	0.243	2.22E-03	1.44E-04	4.58E-02	3.70E-01	95.16
7	24.8371	2405	9.657	0.161	2.32E-03	1.67E-04	5.51E-02	4.46E-01	95.79
8	24.7417	3625	6.382	0.106	2.09E-03	2.37E-04	6.92E-02	4.47E-01	96.98

TABLE B.1g Feed Specification: $[SO_4^{2-}]$ 2.84E-02 M Water Flux Rate = 61.285 l/m^2*hr

$[QUAT]$ 2.18E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	25.3645	1232	19.251	0.314	4.47E-03	1.73E-04	3.06E-02	2.38E-01	85.40
2	24.8907	1253	18.575	0.303	4.78E-03	1.11E-04	3.36E-02	2.62E-01	85.77
3	24.9909	1374	17.007	0.278	4.68E-03	1.12E-04	3.73E-02	2.91E-01	87.48
4	24.8803	1545	15.058	0.246	4.82E-03	1.25E-04	4.20E-02	3.29E-01	88.53
5	24.8793	1776	13.099	0.214	4.61E-03	1.41E-04	4.80E-02	3.74E-01	90.40
6	24.8988	2107	11.050	0.180	4.39E-03	1.67E-04	5.60E-02	4.36E-01	92.16
7	24.9661	2789	8.370	0.137	4.08E-03	2.11E-04	6.72E-02	5.23E-01	93.93
8	25.0972	4312	5.442	0.089	3.78E-03	3.25E-04	8.41E-02	5.38E-01	95.51

TABLE B.1h   Feed Specification: $[SO_4^{2-}]$ 3.07E-02 M   Water Flux Rate = 62.2134 l/m^2*hr
  $[QUAT]$ 2.10E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	25.3561	1198	19.791	0.318	4.15E-03	1.90E-04	3.31E-02	2.29E-01	87.46
2	24.8503	1231	18.876	0.303	4.72E-03	1.27E-04	3.63E-02	2.52E-01	87.03
3	24.9231	1344	17.340	0.279	4.84E-03	1.31E-04	4.04E-02	2.80E-01	88.01
4	24.9821	1535	15.218	0.245	4.77E-03	1.31E-04	4.54E-02	3.17E-01	89.50
5	25.0553	1770	13.236	0.213	4.42E-03	1.53E-04	5.20E-02	3.60E-01	91.49
6	24.9553	1984	11.762	0.189	4.24E-03	1.70E-04	6.07E-02	4.20E-01	93.00
7	24.8809	2736	8.503	0.137	4.50E-03	2.15E-04	7.27E-02	5.04E-01	93.80
8	25.2431	4479	5.270	0.085	4.02E-03	3.52E-04	9.12E-02	5.48E-01	95.59

TABLE B.1i   Feed Specification: $[SO_4^{2-}]$ 2.86E-02 M   Water Flux Rate = 60.8284 l/m^2*hr
  $[QUAT]$ 2.00E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9320	1181	19.740	0.325	4.44E-03	1.96E-04	3.07E-02	2.18E-01	85.56
2	25.8580	1254	19.281	0.317	4.72E-03	1.20E-04	3.39E-02	2.41E-01	86.07
3	25.0823	1356	17.296	0.284	4.82E-03	1.30E-04	3.77E-02	2.68E-01	87.21
4	24.9351	1492	15.627	0.257	4.87E-03	1.42E-04	4.24E-02	3.03E-01	88.51
5	24.9289	1704	13.680	0.225	4.79E-03	1.61E-04	4.85E-02	3.44E-01	90.12
6	25.6576	2123	11.301	0.186	4.76E-03	1.98E-04	5.68E-02	4.04E-01	91.63
7	26.4615	2859	8.655	0.142	4.75E-03	2.55E-04	6.91E-02	4.91E-01	93.13
8	25.6489	4496	5.334	0.088	4.51E-03	4.03E-04	8.76E-02	4.98E-01	94.85

TABLE 2B : EXPERIMENTAL DATA OF SULPHATE REJECTION STUDIES

$$[QUAT]:[SO_4^{2-}] \quad = \quad 10:1$$

TABLE B.2a   Feed Specification: $[SO_4^{2-}]$ 6.29E-03   M   Water Flux Rate   =   62.2126 l/m^2*hr

$[QUAT]$ 9.69E-02   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	25.6806	716	33.538	0.539	2.20E-04	5.81E-05	6.86E-03	1.06E-01	96.80
2	24.8005	784	29.579	0.475	2.24E-04	3.41E-05	7.54E-03	1.16E-01	97.03
3	24.8271	813	28.555	0.459	2.00E-04	2.55E-05	8.38E-03	1.29E-01	97.61
4	25.0270	844	27.727	0.446	2.21E-04	2.86E-05	9.42E-03	1.46E-01	97.66
5	24.7971	921	25.176	0.405	2.10E-04	3.07E-05	1.08E-02	1.66E-01	98.05
6	24.7927	1055	21.974	0.353	1.97E-04	3.65E-05	1.25E-02	1.94E-01	98.43
7	24.8307	1253	18.530	0.298	1.73E-04	4.67E-05	1.50E-02	2.32E-01	98.85
8	25.0406	1581	14.810	0.238	1.65E-04	5.95E-05	1.88E-02	2.39E-01	99.12

TABLE B.2b Feed Specification: $[SO_4^{2-}]$ 6.47E-03 M Water Flux Rate = 59.7275 l/m^2*hr

$[QUAT]$ 9.05E-02 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8842	710	32.772	0.549	2.10E-04	3.61E-05	7.03E-03	9.87E-02	97.01
2	24.8496	729	31.874	0.534	2.12E-04	2.60E-05	7.73E-03	1.08E-01	97.25
3	25.7140	786	30.591	0.512	2.20E-04	2.41E-05	8.61E-03	1.21E-01	97.45
4	24.9269	842	27.682	0.463	2.08E-04	2.67E-05	9.69E-03	1.37E-01	97.85
5	24.8988	922	25.252	0.423	2.10E-04	2.94E-05	1.11E-02	1.55E-01	98.11
6	25.4191	1063	22.360	0.374	1.80E-04	3.55E-05	1.30E-02	1.82E-01	98.61
7	24.9143	1160	20.083	0.336	1.85E-04	4.52E-05	1.56E-02	2.18E-01	98.81
8	25.7348	1563	15.396	0.258	1.64E-04	6.14E-05	1.96E-02	2.37E-01	99.16

TABLE B.2c Feed Specification: $[SO_4^{2-}]$ 5.90E-03 M Water Flux Rate = 58.9117 l/m^2*hr

$[QUAT]$ 9.48E-02 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9403	702	33.221	0.564	2.24E-04	1.09E-04	6.41E-03	1.03E-01	96.51
2	25.6197	758	31.604	0.536	2.44E-04	3.99E-05	7.07E-03	1.14E-01	96.55
3	24.9202	779	29.913	0.508	2.28E-04	3.24E-05	7.85E-03	1.27E-01	97.09
4	24.8690	830	28.017	0.476	2.24E-04	3.02E-05	8.83E-03	1.43E-01	97.46
5	24.8136	913	25.413	0.431	2.29E-04	4.42E-05	1.01E-02	1.63E-01	97.73
6	25.1942	1044	22.565	0.383	2.04E-04	5.48E-05	1.18E-02	1.90E-01	98.27
7	24.6709	1197	19.272	0.327	1.61E-04	5.63E-05	1.41E-02	2.27E-01	98.86
8	24.7058	1530	15.099	0.256	1.59E-04	6.47E-05	1.76E-02	2.37E-01	99.10

TABLE B.2d Feed Specification: $[SO_4^{2-}]$ 1.04E-02 M Water Flux Rate = 55.8947 l/m^2*hr
$[QUAT]$ 1.51E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8590	916	25.376	0.454	5.98E-04	8.48E-05	1.13E-02	1.65E-01	94.69
2	24.8588	941	24.702	0.442	5.68E-04	5.07E-05	1.24E-02	1.81E-01	95.41
3	24.8549	1019	22.808	0.408	5.34E-04	4.94E-05	1.37E-02	2.01E-01	96.11
4	24.8743	1132	20.547	0.368	5.33E-04	5.27E-05	1.54E-02	2.27E-01	96.55
5	24.8318	1285	18.070	0.323	5.21E-04	5.83E-05	1.76E-02	2.58E-01	97.05
6	24.9577	1497	15.589	0.279	4.75E-04	7.65E-05	2.06E-02	3.01E-01	97.69
7	25.4915	2305	10.341	0.185	4.27E-04	9.35E-05	2.47E-02	3.62E-01	98.28
8	26.0653	3504	6.956	0.124	3.44E-04	1.11E-04	3.13E-02	3.76E-01	98.90

TABLE B.2e Feed Specification: $[SO_4^{2-}]$ 9.81E-03 M Water Flux Rate = 52.4761 l/m^2*hr
$[QUAT]$ 1.70E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8693	974	23.875	0.455	5.88E-04	9.48E-05	1.06E-02	1.85E-01	94.48
2	24.8624	1000	23.248	0.443	5.23E-04	5.71E-05	1.17E-02	2.04E-01	95.53
3	24.951	1069	21.825	0.416	5.18E-04	5.94E-05	1.30E-02	2.26E-01	96.01
4	24.9734	1213	19.251	0.367	4.67E-04	6.31E-05	1.46E-02	2.56E-01	96.81
5	25.6140	1416	16.914	0.322	5.18E-04	7.12E-05	1.68E-02	2.92E-01	96.91
6	25.3015	1666	14.201	0.271	3.46E-04	8.53E-05	1.96E-02	3.41E-01	98.24
7	26.4847	2436	10.166	0.194	3.43E-04	1.17E-04	2.39E-02	4.15E-01	98.56
8	24.9118	3630	6.417	0.122	3.08E-04	1.86E-04	2.99E-02	4.41E-01	98.97

TABLE B.2f   Feed Specification: $[SO_4^{2-}]$ 1.05E-02 M   Water Flux Rate = 55.5098 l/m^2*hr
                                     $[QUAT]$ 1.62E-01 M   Filtration Area = 38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[SO_4^{2-}]$ Rejection, % |
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8718	954	24.378	0.439	4.22E-04	1.14E-04	1.14E-02	1.76E-01	96.29
2	24.9582	1001	23.314	0.420	5.60E-04	6.45E-05	1.25E-02	1.94E-01	95.52
3	25.0257	1088	21.508	0.387	4.95E-04	6.24E-05	1.39E-02	2.15E-01	96.44
4	24.7979	1211	19.148	0.345	4.89E-04	6.71E-05	1.56E-02	2.43E-01	96.87
5	24.8951	1390	16.747	0.302	4.16E-04	7.74E-05	1.78E-02	2.77E-01	97.67
6	25.3481	1681	14.100	0.254	3.47E-04	1.06E-04	2.09E-02	3.23E-01	98.34
7	24.6261	2700	8.529	0.154	3.01E-04	1.13E-04	2.50E-02	3.87E-01	98.79
8	24.9254	3239	7.196	0.130	2.85E-04	1.68E-04	3.12E-02	4.05E-01	99.09

TABLE B.2g   Feed Specification: $[SO_4^{2-}]$ 1.42E-02 M   Water Flux Rate = 48.19947 $l/m2*$
                                     $[QUAT]$ 2.02E-01 M   Filtration Area = 38.5 cm^2

| Retentate No. | Permeate Weight (g) | Time Interval (sec) | Solution Flux (l/m^2*hr) | Relative Flux | Permeate | | Retentate | | $[SO_4^{2-}]$ Rejection, % |
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	25.0272	1236	18.934	0.393	7.93E-04	1.48E-04	1.54E-02	2.20E-01	94.87
2	24.9045	1262	18.453	0.383	8.71E-04	9.45E-05	1.70E-02	2.42E-01	94.87
3	24.9311	1591	14.653	0.304	9.23E-04	9.47E-05	1.88E-02	2.69E-01	95.10
4	24.9319	1871	12.460	0.259	8.94E-04	1.12E-04	2.12E-02	3.04E-01	95.78
5	24.8216	2360	9.835	0.204	9.04E-04	1.26E-04	2.42E-02	3.45E-01	96.26
6	24.8368	3049	7.617	0.158	7.40E-04	1.58E-04	2.82E-02	4.02E-01	97.38
7	24.7835	3049	7.601	0.158	6.20E-04	2.20E-04	3.38E-02	4.81E-01	98.17
8	24.4774	7002	3.269	0.068	4.41E-04	4.10E-04	4.20E-02	4.95E-01	98.95

TABLE B.2h Feed Specification: $[SO_4^{2-}]$ 1.40E-02 M Water Flux Rate = 54.6967 l/m^2*hr
$[QUAT]$ 2.28E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.9203	1138	20.476	0.374	8.22E-04	1.92E-04	1.52E-02	2.49E-01	94.58
2	24.8469	1231	18.874	0.345	8.71E-04	1.07E-02	1.67E-02	2.73E-01	94.77
3	25.0689	1353	17.325	0.317	9.35E-04	9.95E-05	1.85E-02	3.04E-01	94.95
4	24.9271	1569	14.856	0.272	7.91E-04	6.51E-05	2.08E-02	3.44E-01	96.20
5	24.9461	1819	12.824	0.234	7.75E-04	7.34E-05	2.38E-02	3.91E-01	96.75
6	24.8470	2297	10.115	0.185	6.85E-04	1.63E-04	2.78E-02	4.55E-01	97.53
7	24.9086	3201	7.276	0.133	5.94E-04	1.23E-04	3.33E-02	5.46E-01	98.21
8	24.9912	6886	3.394	0.062	4.62E-04	4.43E-04	4.16E-02	5.93E-01	98.89

TABLE B.2i Feed Specification: $[SO_4^{2-}]$ 1.42E-02 M Water Flux Rate = 60.0484 l/m^2*hr
$[QUAT]$ 2.16E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	25.5652	1128	21.192	0.353	8.04E-04	1.30E-04	1.55E-02	2.36E-01	94.80
2	25.0160	1209	19.348	0.322	8.60E-04	1.01E-04	1.70E-02	2.59E-01	94.95
3	24.8762	1399	16.627	0.277	8.19E-04	1.01E-04	1.89E-02	2.88E-01	95.67
4	24.8881	1630	14.277	0.238	7.61E-04	1.15E-04	2.13E-02	3.26E-01	96.42
5	24.8921	1930	12.060	0.201	7.46E-04	1.37E-04	2.43E-02	3.70E-01	96.93
6	25.4412	2421	9.826	0.164	7.32E-04	1.95E-04	2.85E-02	4.33E-01	97.43
7	25.6782	3755	6.394	0.106	5.75E-04	2.53E-04	3.44E-02	5.23E-01	98.33
8	24.9468	9303	2.507	0.042	4.38E-04	4.54E-04	4.32E-02	5.40E-01	98.99

APPENDIX B

TABLE 3B : EXPERIMENTAL DATA OF SULPHATE REJECTION STUDIES

$$[QUAT]:[SO_4^{2-}] \quad = \quad 20:1$$

TABLE B.3a   Feed Specification: $[SO_4^{2-}]$ 4.07E-03   M   Water Flux Rate   =   45.5256 l/m^2*hr
    $[QUAT]$ 9.76E-02   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.9471	769	30.334	0.666	4.18E-05	6.51E-05	4.43E-03	1.06E-01	99.06
2	24.8673	791	29.396	0.646	3.58E-05	2.75E-05	4.87E-03	1.17E-01	99.26
3	26.4988	893	27.747	0.609	3.51E-05	2.36E-05	5.45E-03	1.31E-01	99.36
4	25.3344	926	25.582	0.562	3.14E-05	2.36E-05	6.15E-03	1.48E-01	99.49
5	24.9330	1037	22.482	0.494	3.04E-05	2.71E-05	7.03E-03	1.69E-01	99.57
6	24.8032	1194	19.424	0.427	2.65E-05	3.19E-05	8.20E-03	1.97E-01	99.68
7	24.9500	1464	15.936	0.350	2.16E-05	4.13E-05	9.86E-03	2.37E-01	99.78
8	25.7589	2042	11.795	0.259	2.11E-05	1.24E-04	1.25E-02	2.42E-01	99.83

TABLE B.3b   Feed Specification: $[SO_4^{2-}]$ 4.01E-03   M   Water Flux Rate   =   46.7831 l/m^2*hr
                                    $[QUAT]$ 9.76E-02   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.9279	805	28.956	0.619	4.36E-05	3.55E-05	4.37E-03	1.06E-01	99.00
2	25.1917	832	28.312	0.605	3.53E-05	2.48E-05	4.81E-03	1.17E-01	99.27
3	25.0501	868	26.986	0.577	3.37E-05	2.91E-05	5.35E-03	1.30E-01	99.37
4	25.0449	946	24.755	0.529	3.00E-05	2.52E-05	6.02E-03	1.47E-01	99.50
5	25.1863	1063	22.155	0.474	2.79E-05	3.05E-05	6.88E-03	1.68E-01	99.59
6	24.8021	1225	18.932	0.405	2.73E-05	3.46E-05	8.02E-03	1.96E-01	99.66
7	26.1237	1574	15.519	0.332	2.58E-05	4.97E-05	9.72E-03	2.37E-01	99.73
8	25.3337	2095	11.307	0.242	2.64E-05	6.86E-05	1.22E-02	2.55E-01	99.78

TABLE B.3c   Feed Specification: $[SO_4^{2-}]$ 4.18E-03   M   Water Flux Rate   =   85.111 l/m^2*hr
                                    $[QUAT]$ 1.05E-01   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[SO_4^{2-}]$ Rejection, %
					$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	$[SO_4^{2-}]$, (M)	$[QUAT]$, (M)	
1	24.8958	697	33.399	0.392	4.00E-05	3.14E-05	4.55E-03	1.15E-01	99.12
2	24.8608	722	32.197	0.378	3.59E-05	1.41E-05	5.00E-03	1.26E-01	99.28
3	26.7434	827	30.238	0.355	3.02E-05	2.69E-05	5.60E-03	1.41E-01	99.46
4	24.6586	893	25.820	0.303	3.03E-05	1.23E-05	6.30E-03	1.60E-01	99.52
5	26.6196	967	25.740	0.302	2.72E-05	3.36E-05	7.27E-03	1.83E-01	99.63
6	25.1537	1152	20.417	0.240	1.98E-05	3.63E-05	8.52E-03	2.15E-01	99.77
7	24.6058	1399	16.446	0.193	1.91E-05	2.45E-05	1.02E-02	2.58E-01	99.81
8	24.8847	1833	12.694	0.149	1.84E-05	7.33E-05	1.28E-02	2.64E-01	99.86

TABLE B.3d Feed Specification: $[SO_4^{2-}]$ 6.28E-03 M   Water Flux Rate = 78.3848 l/m^2*hr

$[QUAT]$ 1.74E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.8197	927	25.036	0.319	6.36E-05	2.45E-05	6.84E-03	1.89E-01	99.07
2	24.8676	978	23.776	0.303	6.23E-05	3.92E-05	7.52E-03	2.08E-01	99.17
3	24.7670	1081	21.423	0.273	6.23E-05	3.33E-05	8.34E-03	2.31E-01	99.25
4	26.5527	1202	20.656	0.264	7.01E-05	2.90E-05	9.45E-03	2.63E-01	99.26
5	24.8387	1435	16.185	0.206	5.07E-05	3.64E-05	1.08E-02	2.99E-01	99.53
6	24.7653	1783	12.988	0.166	4.46E-05	3.89E-05	1.26E-02	3.49E-01	99.65
7	24.8907	2456	9.477	0.121	3.76E-05	4.04E-05	1.51E-02	4.19E-01	99.75
8	24.9810	4948	4.721	0.060	2.58E-05	5.24E-05	1.89E-02	4.28E-01	99.86

TABLE B.3e Feed Specification: $[SO_4^{2-}]$ 6.75E-03 M   Water Flux Rate = 72.8707 l/m^2*hr

$[QUAT]$ 1.66E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	26.6555	935	26.657	0.366	5.32E-05	8.06E-05	7.40E-03	1.82E-01	99.28
2	25.0369	942	24.853	0.341	6.90E-05	5.75E-05	8.14E-03	2.00E-01	99.15
3	24.9471	1061	21.986	0.302	6.61E-05	5.74E-05	9.05E-03	2.23E-01	99.27
4	24.9913	1221	19.139	0.263	6.77E-05	3.88E-05	1.02E-02	2.52E-01	99.34
5	24.8961	1428	16.302	0.224	6.85E-05	4.76E-05	1.17E-02	2.87E-01	99.41
6	24.8304	1759	13.200	0.181	6.35E-05	6.06E-05	1.36E-02	3.35E-01	99.53
7	24.9570	2420	9.643	0.132	3.88E-05	6.64E-05	1.64E-02	4.02E-01	99.76
8	25.0364	4488	5.216	0.072	3.65E-05	9.55E-05	2.05E-02	4.31E-01	99.82

TABLE B.3f — Feed Specification: $[SO_4^{2-}]$ 6.52E-03 M, $[QUAT]$ 1.87E-01 M, Water Flux Rate = 63.5403 l/m²*hr, Filtration Area = 38.5 cm²

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m²*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.8744	933	24.929	0.392	9.47E-05	4.02E-05	7.10E-03	2.04E-01	98.67
2	26.8005	1055	23.754	0.374	7.18E-05	3.01E-05	7.87E-03	2.26E-01	99.09
3	24.9293	1067	21.847	0.344	8.85E-05	2.98E-05	8.75E-03	2.51E-01	98.99
4	24.8307	1218	19.063	0.300	6.17E-05	3.32E-05	9.84E-03	2.84E-01	99.37
5	24.8022	1426	16.263	0.256	4.68E-05	5.31E-05	1.13E-02	3.23E-01	99.58
6	25.1472	1779	13.218	0.208	5.66E-05	6.88E-05	1.32E-02	3.77E-01	99.57
7	24.9678	2434	9.592	0.151	3.63E-05	7.21E-05	1.58E-02	4.54E-01	99.77
8	24.9167	4542	5.130	0.081	3.49E-05	1.18E-04	1.98E-02	4.68E-01	99.82

TABLE B.3g — Feed Specification: $[SO_4^{2-}]$ 1.01E-02 M, $[QUAT]$ 2.30E-01 M, Water Flux Rate = 58.6495 l/m²*hr, Filtration Area = 38.5 cm²

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m²*hr)	Relative Flux	Permeate $[SO_4^{2-}]$, (M)	Permeate $[QUAT]$, (M)	Retentate $[SO_4^{2-}]$, (M)	Retentate $[QUAT]$, (M)	$[SO_4^{2-}]$ Rejection, %
1	24.9308	1164	20.027	0.341	1.43E-04	1.02E-04	1.10E-02	2.51E-01	98.70
2	24.8936	1271	18.314	0.312	2.05E-04	5.48E-05	1.21E-02	2.76E-01	98.30
3	24.8652	1424	16.328	0.278	1.76E-04	5.60E-05	1.34E-02	3.06E-01	98.69
4	24.9816	1830	12.765	0.218	1.80E-04	8.53E-05	1.51E-02	3.46E-01	98.81
5	24.8559	2112	11.005	0.188	1.77E-04	7.29E-05	1.72E-02	3.93E-01	98.97
6	25.2093	2708	8.705	0.148	1.39E-04	9.36E-05	2.01E-02	4.59E-01	99.31
7	24.8926	5936	3.921	0.067	1.38E-04	1.56E-04	2.41E-02	5.50E-01	99.43
8	13.3254	-	-	-	1.36E-04	3.62E-04	2.70E-02	5.16E-01	99.50

TABLE B.3h Feed Specification: [SO$_4^{2-}$] 9.74E-03 M   Water Flux Rate = 58.7724 l/m^2*hr

[QUAT] 2.25E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[SO$_4^{2-}$] Rejection, %
					[SO$_4^{2-}$], (M)	[QUAT], (M)	[SO$_4^{2-}$], (M)	[QUAT], (M)	
1	24.8945	1269	18.344	0.312	2.58E-04	8.11E-05	1.06E-02	2.45E-01	97.57
2	25.3662	1361	17.428	0.297	2.30E-04	5.62E-05	1.17E-02	2.70E-01	98.03
3	24.8637	1488	15.624	0.266	1.83E-04	6.97E-05	1.30E-02	3.00E-01	98.59
4	26.0216	1853	13.131	0.223	1.86E-04	7.99E-05	1.47E-02	3.41E-01	98.73
5	24.9801	2229	10.479	0.178	1.73E-04	7.28E-05	1.68E-02	3.88E-01	98.97
6	26.3408	3185	7.733	0.132	1.35E-04	8.33E-05	1.98E-02	4.57E-01	99.32
7	24.8226	5943	3.906	0.066	1.24E-04	1.09E-04	2.38E-02	5.49E-01	99.48
8	14.0348	-	-	-	1.12E-04	2.01E-04	2.69E-02	5.34E-01	99.58

TABLE B.3i Feed Specification: [SO$_4^{2-}$] 9.54E-03 M   Water Flux Rate = 59.6726 l/m^2*hr

[QUAT] 2.03E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[SO$_4^{2-}$] Rejection, %
					[SO$_4^{2-}$], (M)	[QUAT], (M)	[SO$_4^{2-}$], (M)	[QUAT], (M)	
1	26.2548	1295	18.957	0.318	2.29E-04	7.66E-05	1.04E-02	2.23E-01	97.81
2	26.6686	1431	17.426	0.292	2.38E-04	8.39E-05	1.16E-02	2.47E-01	97.94
3	24.7979	1479	15.678	0.263	1.77E-04	6.13E-05	1.29E-02	2.75E-01	98.62
4	24.7880	1746	13.275	0.222	1.87E-04	7.27E-05	1.45E-02	3.11E-01	98.71
5	25.3386	2260	10.484	0.176	2.04E-04	9.38E-05	1.66E-02	3.55E-01	98.77
6	25.2152	3037	7.764	0.130	1.40E-04	1.41E-04	1.95E-02	4.15E-01	99.28
7	24.6825	5948	3.880	0.065	1.25E-04	2.09E-04	2.34E-02	4.99E-01	99.46
8	12.8896	-	-	-	1.24E-04	2.35E-04	2.62E-02	4.63E-01	99.53

APPENDIX C

TABLE 1C : EXPERIMENTAL DATA OF NITRATE REJECTION STUDIES

$[QUAT]:[NO_3^-]$ = 5:1

Solution Flux $(l/m^2 \cdot hr)$ = (volume of permeate $(ml) \ast 100^2 (cm^2) \ast 3600(s)) \ast$ (time interval$(s) \ast 38.5 (cm^2) \ast 100(ml)$

Relative Flux = (solution flux)/(water flux)

TABLE C.1a Feed Specification: $[NO_3^-]$ 1.90E-02 M Water Flux Rate = 74.7075 $l/m^2 \ast hr$

$[QUAT]$ 9.36E-02 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux $(l/m^2 \ast hr)$	Relative Flux	Permeate		Retentate		$[NO_3^-]$ Rejection, %
					$[NO_3^-]$, (M)	$[QUAT]$, (M)	$[NO_3^-]$, (M)	$[QUAT]$, (M)	
1	24.9202	729	31.964	0.428	2.58E-03	5.93E-05	2.04E-02	1.02E-01	87.38
2	25.7032	770	31.213	0.418	3.01E-03	3.94E-05	2.25E-02	1.13E-01	86.65
3	24.9824	790	29.570	0.396	3.35E-03	2.72E-05	2.50E-02	1.25E-01	86.57
4	24.9557	862	27.071	0.362	3.05E-03	2.18E-05	2.81E-02	1.42E-01	89.16
5	24.8324	968	23.988	0.321	3.13E-03	2.49E-05	3.21E-02	1.61E-01	90.27
6	24.8604	1094	21.249	0.284	2.84E-03	2.32E-05	3.75E-02	1.88E-01	92.42
7	24.8315	1310	17.724	0.237	2.84E-03	2.87E-05	4.50E-02	2.25E-01	93.69
8	26.0655	1457	16.728	0.224	2.94E-03	2.90E-05	5.68E-02	2.33E-01	94.83

TABLE C.1b   Feed Specification: $[NO_3^-]$ 1.92E-02   M   Water Flux Rate = 71.873 l/m^2*hr

$[QUAT]$ 1.08E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[NO_3^-]$, (M)	[QUAT], (M)	Retentate $[NO_3^-]$, (M)	[QUAT], (M)	$[NO_3^-]$ Rejection, %
1	24.9809	669	34.916	0.486	3.05E-03	3.72E-05	2.07E-02	1.18E-01	85.23
2	24.9443	712	32.759	0.456	3.12E-03	2.81E-05	2.27E-02	1.30E-01	86.26
3	25.3968	752	31.579	0.439	2.92E-03	2.61E-05	2.53E-02	1.45E-01	88.47
4	24.9349	806	28.928	0.402	3.02E-03	2.14E-05	2.85E-02	1.64E-01	89.38
5	26.4045	935	26.406	0.367	3.43E-03	2.21E-05	3.27E-02	1.88E-01	89.53
6	25.2887	1035	22.847	0.318	3.15E-03	2.45E-05	3.84E-02	2.20E-01	91.78
7	24.8749	1225	18.987	0.264	2.89E-03	3.27E-05	4.62E-02	2.64E-01	93.74
8	25.2645	1609	14.682	0.204	2.92E-03	2.74E-05	5.81E-02	2.82E-01	94.97

TABLE C.1c   Feed Specification: $[NO_3^-]$ 1.86E-02   M   Water Flux Rate = 86.4488 l/m^2*hr

$[QUAT]$ 1.01E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate $[NO_3^-]$, (M)	[QUAT], (M)	Retentate $[NO_3^-]$, (M)	[QUAT], (M)	$[NO_3^-]$ Rejection, %
1	24.9190	694	33.575	0.388	2.59E-03	4.05E-05	2.00E-02	1.10E-01	87.04
2	24.9554	722	32.320	0.374	3.10E-03	2.52E-05	2.20E-02	1.21E-01	85.87
3	26.1129	793	30.791	0.356	3.27E-03	3.17E-05	2.45E-02	1.35E-01	86.66
4	26.2324	876	28.001	0.324	2.92E-03	2.92E-05	2.78E-02	1.54E-01	89.50
5	26.3997	990	24.935	0.288	3.00E-03	3.26E-05	3.20E-02	1.76E-01	90.63
6	25.1936	1074	21.934	0.254	3.28E-03	3.40E-05	3.75E-02	2.07E-01	91.27
7	24.6444	1261	18.274	0.211	3.07E-03	3.36E-05	4.52E-02	2.49E-01	93.21
8	24.8783	1685	13.806	0.160	2.94E-03	4.79E-05	5.69E-02	2.52E-01	94.84

TABLE C.1d   Feed Specification: [NO$_3^-$]   2.69E-02   M   Water Flux Rate = 67.4761 l/m^2*hr
              [QUAT]   1.65E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	24.7870	930	24.922	0.369	4.72E-03	8.24E-05	2.89E-02	1.80E-01	83.63
2	24.8910	968	24.044	0.356	4.70E-03	4.51E-05	3.17E-02	1.98E-01	85.18
3	24.8374	1031	22.526	0.334	4.57E-03	4.41E-05	3.52E-02	2.20E-01	87.03
4	24.9710	1165	20.042	0.297	4.66E-03	4.62E-05	3.96E-02	2.49E-01	88.22
5	24.7635	1318	17.569	0.260	4.73E-03	5.12E-05	4.52E-02	2.82E-01	89.54
6	25.5713	1611	14.842	0.220	4.62E-03	5.75E-05	5.29E-02	3.31E-01	91.25
7	24.8649	2022	11.499	0.170	4.68E-03	6.86E-05	6.34E-02	3.96E-01	92.61
8	25.2443	3156	7.479	0.111	4.49E-03	9.74E-05	7.94E-02	4.08E-01	94.34

TABLE C.1e   Feed Specification: [NO$_3^-$]   2.89E-02   M   Water Flux Rate = 60.8567 l/m^2*hr
              [QUAT]   1.73E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	26.7129	1010	24.731	0.406	4.32E-03	9.52E-05	3.13E-02	1.90E-01	86.20
2	25.1455	984	23.895	0.393	4.49E-03	6.83E-05	3.45E-02	2.09E-01	86.97
3	24.9685	1042	22.406	0.368	4.54E-03	7.24E-05	3.83E-02	2.33E-01	88.16
4	24.9912	1192	19.604	0.322	4.78E-03	6.60E-05	4.31E-02	2.63E-01	88.92
5	24.9153	1330	17.517	0.288	4.90E-03	6.16E-05	4.93E-02	2.99E-01	90.07
6	26.3511	1679	14.675	0.241	4.91E-03	6.77E-05	5.81E-02	3.53E-01	91.55
7	24.9667	2037	11.461	0.188	4.74E-03	8.72E-05	7.01E-02	4.25E-01	93.24
8	25.0588	3017	7.767	0.128	4.40E-03	1.12E-04	8.83E-02	4.50E-01	95.02

TABLE C.1f   Feed Specification: [NO$_3^-$]   2.77E-02   M   Water Flux Rate = 60.3419 l/m^2*hr
[QUAT]   1.50E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	[QUAT], (M)	Retentate [NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$] Rejection, %
1	25.7472	915	26.312	0.436	4.42E-03	9.28E-05	2.99E-02	1.64E-01	85.24
2	24.9073	960	24.260	0.402	4.63E-03	5.88E-05	3.29E-02	1.81E-01	85.91
3	24.8865	1015	22.927	0.380	5.12E-03	6.00E-05	3.65E-02	2.01E-01	85.97
4	24.8349	1134	20.478	0.339	4.74E-03	6.31E-05	4.11E-02	2.27E-01	88.47
5	24.9993	1298	18.009	0.298	4.63E-03	7.39E-05	4.70E-02	2.58E-01	90.15
6	25.1940	1554	15.160	0.251	4.71E-03	1.18E-04	5.49E-02	3.02E-01	91.41
7	24.7786	1984	11.678	0.194	4.58E-03	1.16E-04	6.58E-02	3.62E-01	93.04
8	24.9910	3048	7.667	0.127	4.34E-03	1.60E-04	8.24E-02	3.77E-01	94.73

TABLE C.1g   Feed Specification: [NO$_3^-$]   3.70E-02   M   Water Flux Rate = 58.9561 l/m^2*hr
[QUAT]   2.07E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	[QUAT], (M)	Retentate [NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$] Rejection, %
1	25.0084	1233	18.966	0.322	6.44E-03	2.04E-04	3.97E-02	2.26E-01	83.79
2	24.8830	1288	18.065	0.306	6.59E-03	1.01E-04	4.37E-02	2.48E-01	84.92
3	24.8748	1406	16.543	0.281	6.85E-03	1.05E-04	4.85E-02	2.76E-01	85.88
4	24.9155	1626	14.328	0.243	6.60E-03	1.18E-04	5.45E-02	3.12E-01	87.90
5	24.8681	1879	12.375	0.210	6.61E-03	1.38E-04	6.23E-02	3.54E-01	89.39
6	24.8331	2347	9.894	0.168	6.06E-03	1.68E-04	7.26E-02	4.12E-01	91.65
7	24.9056	3404	6.841	0.116	6.52E-03	2.37E-04	8.69E-02	4.94E-01	92.50
8	25.0566	7594	3.085	0.052	6.07E-03	2.57E-04	1.09E-01	5.11E-01	94.41

TABLE C.1h — Feed Specification: [NO$_3^-$] 3.72E-02 M, [QUAT] 1.90E-01 M, Water Flux Rate = 63.4298 l/m^2*hr, Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	Permeate [QUAT], (M)	Retentate [NO$_3^-$], (M)	Retentate [QUAT], (M)	[NO$_3^-$] Rejection, %
1	25.0060	1272	18.382	0.290	6.29E-03	1.88E-04	4.00E-02	2.07E-01	84.29
2	23.8815	1348	16.566	0.261	7.69E-03	1.24E-04	4.37E-02	2.27E-01	82.40
3	24.9655	1446	16.144	0.255	7.37E-03	1.48E-04	4.85E-02	2.52E-01	84.81
4	24.9356	1664	14.012	0.221	6.60E-03	1.32E-04	5.46E-02	2.84E-01	87.92
5	24.9032	1982	11.749	0.185	6.88E-03	1.56E-04	6.23E-02	3.23E-01	88.97
6	24.9733	2434	9.594	0.151	6.41E-03	1.92E-04	7.27E-02	3.76E-01	91.19
7	24.9434	3420	6.820	0.108	6.24E-03	2.66E-04	8.71E-02	4.50E-01	92.83
8	25.0239	6994	3.346	0.053	6.38E-03	2.74E-04	1.09E-01	4.97E-01	94.12

TABLE C.1i — Feed Specification: [NO$_3^-$] 3.75E-02 M, [QUAT] 1.93E-01 M, Water Flux Rate = 57.9461 l/m^2*hr, Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	Permeate [QUAT], (M)	Retentate [NO$_3^-$], (M)	Retentate [QUAT], (M)	[NO$_3^-$] Rejection, %
1	25.1926	1239	19.013	0.328	6.42E-03	1.44E-04	4.03E-02	2.10E-01	84.07
2	24.9166	1287	18.103	0.312	6.18E-03	1.08E-04	4.44E-02	2.31E-01	86.08
3	24.8937	1383	16.831	0.290	6.72E-03	1.17E-04	4.92E-02	2.57E-01	86.35
4	24.9414	1623	14.370	0.248	6.75E-03	1.26E-04	5.54E-02	2.90E-01	87.80
5	24.9517	1896	12.306	0.212	6.89E-03	1.58E-04	6.32E-02	3.30E-01	89.11
6	25.2445	2398	9.844	0.170	6.53E-03	2.18E-04	7.39E-02	3.86E-01	91.17
7	24.792	3457	6.706	0.116	6.62E-03	5.06E-04	8.86E-02	4.62E-01	92.52
8	25.0744	6966	3.366	0.058	6.34E-03	2.77E-04	1.11E-01	4.82E-01	94.28

APPENDIX C

TABLE 2C : EXPERIMENTAL DATA OF SULPHATE REJECTION STUDIES

[QUAT]:[NO$_3^-$]   =   10 : 1

TABLE C.2a   Feed Specification: [NO$_3^-$]   9.31E-03   M   Water Flux Rate   =   58.9348 l/m^2*hr
                                            [QUAT]   1.02E-01   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	24.8792	740	31.437	0.533	7.71E-04	8.50E-05	1.01E-02	1.11E-01	92.35
2	24.7884	745	31.112	0.528	9.26E-04	2.86E-05	1.11E-02	1.22E-01	91.63
3	24.9267	781	29.844	0.506	9.54E-04	4.31E-05	1.23E-02	1.36E-01	92.23
4	24.8778	858	27.112	0.460	8.94E-04	3.26E-05	1.38E-02	1.53E-01	93.53
5	24.8966	955	24.377	0.414	8.35E-04	3.29E-05	1.58E-02	1.74E-01	94.71
6	24.7867	1082	21.421	0.363	7.31E-04	3.86E-05	1.84E-02	2.03E-01	96.02
7	24.9089	1317	17.685	0.300	8.26E-04	5.02E-05	2.20E-02	2.43E-01	96.25
8	27.2552	1972	12.924	0.219	7.38E-04	7.33E-05	2.81E-02	2.71E-01	97.38

TABLE C.2b   Feed Specification: [NO$_3^-$]   9.88E-03   M   Water Flux Rate = 56.4863 l/m^2*hr

[QUAT]   1.04E-01   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	25.1449	747	31.475	0.557	7.72E-04	4.75E-05	1.07E-02	1.14E-01	92.79
2	24.8751	756	30.767	0.545	1.06E-03	2.88E-05	1.17E-02	1.25E-01	91.01
3	25.5459	809	29.527	0.523	9.34E-04	3.15E-05	1.31E-02	1.39E-01	92.87
4	24.9418	873	26.715	0.473	9.40E-04	3.03E-05	1.47E-02	1.57E-01	93.62
5	25.3450	968	24.483	0.433	9.04E-04	3.94E-05	1.69E-02	1.80E-01	94.64
6	26.4287	1112	22.224	0.393	8.39E-04	6.25E-05	1.99E-02	2.12E-01	95.78
7	24.795	1357	17.085	0.302	7.91E-04	5.11E-05	2.39E-02	2.54E-01	96.70
8	24.7822	1839	12.601	0.223	7.32E-04	7.13E-05	3.00E-02	2.61E-01	97.56

TABLE C.2c   Feed Specification: [NO$_3^-$]   1.02E-02   M   Water Flux Rate = 63.0153 l/m^2*hr

[QUAT]   9.62E-02   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	25.1687	740	31.803	0.505	8.74E-04	4.52E-05	1.11E-02	1.05E-01	92.09
2	24.9551	753	30.989	0.492	9.66E-04	2.73E-05	1.22E-02	1.15E-01	92.05
3	25.2872	801	29.520	0.468	1.02E-03	3.16E-05	1.35E-02	1.28E-01	92.47
4	24.9735	862	27.090	0.430	9.29E-04	2.86E-05	1.52E-02	1.45E-01	93.90
5	24.9483	965	24.174	0.384	8.54E-04	4.16E-05	1.74E-02	1.65E-01	95.09
6	24.9245	1106	21.072	0.334	9.23E-04	3.47E-05	2.03E-02	1.93E-01	95.45
7	24.9135	1331	17.502	0.278	8.02E-04	4.62E-05	2.44E-02	2.31E-01	96.71
8	25.0869	1780	13.179	0.209	7.42E-04	6.21E-05	3.05E-02	2.37E-01	97.57

TABLE C.2d Feed Specification: [NO$_3$] 1.12E-02 M Water Flux Rate = 79.3914 l/m^2*hr

[QUAT] 1.64E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3$] Rejection, %
					[NO$_3$], (M)	[QUAT], (M)	[NO$_3$], (M)	[QUAT], (M)	
1	25.1687	926	25.415	0.320	1.59E-03	9.33E-05	1.21E-02	1.79E-01	86.91
2	25.0334	962	24.332	0.306	1.55E-03	5.09E-05	1.33E-02	1.97E-01	88.36
3	24.9257	1023	22.783	0.287	1.77E-03	4.48E-05	1.48E-02	2.19E-01	88.03
4	24.8523	1152	20.172	0.254	1.76E-03	3.97E-05	1.66E-02	2.47E-01	89.40
5	24.8948	1220	19.081	0.240	1.64E-03	5.48E-05	1.90E-02	2.81E-01	91.38
6	24.8745	1588	14.647	0.184	1.52E-03	3.37E-05	2.22E-02	3.27E-01	93.17
7	24.7943	2188	10.596	0.133	1.56E-03	4.44E-05	2.66E-02	3.92E-01	94.15
8	24.8666	3794	6.129	0.077	1.19E-03	5.93E-05	3.32E-02	4.26E-01	96.43

TABLE C.2e Feed Specification: [NO$_3$] 1.13E-02 M Water Flux Rate = 67.6201 l/m^2*hr

[QUAT] 1.64E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3$] Rejection, %
					[NO$_3$], (M)	[QUAT], (M)	[NO$_3$], (M)	[QUAT], (M)	
1	24.9439	955	24.423	0.361	1.56E-03	6.38E-05	1.21E-02	1.87E-01	87.18
2	24.9069	999	23.313	0.345	1.57E-03	3.55E-05	1.34E-02	2.05E-01	88.24
3	24.9458	1065	21.902	0.324	1.62E-03	3.58E-05	1.48E-02	2.28E-01	89.08
4	24.8769	1196	19.449	0.288	1.67E-03	3.18E-05	1.67E-02	2.58E-01	89.96
5	24.8945	1364	17.066	0.252	1.61E-03	3.83E-05	1.90E-02	2.93E-01	91.53
6	25.2153	1689	13.960	0.206	1.52E-03	4.88E-05	2.22E-02	3.42E-01	93.16
7	26.5207	2409	10.294	0.152	1.40E-03	5.61E-05	2.70E-02	4.15E-01	94.80
8	24.8984	4158	5.599	0.083	1.19E-03	7.68E-05	3.39E-02	4.28E-01	96.48

TABLE C.2f   Feed Specification: [NO$_3$$^-$]   1.11E-02   M   Water Flux Rate = 71.6906 l/m^2*hr

[QUAT]   1.59E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3$$^-$] Rejection, %
					[NO$_3$$^-$], (M)	[QUAT], (M)	[NO$_3$$^-$], (M)	[QUAT], (M)	
1	24.9230	963	24.200	0.338	1.59E-03	5.54E-05	1.19E-02	1.73E-01	86.67
2	24.9072	1004	23.197	0.324	1.58E-03	3.39E-05	1.31E-02	1.90E-01	87.90
3	25.4482	1112	21.399	0.298	1.69E-03	3.20E-05	1.46E-02	2.12E-01	88.37
4	25.0637	1258	18.630	0.260	1.70E-03	3.51E-05	1.64E-02	2.40E-01	89.65
5	26.2117	1553	15.782	0.220	1.65E-03	3.90E-05	1.89E-02	2.74E-01	91.26
6	25.3694	1848	12.837	0.179	1.55E-03	4.43E-05	2.21E-02	3.21E-01	93.01
7	25.8782	2544	9.512	0.133	1.37E-03	5.86E-05	2.68E-02	3.89E-01	94.91
8	24.9847	4643	5.032	0.070	1.24E-03	9.76E-05	3.38E-02	3.90E-01	96.34

TABLE C.2g   Feed Specification: [NO$_3$$^-$]   2.34E-02   M   Water Flux Rate = 63.4675 l/m^2*hr

[QUAT]   1.84E-01   M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3$$^-$] Rejection, %
					[NO$_3$$^-$], (M)	[QUAT], (M)	[NO$_3$$^-$], (M)	[QUAT], (M)	
1	24.8456	1191	19.507	0.307	3.64E-03	9.02E-05	2.52E-02	2.00E-01	85.53
2	25.4256	1297	18.330	0.289	4.11E-03	5.24E-05	2.77E-02	2.21E-01	85.15
3	25.9211	1475	16.432	0.259	4.06E-03	5.87E-05	3.09E-02	2.46E-01	86.85
4	24.9261	1661	14.032	0.221	4.07E-03	5.72E-05	3.47E-02	2.78E-01	88.30
5	24.9383	2034	11.465	0.181	4.02E-03	6.91E-05	3.97E-02	3.17E-01	89.89
6	24.9181	2726	8.547	0.135	3.54E-03	8.74E-05	4.65E-02	3.70E-01	92.37
7	26.9369	5125	4.915	0.077	3.20E-03	1.49E-04	5.67E-02	4.51E-01	94.36
8	17.6961	-	-	-	2.86E-03	1.57E-04	6.67E-02	4.48E-01	95.71

TABLE C.2h Feed Specification: [NO$_3^-$] 2.35E-02 M Water Flux Rate = 63.5014 l/m^2*hr
[QUAT] 1.96E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	25.5825	1204	19.868	0.313	3.62E-03	1.16E-04	2.53E-02	2.15E-01	85.69
2	26.4751	1371	18.057	0.284	3.96E-03	7.94E-05	2.80E-02	2.37E-01	85.83
3	24.8883	1426	16.320	0.257	4.07E-03	5.34E-05	3.11E-02	2.64E-01	86.91
4	24.8663	1666	13.957	0.220	4.11E-03	6.54E-05	3.50E-02	2.99E-01	88.27
5	24.8621	2049	11.346	0.179	4.03E-03	6.36E-05	4.01E-02	3.40E-01	89.94
6	25.5091	2585	9.227	0.145	3.98E-03	8.60E-05	4.70E-02	3.98E-01	91.52
7	27.2505	5205	4.895	0.077	3.60E-03	1.56E-04	5.76E-02	4.88E-01	93.76
8	17.2742	-	-	-	3.26E-03	1.66E-04	6.76E-02	4.61E-01	95.18

TABLE C.2i Feed Specification: [NO$_3^-$] 2.42E-02 M Water Flux Rate = 64.7836 l/m^2*hr
[QUAT] 1.97E-01 M Filtration Area = 38.5 cm^2

Retentate No	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	24.8633	1165	19.956	0.308	4.50E-03	1.03E-04	2.60E-02	2.14E-01	82.71
2	25.6103	1289	18.578	0.287	4.45E-03	7.18E-05	2.87E-02	2.36E-01	84.50
3	24.9279	1383	16.854	0.260	4.33E-03	6.72E-05	3.19E-02	2.63E-01	86.41
4	24.9464	1652	14.120	0.218	4.33E-03	6.81E-05	3.59E-02	2.97E-01	87.94
5	25.7165	2082	11.550	0.178	4.39E-03	8.55E-05	4.12E-02	3.39E-01	89.33
6	25.3271	2597	9.119	0.141	4.26E-03	1.08E-04	4.82E-02	3.97E-01	91.17
7	24.9101	4835	4.817	0.074	3.86E-03	1.73E-04	5.80E-02	4.77E-01	93.35
8	19.6201	-	-	-	3.20E-03	4.04E-04	6.93E-02	4.63E-01	95.38

APPENDIX C

TABLE 3C : EXPERIMENTAL DATA OF NITRATE REJECTION STUDIES

$$[QUAT]:[NO_3^-] \quad = \quad 20:1$$

TABLE C.3a   Feed Specification: $[NO_3^-]$ 4.75E-03   M   Water Flux Rate   =   54.9995 l/m^2*hr

$[QUAT]$ 9.58E-02   M   Filtration Area   =   38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[NO_3^-]$ Rejection, %
					$[NO_3^-]$, (M)	$[QUAT]$, (M)	$[NO_3^-]$, (M)	$[QUAT]$, (M)	
1	24.9319	777	30.004	0.546	3.17E-04	4.98E-05	5.15E-03	1.04E-01	93.86
2	24.9818	778	30.025	0.546	4.37E-04	2.36E-05	5.66E-03	1.15E-01	92.27
3	24.9609	812	28.744	0.523	2.77E-04	2.86E-05	6.30E-03	1.28E-01	95.61
4	24.9518	904	25.809	0.469	2.79E-04	2.10E-05	7.09E-03	1.44E-01	96.07
5	24.8344	1002	23.175	0.421	2.66E-04	2.16E-05	8.09E-03	1.64E-01	96.71
6	24.9045	1188	19.602	0.356	2.52E-04	2.68E-05	9.43E-03	1.91E-01	97.32
7	24.8619	1465	15.869	0.289	2.52E-04	4.35E-05	1.13E-02	2.29E-01	97.77
8	24.9322	1974	11.810	0.215	2.50E-04	4.56E-05	1.41E-02	2.49E-01	98.23

TABLE C.3b   Feed Specification: [NO$_3^-$]   5.21E-03   M   Water Flux Rate   =   54.4585 l/m^2*hr

[QUAT]   9.76E-02   M   Filtration Area   =   38.5   cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	25.2330	777	30.366	0.558	3.12E-04	2.74E-05	5.66E-03	1.07E-01	94.49
2	26.3566	778	31.678	0.582	3.07E-04	1.93E-05	6.26E-03	1.18E-01	95.10
3	25.0253	812	28.818	0.529	2.95E-04	2.23E-05	6.96E-03	1.31E-01	95.77
4	24.8685	904	25.723	0.472	2.72E-04	1.95E-05	7.84E-03	1.48E-01	96.54
5	25.3265	1002	23.635	0.434	2.35E-04	2.96E-05	8.99E-03	1.69E-01	97.39
6	26.1104	1188	20.551	0.377	2.33E-04	3.15E-05	1.06E-02	1.99E-01	97.80
7	25.9156	1465	16.541	0.304	2.29E-04	3.88E-05	1.29E-02	2.42E-01	98.22
8	24.7867	1974	11.741	0.216	2.16E-04	4.93E-05	1.62E-02	2.44E-01	98.67

TABLE C.3c   Feed Specification: [NO$_3^-$]   5.01E-03   M   Water Flux Rate   =   52.7871 l/m^2*hr

[QUAT]   9.82E-02   M   Filtration Area   =   38.5   cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		[NO$_3^-$] Rejection, %
					[NO$_3^-$], (M)	[QUAT], (M)	[NO$_3^-$], (M)	[QUAT], (M)	
1	24.9139	781	29.829	0.565	3.03E-04	5.64E-05	5.43E-03	1.07E-01	94.41
2	24.8195	788	29.452	0.558	3.22E-04	2.01E-05	5.97E-03	1.18E-01	94.61
3	24.8707	827	28.121	0.533	2.93E-04	2.59E-05	6.63E-03	1.31E-01	95.57
4	24.7855	904	25.637	0.486	2.79E-04	1.99E-05	7.45E-03	1.48E-01	96.26
5	25.7738	1052	22.909	0.434	2.57E-04	2.21E-05	8.55E-03	1.68E-01	97.00
6	25.4781	1165	20.450	0.387	2.36E-04	3.06E-05	1.00E-02	1.97E-01	97.64
7	24.9762	1404	16.634	0.315	2.27E-04	2.92E-05	1.20E-02	2.37E-01	98.11
8	24.9438	2036	11.456	0.217	2.23E-04	4.60E-05	1.50E-02	2.42E-01	98.52

TABLE C.3d Feed Specification: [NO₃⁻] 7.26E-03 M Water Flux Rate = 59.7127 l/m²*hr
[QUAT] 1.68E-01 M Filtration Area = 38.5 cm²

TABLE_C.3d: Feed Specification: $[NO_3^-]$ 7.26E-03 M; $[QUAT]$ 1.68E-01 M; Water Flux Rate = 59.7127 l/m^2*hr; Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[NO_3^-]$ Rejection, %
					$[NO_3^-]$, (M)	$[QUAT]$, (M)	$[NO_3^-]$, (M)	$[QUAT]$, (M)	
1	24.9141	968	24.066	0.403	4.87E-04	9.54E-05	7.87E-03	1.83E-01	93.82
2	25.0853	1054	22.255	0.373	4.58E-04	6.40E-05	8.67E-03	2.02E-01	94.72
3	24.9028	1097	21.227	0.355	4.65E-04	7.19E-05	9.63E-03	2.24E-01	95.17
4	24.9140	1266	18.401	0.308	4.65E-04	5.52E-05	1.08E-02	2.53E-01	95.71
5	24.8302	1530	15.175	0.254	4.41E-04	5.26E-05	1.24E-02	2.87E-01	96.43
6	24.8504	1892	12.282	0.206	4.18E-04	5.84E-05	1.44E-02	3.35E-01	97.10
7	28.1239	2727	9.643	0.161	4.09E-04	9.34E-05	1.77E-02	4.12E-01	97.69
8	24.8926	5172	4.500	0.075	4.02E-04	1.59E-04	2.22E-02	4.35E-01	98.19

TABLE_C.3e: Feed Specification: $[NO_3^-]$ 7.23E-03 M; $[QUAT]$ 1.72E-01 M; Water Flux Rate = 55.701 l/m^2*hr; Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate		Retentate		$[NO_3^-]$ Rejection, %
					$[NO_3^-]$, (M)	$[QUAT]$, (M)	$[NO_3^-]$, (M)	$[QUAT]$, (M)	
1	24.9108	1060	21.975	0.395	4.63E-04	6.43E-05	7.84E-03	1.88E-01	94.10
2	24.8808	1104	21.074	0.378	5.07E-04	5.17E-05	8.62E-03	2.07E-01	94.12
3	25.0828	1205	19.464	0.349	4.53E-04	6.54E-05	9.58E-03	2.30E-01	95.27
4	24.9357	1371	17.007	0.305	4.46E-04	4.73E-05	1.08E-02	2.60E-01	95.86
5	24.8950	1625	14.325	0.257	4.37E-04	7.10E-05	1.23E-02	2.95E-01	96.45
6	25.1440	2032	11.571	0.208	4.11E-04	9.23E-05	1.44E-02	3.45E-01	97.14
7	24.5110	2841	8.067	0.145	3.99E-04	1.22E-04	1.72E-02	4.12E-01	97.67
8	24.8142	5717	4.059	0.073	3.98E-04	1.62E-04	2.14E-02	4.31E-01	98.14

TABLE C.3f Feed Specification: [NO$_3^-$] 7.10E-03 M Water Flux Rate = 52.1273 l/m^2*hr

[QUAT] 1.59E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	Permeate [QUAT], (M)	Retentate [NO$_3^-$], (M)	Retentate [QUAT], (M)	[NO$_3^-$] Rejection, %
1	25.2588	984	24.003	0.460	4.41E-04	6.13E-05	7.71E-03	1.74E-01	94.29
2	25.0545	1083	21.632	0.415	4.12E-04	4.67E-05	8.49E-03	1.91E-01	95.14
3	25.5304	1164	20.509	0.393	4.09E-04	3.91E-05	9.46E-03	2.13E-01	95.68
4	25.1396	1271	18.495	0.355	4.43E-04	4.20E-05	1.07E-02	2.41E-01	95.84
5	24.8339	1574	14.753	0.283	4.33E-04	4.73E-05	1.22E-02	2.74E-01	96.44
6	24.7901	1945	11.918	0.229	4.11E-04	5.87E-05	1.42E-02	3.20E-01	97.10
7	24.8745	2825	8.233	0.158	4.07E-04	8.33E-05	1.70E-02	3.84E-01	97.61
8	24.7615	6106	3.792	0.073	4.03E-04	1.67E-04	2.13E-02	3.91E-01	98.10

TABLE C.3g Feed Specification: [NO$_3^-$] 9.88E-03 M Water Flux Rate = 56.3323 l/m^2*hr

[QUAT] 1.94E-01 M Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3^-$], (M)	Permeate [QUAT], (M)	Retentate [NO$_3^-$], (M)	Retentate [QUAT], (M)	[NO$_3^-$] Rejection, %
1	24.8845	1250	18.615	0.330	9.17E-04	1.24E-04	1.07E-02	2.12E-01	91.42
2	24.8596	1331	17.465	0.310	9.18E-04	9.38E-05	1.18E-02	2.33E-01	92.19
3	26.1116	1581	15.443	0.274	9.37E-04	1.02E-04	1.31E-02	2.60E-01	92.85
4	23.9011	1827	12.233	0.217	9.31E-04	9.31E-05	1.47E-02	2.93E-01	93.66
5	24.7460	2278	10.158	0.180	8.91E-04	9.76E-05	1.68E-02	3.32E-01	94.69
6	24.9189	3265	7.137	0.127	8.33E-04	1.23E-04	1.95E-02	3.87E-01	95.74
7	24.8643	6973	3.334	0.059	8.10E-04	2.11E-04	2.34E-02	4.64E-01	96.54
8	10.9244	-	-	-	7.96E-04	5.54E-04	2.57E-02	4.54E-01	96.91

TABLE C.3h Feed Specification: [NO$_3$$^-$] 9.70E-03 M   Water Flux Rate = 55.1144 l/m^2*hr
[QUAT] 1.93E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3$$^-$], (M)	[QUAT], (M)	Retentate [NO$_3$$^-$], (M)	[QUAT], (M)	[NO$_3$$^-$] Rejection, %
1	24.9933	1304	17.922	0.325	9.18E-04	8.24E-05	1.05E-02	2.11E-01	91.26
2	23.8013	1401	15.886	0.288	8.61E-04	6.28E-05	1.15E-02	2.31E-01	92.51
3	24.8708	1622	14.338	0.260	8.61E-04	8.52E-05	1.28E-02	2.56E-01	93.25
4	24.8840	1953	11.914	0.216	8.85E-04	7.89E-05	1.43E-02	2.89E-01	93.83
5	24.8316	2488	9.332	0.169	8.86E-04	9.86E-05	1.64E-02	3.28E-01	94.58
6	25.2182	3640	6.478	0.118	8.28E-04	1.66E-04	1.91E-02	3.83E-01	95.66
7	24.5676	7783	2.952	0.054	8.17E-04	2.43E-04	2.28E-02	4.57E-01	96.42
8	9.0527	-	-	-	8.17E-04	6.09E-04	2.47E-02	4.30E-01	96.69

TABLE C.3i Feed Specification: [NO$_3$$^-$] 9.93E-03 M   Water Flux Rate = 54.0039 l/m^2*hr
[QUAT] 1.90E-01 M   Filtration Area = 38.5 cm^2

Retentate No.	Permeate Weight (g)	Time Interval (sec)	Solution Flux (l/m^2*hr)	Relative Flux	Permeate [NO$_3$$^-$], (M)	[QUAT], (M)	Retentate [NO$_3$$^-$], (M)	[QUAT], (M)	[NO$_3$$^-$] Rejection, %
1	24.8038	1286	18.035	0.334	9.01E-04	8.07E-05	1.07E-02	2.07E-01	91.61
2	24.8699	1398	16.634	0.308	9.02E-04	5.96E-05	1.18E-02	2.28E-01	92.36
3	24.9356	1603	14.545	0.269	9.05E-04	6.48E-05	1.31E-02	2.53E-01	93.10
4	25.9713	1965	12.359	0.229	9.16E-04	7.45E-05	1.48E-02	2.87E-01	93.82
5	25.5352	2518	9.483	0.176	8.72E-04	9.38E-05	1.70E-02	3.28E-01	94.87
6	24.8600	3658	6.355	0.118	8.37E-04	1.33E-04	1.99E-02	3.82E-01	95.78
7	24.8668	8678	2.679	0.050	8.12E-04	2.59E-04	2.38E-02	4.59E-01	96.59
8	6.8269	-	-	-	8.01E-04	6.91E-04	2.53E-02	4.06E-01	96.84

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