



เอกสารอ้างอิง

ภาษาไทย

- ธงชัย สกพัฒนาสุข, "การกักัณเตรคสสำหรับน้ำดื่ม โดยกระบวนการแลกเปลี่ยนไอออน,"
วิทยานิพนธ์ปริญญามหาบัณฑิต, ภาควิชาวิศวกรรมสุขาภิบาล บัณฑิตวิทยาลัยจุฬาลงกรณ์
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- มันลีน คัญลเวศม์, วิศวกรรมการประปา เล่ม 2, ภาควิชาวิศวกรรมสุขาภิบาล คณะ-
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- อุสาหะ ต้นอุลีน, "การนำกรดโครมิกจากน้ำทิ้งที่มาจากโครเมียมกลับมาใช้อีกด้วยวิธีแลกเปลี่ยนไอออน," วิทยานิพนธ์ปริญญามหาบัณฑิต, ภาควิชาวิศวกรรมสุขาภิบาล บัณฑิต
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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



ภาคผนวก

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



ภาคผนวก ก

ข้อมูลต่าง ๆ จากการทดลอง

ศูนย์วิจัยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ตารางที่ ก-1

TEST NO. 1 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 58.11 Kg /cu m
 REGENERATION EFFICIENCY 70.68 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca	Mg	HARDNESS	pH
	mg /l	mg /l	mg /l	
20.00	2.37	0.91	3.28	7.35
40.00	2.10	0.99	3.09	7.20
60.00	2.22	0.99	3.21	7.30
80.00	1.92	0.95	2.97	7.20
100.00	2.20	1.03	3.23	7.30
117.57	5.91	9.84	15.83	7.30
RAW WATER	336.05	158.20	494.25	7.30

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-2

TEST NO. 2 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 54.73 Kg /cu m
 REGENERATION EFFICIENCY 66.57 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.60	1.03	3.63	7.30
40.00	2.02	1.03	3.05	7.35
60.00	2.12	0.99	3.11	7.20
80.00	2.50	0.99	3.49	7.25
100.00	2.57	1.23	3.80	7.40
107.14	4.00	4.69	8.69	7.30
RAW WATER	337.08	173.72	510.80	7.35

UNIT : Ca, Mg, HARDNESS in mg /l calcium carbonate

ตารางที่ ๓-3

TEST NO. 3 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu .m .
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 58.48 Kg /cu m
 REGENERATION EFFICIENCY 71.13 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.52	1.19	3.17	7.40
40.00	2.47	1.19	3.66	7.40
60.00	2.55	1.07	3.62	7.40
80.00	2.17	0.95	3.12	7.55
100.00	2.10	1.19	3.29	7.45
115.66	4.52	5.89	10.41	7.40
RAW WATER	332.95	172.68	505.63	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-4

TEST NO. 4 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 59.36 Kg /cu m
 REGENERATION EFFICIENCY 72.21 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.37	0.99	3.36	7.50
40.00	2.40	1.03	3.43	7.45
60.00	2.10	0.91	3.01	7.45
80.00	2.32	0.99	3.31	7.55
100.00	2.17	1.03	3.20	7.60
115.51	4.92	7.78	12.70	7.50
RAW WATER	340.19	173.71	513.90	7.55

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-5

TEST NO. 5 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu .m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 56.09 Kg /cu .m
 REGENERATION EFFICIENCY 68.23 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.52	1.23	3.75	7.45
40.00	2.25	1.15	3.40	7.45
60.00	2.10	1.11	3.21	7.40
80.00	2.17	1.11	3.28	7.30
100.00	2.42	1.40	3.82	7.35
109.36	4.20	5.89	10.09	7.40
RAW WATER	335.02	177.84	512.86	7.40

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-6

TEST NO. 6 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 55.56 Kg /cu m
 REGENERATION EFFICIENCY 67.58 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.30	1.23	3.53	7.30
40.00	2.37	1.23	3.60	7.30
60.00	2.32	1.15	3.47	7.55
80.00	2.35	1.32	3.67	7.40
100.00	2.87	1.44	4.31	7.50
109.22	4.20	5.89	10.09	7.40
RAW WATER	341.22	167.51	508.73	7.35

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ๖-7

TEST NO. 7 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 57.13 Kg /cu m
 REGENERATION EFFICIENCY 69.49 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.45	1.15	3.60	7.30
40.00	2.10	1.07	3.17	7.30
60.00	2.32	1.19	3.51	7.50
80.00	2.07	1.07	3.14	7.50
100.00	2.15	1.23	3.38	7.55
111.62	4.50	5.64	10.14	7.50
RAW WATER	332.95	178.88	511.83	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-8

TEST NO. 8 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 55.38 Kg /cu m
 REGENERATION EFFICIENCY 67.36 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	3.02	1.52	4.54	7.25
40.00	2.80	1.52	4.32	7.20
60.00	2.85	1.40	4.25	7.25
80.00	2.57	1.32	3.89	7.25
100.00	2.47	1.65	4.12	7.20
107.97	7.64	13.13	20.77	7.25
RAW WATER	340.19	178.67	512.86	7.35

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-9

TEST NO. 9 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 54.63 Kg /cu m
 REGENERATION EFFICIENCY 66.45 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	2.87	1.48	4.35	7.35
40.00	2.40	1.44	3.84	7.45
60.00	2.47	1.44	3.91	7.45
80.00	2.40	1.44	3.84	7.50
100.00	2.47	1.77	4.24	7.55
106.08	4.84	6.63	11.47	7.50
RAW WATER	338.12	176.81	514.93	7.55

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-10

TEST NO. 10 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 52.21 Kg /cu m
 REGENERATION EFFICIENCY 63.51 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	3.75	1.65	5.40	7.35
40.00	3.50	1.65	5.15	7.30
60.00	4.50	2.47	6.97	7.40
80.00	3.60	1.51	5.11	7.35
100.00	3.25	1.65	4.90	7.30
109.74	7.24	4.94	12.18	7.45
RAW WATER	328.06	147.68	475.74	7.40

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-11

TEST NO. 11 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 49.28 Kg /cu m
 REGENERATION EFFICIENCY 59.94 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	3.50	1.65	5.15	7.40
40.00	3.50	1.65	5.15	7.50
60.00	3.50	1.65	5.15	7.50
80.00	3.25	1.65	4.90	7.55
100.00	4.50	2.47	6.97	7.50
104.95	9.49	5.35	15.34	7.55
RAW WATER	340.33	129.28	469.61	7.60

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-12

TEST NO. 12 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 54.19 Kg /cu m
 REGENERATION EFFICIENCY 65.92 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	3.50	1.65	5.15	7.45
40.00	3.25	1.65	4.90	7.50
60.00	3.50	1.65	5.15	7.40
80.00	3.25	1.24	4.49	7.55
100.00	3.50	1.65	5.15	7.55
106.90	7.24	4.94	12.18	7.60
RAW WATER	341.35	165.56	506.91	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-13

TEST NO. 13 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 55.05 Kg /cu m
 REGENERATION EFFICIENCY 66.96 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	3.00	1.24	4.24	7.50
40.00	2.75	1.24	3.99	7.55
60.00	2.75	1.24	3.99	7.55
80.00	2.75	1.24	3.99	7.65
100.00	3.25	1.65	4.90	7.65
107.51	9.49	11.12	20.61	7.60
RAW WATER	337.26	174.76	512.02	7.60

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-14

TEST NO. 15 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 45.73 Kg /cu m
 REGENERATION EFFICIENCY 55.63 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.13	7.30
40.00	ND	ND	0.13	7.35
60.00	ND	ND	0.19	7.30
80.00	1.25	1.65	2.90	7.35
89.84	5.24	9.47	14.71	7.30
RAW WATER	339.30	169.66	508.96	7.30

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-15

TEST NO. 16 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 47.53 Kg /cu m
 REGENERATION EFFICIENCY 57.82 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.19	7.50
40.00	ND	ND	0.13	7.55
60.00	ND	ND	0.13	7.40
80.00	1.25	1.65	2.90	7.55
91.46	4.25	8.65	12.90	7.50
RAW WATER	336.24	183.45	519.69	7.55

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-16

TEST NO. 17 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 46.46 Kg /cu m
 REGENERATION EFFICIENCY 56.51 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.13	7.50
40.00	ND	ND	0.13	7.50
60.00	ND	ND	0.19	7.70
80.00	0.75	1.65	2.40	7.55
91.29	4.00	8.23	12.23	7.65
RAW WATER	331.17	175.79	509.96	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-17

TEST NO. 18 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 46.39 Kg /cu m
 REGENERATION EFFICIENCY 56.43 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.13	7.55
40.00	ND	ND	0.13	7.60
60.00	ND	ND	0.13	7.60
80.00	1.25	1.65	2.90	7.60
90.07	4.25	9.47	13.72	7.50
RAW WATER	339.30	175.79	515.09	7.60

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-18

TEST NO. 19 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 44.13 Kg /cu m
 REGENERATION EFFICIENCY 53.68 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.13	7.45
40.00	ND	ND	0.13	7.50
60.00	ND	ND	0.39	7.45
80.00	2.75	4.12	6.87	7.35
84.17	4.00	8.65	12.65	7.40
RAW WATER	342.37	181.92	527.29	7.45

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-19

TEST NO. 20 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 44.19 Kg /cu m
 REGENERATION EFFICIENCY 53.75 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.19	7.45
40.00	ND	ND	0.13	7.50
60.00	ND	ND	0.13	7.40
80.00	1.25	2.06	3.31	7.40
86.47	3.75	8.23	11.98	7.50
RAW WATER	336.24	177.76	511.00	7.55

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-20

TEST NO. 21 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 41.97 Kg /cu m
 REGENERATION EFFICIENCY 51.05 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.19	7.30
40.00	ND	ND	0.13	7.40
60.00	ND	ND	0.38	7.35
80.00	2.25	3.71	5.96	7.40
82.13	4.00	7.82	11.82	7.40
RAW WATER	335.22	175.78	511.00	7.40

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-21

TEST NO. 22 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 48.8 Kg /cu m
 REGENERATION EFFICIENCY 59.36 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.25	7.50
40.00	ND	ND	0.13	7.55
60.00	ND	ND	0.13	7.50
80.00	0.50	0.82	1.32	7.50
96.34	3.75	8.23	11.98	7.45
RAW WATER	333.58	172.89	506.47	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-22

TEST NO. 23 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 45.34 Kg /cu m
 REGENERATION EFFICIENCY 55.15 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.13	7.50
40.00	ND	ND	0.13	7.55
60.00	ND	ND	0.25	7.50
80.00	1.35	2.06	3.31	7.45
88.99	3.25	9.88	13.13	7.45
RAW WATER	333.58	175.94	509.52	7.55

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-23

TEST NO. 24 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 43.89 Kg /cu m
 REGENERATION EFFICIENCY 53.39 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.19	7.50
40.00	ND	ND	0.13	7.45
60.00	ND	ND	0.25	7.50
80.00	2.29	2.66	4.95	7.55
85.64	4.06	7.62	11.68	7.55
RAW WATER	339.68	172.89	512.57	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-24

TEST NO. 25 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM Na
 RAW WATER A
 REGENERANT 10% NaCl(W/V)
 REGENERATION LEVEL 96 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 43.80 Kg /cu m
 REGENERATION EFFICIENCY 53.28 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT			
	Ca mg /l	Mg mg /l	HARDNESS mg /l	pH
20.00	ND	ND	0.19	7.50
40.00	ND	ND	0.13	7.50
60.00	ND	ND	0.25	7.45
80.00	2.00	2.88	4.88	7.45
86.84	3.50	9.47	12.97	7.50
RAW WATER	334.59	169.84	504.43	7.50

UNIT : Ca,Mg,HARDNESS in mg /l calcium carbonate

ตารางที่ ก-25

TEST NO. 26 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 69.49 Kg /cu m
 REGENERATION EFFICIENCY 45.20 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	ng /l	ng /l	ng /l	ng /l	Micronhos/cm	ng /l	ng /l	
20.00	ND	ND	0.51	5.21	2790.00	375.25	0.00	2.45
40.00	ND	ND	0.51	5.21	2770.00	373.50	0.00	2.45
60.00	ND	ND	0.51	4.95	2810.00	375.25	0.00	2.45
80.00	ND	ND	0.51	5.11	2800.00	375.00	0.00	2.45
100.00	ND	ND	0.51	5.15	2820.00	373.50	0.00	2.45
120.00	ND	ND	0.51	10.88	2790.00	369.25	0.00	2.40
137.20	ND	ND	0.76	40.70	2680.00	337.75	0.00	2.45
RAW WATER	249.17	133.22	382.39	124.08	1034.00	0.00	121.00	7.40

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in ng /l calcium carbonate

ตารางที่ ก-26

TEST NO. 27 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 69.78 Kg /cu m
 REGENERATION EFFICIENCY 45.39 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	BV	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l	
20.00	ND	ND	0.51	5.01	2800.00	375.00	0.00	2.45	
40.00	ND	ND	0.51	5.17	2810.00	376.50	0.00	2.45	
60.00	ND	ND	0.51	5.20	2820.00	374.25	0.00	2.45	
80.00	ND	ND	0.51	4.86	2820.00	375.75	0.00	2.45	
100.00	ND	ND	0.64	4.93	2780.00	374.00	0.00	2.40	
120.00	ND	ND	0.51	11.75	2770.00	368.25	0.00	2.45	
137.77	ND	ND	0.76	36.90	2620.00	331.00	0.00	2.45	
RAW WATER	249.17	133.22	382.39	124.08	989.00	0.00	122.00	7.40	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-27

TEST NO. 28 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 68.84 Kg /cu m
 REGENERATION EFFICIENCY 44.78 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	ng /l	ng /l	ng /l	ng /l	ng /l	Micromhos/cm	ng /l	ng /l	
20.00	ND	ND	0.51	4.88	2830.00	378.00	0.00	2.45	
40.00	ND	ND	0.51	4.92	2870.00	379.50	0.00	2.45	
60.00	ND	ND	0.51	4.94	2800.00	378.50	0.00	2.45	
80.00	ND	ND	0.51	5.10	2850.00	379.25	0.00	2.40	
100.00	ND	ND	0.51	4.98	2780.00	377.50	0.00	2.45	
120.00	ND	ND	0.64	9.90	2810.00	376.75	0.00	2.45	
133.14	ND	ND	0.76	41.15	2690.00	347.25	0.00	2.45	
RAW WATER	252.22	134.24	386.46	130.61	1024.00	0.00	127.00	7.30	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in ng /l calcium carbonate

ตารางที่ ก-28

TEST NO. 29 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 68.87 Kg /cu m
 REGENERATION EFFICIENCY 44.80 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	ALK. mg /l	pH
20.00	ND	ND	0.51	4.82	2820.00	374.75	0.00	2.40
40.00	ND	ND	0.51	4.75	2810.00	374.00	0.00	2.40
60.00	ND	ND	0.51	5.00	2830.00	374.50	0.00	2.40
80.00	ND	ND	0.51	4.85	2830.00	375.50	0.00	2.45
100.00	ND	ND	0.34	4.70	2850.00	375.75	0.00	2.40
120.00	ND	ND	0.51	10.27	2760.00	367.75	0.00	2.45
136.25	ND	ND	0.51	38.50	2680.00	335.75	0.00	2.45
RAW WATER	254.25	127.13	381.38	124.08	992.00	0.00	123.50	7.40

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-29

TEST NO. 30 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 70.92 Kg /cu m
 REGENERATION EFFICIENCY 46.13 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	ng /l	ng /l	ng /l	ng /l	Micromhos/cm	ng /l	ng /l	
20.00	ND	ND	0.51	4.83	2720.00	376.50	0.00	2.45
40.00	ND	ND	0.51	4.83	2740.00	377.25	0.00	2.45
60.00	ND	ND	0.51	4.77	2730.00	377.75	0.00	2.45
80.00	ND	ND	0.34	4.91	2720.00	377.00	0.00	2.45
100.00	ND	ND	0.34	5.01	2720.00	376.25	0.00	2.40
120.00	ND	ND	0.51	9.80	2720.00	369.50	0.00	2.45
138.56	ND	ND	0.76	42.35	2680.00	335.75	0.00	2.45
RAW WATER	255.27	128.14	383.41	128.43	1044.00	0.00	126.00	7.30

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in ng /l calcium carbonate

ตารางที่ ก-30

TEST NO. 31 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 69.57 Kg /cu m
 REGENERATION EFFICIENCY 45.25 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	ng /l	ng /l	ng /l	ng /l	Micronhos/cm	ng /l	ng /l		
20.00	ND	ND	0.51	4.61	2790.00	376.50	0.00	2.40	
40.00	ND	ND	0.51	4.81	2790.00	377.25	0.00	2.40	
60.00	ND	ND	0.34	4.73	2770.00	377.25	0.00	2.45	
80.00	ND	ND	0.51	4.77	2800.00	376.75	0.00	2.40	
100.00	ND	ND	0.51	4.77	2830.00	376.50	0.00	2.45	
120.00	ND	ND	0.51	13.63	2820.00	367.00	0.00	2.45	
137.09	ND	ND	0.76	40.71	2610.00	333.75	0.00	2.45	
RAW WATER	253.23	130.18	383.41	124.08	988.00	0.00	120.50	7.50	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in ng /l calcium carbonate

ตารางที่ ก-31

TEST NO. 32 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 65.92 Kg /cu m
 REGENERATION EFFICIENCY 42.88 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	ng /l	ng /l	ng /l	ng /l	ng /l	Micromhos/cm	ng /l	ng /l	
20.00	ND	ND	0.51	5.21	2840.00	377.25	0.00	2.45	
40.00	ND	ND	0.51	5.69	2780.00	376.50	0.00	2.45	
60.00	ND	ND	0.51	5.65	2770.00	376.25	0.00	2.45	
80.00	ND	ND	0.51	5.57	2790.00	378.00	0.00	2.40	
100.00	ND	ND	0.51	5.57	2760.00	376.75	0.00	2.45	
120.00	ND	ND	0.76	12.11	2780.00	368.00	0.00	2.40	
129.64	ND	ND	0.89	41.40	2670.00	337.00	0.00	2.45	
RAW WATER	258.32	126.11	384.43	124.08	1040.00	0.00	123.50	7.35	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-32

TEST NO. 33 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 65.18 Kg /cu m
 REGENERATION EFFICIENCY 42.40 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	BV	ng /l	ng /l	ng /l	ng /l	Micromhos/cm	ng /l	ng /l	
20.00	ND	ND	0.51	5.31	2870.00	384.00	0.00	2.40	
40.00	ND	ND	0.51	5.25	2870.00	382.50	0.00	2.40	
60.00	ND	ND	0.51	5.20	2880.00	382.75	0.00	2.40	
80.00	ND	ND	0.64	5.44	2810.00	382.50	0.00	2.40	
100.00	ND	ND	0.51	5.54	2820.00	383.50	0.00	2.40	
120.00	ND	ND	0.76	13.49	2830.00	379.00	0.00	2.40	
125.97	ND	ND	0.76	37.82	2750.00	345.00	0.00	2.45	
RAW WATER	253.23	137.98	391.21	126.26	1040.00	0.00	124.00	7.35	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in ng /l calcium carbonate

ตารางที่ ก-33

TEST NO. 34 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 67.57 Kg /cu m
 REGENERATION EFFICIENCY 43.95 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	ALK. mg /l	pH
20.00	ND	ND	0.51	5.14	2820.00	374.50	0.00	2.45
40.00	ND	ND	0.51	5.56	2810.00	374.75	0.00	2.45
60.00	ND	ND	0.64	5.43	2780.00	373.25	0.00	2.45
80.00	ND	ND	0.51	5.56	2770.00	374.75	0.00	2.45
100.00	ND	ND	0.51	5.24	2800.00	374.00	0.00	2.45
120.00	ND	ND	0.64	9.97	2840.00	364.25	0.00	2.45
133.40	ND	ND	0.76	42.00	2690.00	337.50	0.00	2.45
RAW WATER	256.28	126.11	382.39	124.08	1030.00	0.00	126.25	7.25

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-34

TEST NO. 61 CO-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 67.23 Kg /cu m
 REGENERATION EFFICIENCY 43.73 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	ALK. mg /l	pH
20.00	ND	ND	0.64	5.40	3050	395.50	0.00	2.40
40.00	ND	ND	0.51	5.35	3040	394.50	0.00	2.40
60.00	ND	ND	0.51	5.17	3050	394.75	0.00	2.40
80.00	ND	ND	0.51	5.19	3040	394.25	0.00	2.40
100.00	ND	ND	0.51	5.22	3040	395.50	0.00	2.40
120.00	ND	ND	0.76	11.54	3000	386.75	0.00	2.40
127.23	ND	ND	0.76	45.11	2850	361.00	0.00	2.45
RAW WATER	263.52	137.62	401.14	127.29	1150	0.00	133.50	7.15

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-35

TEST NO. 35 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 Bv /hr
 SERVICE FLOW RATE 20 Bv /hr
 RESIN CAPACITY 58.14 Kg /cu m
 REGENERATION EFFICIENCY 37.82 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l		
20.00	ND	ND	0.25	0.91	2830.00	363.25	0.00	2.45	
40.00	ND	ND	0.25	1.10	2800.00	363.75	0.00	2.40	
60.00	ND	ND	0.25	1.05	2810.00	363.50	0.00	2.45	
80.00	ND	ND	0.25	1.13	2770.00	362.75	0.00	2.45	
100.00	ND	ND	0.25	6.59	2740.00	357.25	0.00	2.45	
118.19	ND	ND	0.76	40.05	2620.00	322.75	0.00	2.50	
RAW WATER	243.02	122.65	365.67	126.26	1020.00	0.00	123.00	7.40	

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-36

TEST NO. 36 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 58.35 Kg /cu m
 REGENERATION EFFICIENCY 37.96 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	BV	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l	
20.00	ND	ND	0.25	1.11	2840.00	369.75	0.00	2.35	
40.00	ND	ND	0.25	1.06	2820.00	369.75	0.00	2.40	
60.00	ND	ND	0.25	1.22	2830.00	369.75	0.00	2.35	
80.00	ND	ND	0.25	0.97	2830.00	370.25	0.00	2.35	
100.00	ND	ND	0.25	8.43	2790.00	360.00	0.00	2.40	
116.83	ND	ND	0.51	42.67	2630.00	323.00	0.00	2.45	
RAW WATER	248.41	124.53	372.94	126.26	1050.00	0.00	129.00	7.15	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg/l calcium carbonate

ตารางที่ ก-37

TEST NO. 37 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 58.67 Kg /cu m
 REGENERATION EFFICIENCY 38.16 %

EFFLUENT VOLUME BV.	CHARACTERISTIC OF EFFLUENT							
	Ca ng /l	Mg ng /l	HARDNESS ng /l	Na ng /l	CONDUCTIVITY Micromhos/cm	ACID. ng /l	ALK. ng /l	pH
20.00	ND	ND	0.25	1.27	2860.00	371.25	0.00	2.40
40.00	ND	ND	0.25	0.91	2890.00	371.00	0.00	2.40
60.00	ND	ND	0.25	0.98	2890.00	368.25	0.00	2.45
80.00	ND	ND	0.25	1.14	2880.00	368.25	0.00	2.40
100.00	ND	ND	0.51	7.00	2840.00	363.00	0.00	2.40
117.37	ND	ND	0.76	42.67	2650.00	325.25	0.00	2.45
RAW WATER	250.37	123.23	373.60	126.26	1050.00	0.00	121.00	7.40

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in ng /l calcium carbonate

ตารางที่ ก-38

TEST NO. 38 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV/hr
 SERVICE FLOW RATE 20 BV/hr
 RESIN CAPACITY 60.53 Kg /cu m
 REGENERATION EFFICIENCY 39.37 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Microhm/cm	ACID. mg /l	ALK. mg /l.	pH
20.00	ND	ND	0.25	0.87	2960.00	383.25	0.00	2.45
40.00	ND	ND	0.25	0.94	2950.00	383.75	0.00	2.40
60.00	ND	ND	0.25	0.87	2970.00	384.50	0.00	2.40
80.00	ND	ND	0.25	0.85	2980.00	383.50	0.00	2.40
100.00	ND	ND	0.51	8.82	2940.00	378.50	0.00	2.40
117.17	ND	ND	1.40	36.14	2760.00	337.00	0.00	2.45
RAW WATER	253.30	132.68	385.98	130.61	1070.00	0.00	128.75	7.10

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-39

TEST NO. 39 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 61.78 Kg /cu m
 REGENERATION EFFICIENCY 40.19 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l	
20.00	ND	ND	0.25	1.17	2870.00	372.25	0.00	2.45
40.00	ND	ND	0.25	0.89	2850.00	373.50	0.00	2.45
60.00	ND	ND	0.25	0.89	2870.00	372.00	0.00	2.45
80.00	ND	ND	0.25	0.85	2860.00	372.50	0.00	2.40
100.00	ND	ND	0.25	0.93	2860.00	372.25	0.00	2.45
120.00	ND	ND	0.51	19.16	2760.00	349.00	0.00	2.45
122.91	ND	ND	0.76	37.88	2660.00	328.00	0.00	2.45
RAW WATER	250.37	123.88	374.25	128.43	1050.00	0.00	126.25	7.25

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-40

TEST NO. 40 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 58.53 Kg /cu m
 REGENERATION EFFICIENCY 38.07 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l	
20.00	ND	ND	0.25	0.99	2840.00	372.00	0.00	2.40
40.00	ND	ND	0.25	0.95	2820.00	372.00	0.00	2.40
60.00	ND	ND	0.25	0.86	2800.00	372.50	0.00	2.40
80.00	ND	ND	0.25	1.07	2830.00	371.25	0.00	2.40
100.00	ND	ND	0.25	8.38	2800.00	364.50	0.00	2.40
116.93	ND	ND	0.76	44.84	2620.00	318.50	0.00	2.50
RAW WATER	248.41	125.84	374.25	126.26	1030.00	0.00	129.50	7.15

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-41

TEST NO. 41 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 61.57 Kg /cu m
 REGENERATION EFFICIENCY 40.05 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT							
	VOLUME BV	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	ALK. mg /l
20.00	ND	ND	0.25	1.11	2850.00	366.50	0.00	2.40
40.00	ND	ND	0.51	1.27	2860.00	366.25	0.00	2.45
60.00	ND	ND	0.25	1.35	2860.00	366.75	0.00	2.40
80.00	ND	ND	0.25	1.27	2820.00	366.75	0.00	2.40
100.00	ND	ND	0.25	2.50	2810.00	366.50	0.00	2.40
120.00	ND	ND	0.51	10.11	2720.00	354.25	0.00	2.40
123.62	ND	ND	0.96	40.05	2670.00	316.50	0.00	2.50
RAW WATER	248.41	121.67	369.68	128.43	1060.00	0.00	125.75	7.35

UNIT : Ca, Mg, HARDNESS, Na, ACID., ALK. in mg /l calcium carbonate

ตารางที่ ก-42

TEST NO. 42 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 60.36 Kg /cu m
 REGENERATION EFFICIENCY 39.26 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	ng /l	ng /l	ng /l	ng /l	ng /l	Micromhos/cm	ng /l	ng /l	
20.00	ND	ND	0.25	1.42		2890.00	370.00	0.00	2.35
40.00	ND	ND	0.25	1.42		2870.00	370.50	0.00	2.40
60.00	ND	ND	0.51	1.27		2870.00	371.00	0.00	2.40
80.00	ND	ND	0.25	1.22		2870.00	370.75	0.00	2.40
100.00	ND	ND	0.25	1.42		2860.00	370.00	0.00	2.40
120.00	ND	ND	0.51	8.56		2760.00	365.25	0.00	2.45
120.75	ND	ND	0.76	38.31		2650.00	325.00	0.00	2.45
RAW WATER	250.37	123.23	373.60	126.26		1040.00	0.00	127.50	7.15

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in ng /l calcium carbonate

ตารางที่ ก-43

TEST NO. 43 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 62.76 Kg /cu m
 REGENERATION EFFICIENCY 40.82 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT							
	Ca mg /l	Mg mg /l	HARDNESS mg /l	Na mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	ALK. mg /l	pH
20.00	ND	ND	0.25	1.50	2870.00	368.25	0.00	2.40
40.00	ND	ND	0.25	1.24	2870.00	368.75	0.00	2.40
60.00	ND	ND	0.25	1.36	2870.00	368.50	0.00	2.45
80.00	ND	ND	0.25	1.15	2880.00	368.25	0.00	2.45
100.00	ND	ND	0.25	2.00	2860.00	368.00	0.00	2.40
120.00	ND	ND	0.25	8.92	2820.00	361.25	0.00	2.45
125.88	ND	ND	0.76	42.67	2620.00	320.50	0.00	2.50
RAW WATER	245.48	126.21	372.29	126.26	1050.00	0.00	128.00	7.20

UNIT: Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-44

TEST NO. 63 COUNTER-CURRENT REGENERATION
 RESIN TYPE SAC FORM H
 RAW WATER B
 REGENERANT 10% HCl(W/V)
 REGENERATION LEVEL 112 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 63.92 Kg /cu m
 REGENERATION EFFICIENCY 41.58 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT								
	VOLUME	Ca	Mg	HARDNESS	Na	CONDUCTIVITY	ACID.	ALK.	pH
BV	mg /l	mg /l	mg /l	mg /l	Micromhos/cm	mg /l	mg /l		
20.00	ND	ND	0.25	1.42	3510.00	475.25	0.00	2.00	
40.00	ND	ND	0.25	1.42	3520.00	474.50	0.00	2.05	
60.00	ND	ND	0.25	1.27	3520.00	475.00	0.00	2.00	
80.00	ND	ND	0.25	1.27	3530.00	475.00	0.00	2.00	
100.00	ND	ND	0.25	8.70	3490.00	467.25	0.00	2.00	
106.88	ND	ND	0.76	40.23	3310.00	430.00	0.00	2.00	
RAW WATER	253.18	225.36	478.54	119.50	1223.00	0.00	118.00	7.40	

UNIT : Ca,Mg,HARDNESS,Na,ACID.,ALK. in mg /l calcium carbonate

ตารางที่ ก-45

TEST NO. 44 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m.
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.78 Kg /cu m.
 REGENERATION EFFICIENCY 34.69 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.70	0.00	8.40
20.00	ND	1.40	1.70	0.00	8.30
30.00	ND	1.40	1.80	0.00	8.35
40.00	ND	1.40	1.70	0.00	8.35
50.00	ND	1.40	1.90	0.00	8.40
56.93	ND	9.80	58.10	9.25	4.30
RAW WATER	333.74	154.26	3520.00	480.00	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-46

TEST NO. 44 A CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.28 Kg /cu m
 REGENERATION EFFICIENCY 34.07 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.80	0.00	8.40
20.00	ND	1.40	1.80	0.00	8.40
30.00	ND	1.40	1.70	0.00	8.35
40.00	ND	1.40	1.70	0.00	8.35
50.00	ND	1.40	1.80	0.00	8.40
54.94	ND	10.10	61.00	9.50	4.35
RAW WATER	336.51	160.11	3620.00	492.60	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ 0-47

TEST NO. 45 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 26.26 Kg /cu m
 REGENERATION EFFICIENCY 32.80 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.90	0.00	8.40
20.00	ND	1.40	1.80	0.00	8.35
30.00	ND	1.40	1.80	0.00	8.35
40.00	ND	1.40	1.70	0.00	8.45
50.00	ND	1.40	1.80	0.00	8.40
53.11	ND	9.80	59.50	9.25	4.35
RAW WATER	335.12	159.38	3660.00	489.50	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-48

TEST NO. 59 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu .m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.24 Kg /cu .m
 REGENERATION EFFICIENCY 34.02 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.90	0.00	8.40
20.00	ND	1.40	1.90	0.00	8.50
30.00	ND	1.40	1.80	0.00	8.45
40.00	ND	1.40	1.80	0.00	8.45
50.00	ND	1.40	1.80	0.00	8.55
55.16	ND	9.80	59.00	10.00	4.40
RAW WATER	336.14	157.69	3610.00	490.75	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-49

TEST NO. 46 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 28.44 Kg /cu m
 REGENERATION EFFICIENCY 35.52 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.90	0.00	8.45
20.00	ND	1.40	1.90	0.00	8.55
30.00	ND	1.40	1.80	0.00	8.40
40.00	ND	1.40	1.80	0.00	8.40
50.00	ND	1.40	1.80	0.00	8.45
57.83	ND	9.10	56.10	8.75	4.40
RAW WATER	327.92	163.91	3620.00	490.00	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-50

TEST NO. 46 A CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.33 Kg /cu m
 REGENERATION EFFICIENCY 34.13 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.80	0.00	8.40
20.00	ND	1.40	1.80	0.00	8.40
30.00	ND	1.40	1.80	0.00	8.45
40.00	ND	1.40	1.90	0.00	8.40
50.00	ND	1.70	2.10	0.00	8.35
54.70	ND	9.50	55.70	9.00	4.40
RAW WATER	337.57	162.05	3670.00	492.25	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-51

TEST NO. 47 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.54 Kg /cu m
 REGENERATION EFFICIENCY 34.39 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.70	0.00	8.30
20.00	ND	1.40	1.80	0.00	8.55
30.00	ND	1.40	1.80	0.00	8.40
40.00	ND	1.40	1.80	0.00	8.45
50.00	ND	1.40	1.90	0.00	8.45
54.48	ND	9.50	56.30	8.75	4.45
RAW WATER	340.56	164.94	3670.00	501.75	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-52

TEST NO. 48 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.14 Kg /cu m
 REGENERATION EFFICIENCY 33.90 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.80	0.00	8.30
20.00	ND	1.40	1.80	0.00	8.30
30.00	ND	1.40	1.70	0.00	8.30
40.00	ND	1.70	2.00	0.00	8.35
50.00	ND	1.70	2.00	0.00	8.30
54.09	ND	9.80	62.00	9.00	4.35
RAW WATER	340.53	161.14	3620.00	495.00	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-53

TEST NO. 48 A CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.30 Kg /cu m
 REGENERATION EFFICIENCY 34.10 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.80	0.00	8.40
20.00	ND	1.40	1.80	0.00	8.40
30.00	ND	1.40	1.80	0.00	8.45
40.00	ND	1.40	1.80	0.00	8.40
50.00	ND	1.70	2.20	0.00	8.45
53.46	ND	9.80	61.40	9.25	4.15
RAW WATER	345.91	164.74	3640.00	505.50	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-54

TEST NO. 49 CO-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 26.94 Kg /cu m
 REGENERATION EFFICIENCY 33.65 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.40	1.80	0.00	8.45
20.00	ND	1.40	1.70	0.00	8.45
30.00	ND	1.40	1.80	0.00	8.50
40.00	ND	1.70	2.00	0.00	8.45
50.00	ND	1.70	1.90	0.00	8.50
54.52	ND	9.50	58.10	9.00	4.25
RAW WATER	342.74	151.43	3600.00	492.50	2.30

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-55

TEST NO. 50 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu ■
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.78 Kg /cu ■
 REGENERATION EFFICIENCY 34.69 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.45
20.00	ND	1.00	1.50	0.00	8.45
30.00	ND	1.00	1.40	0.00	8.40
40.00	ND	1.00	1.50	0.00	8.45
50.00	ND	1.00	1.60	0.00	8.45
56.38	ND	10.10	63.60	9.50	4.20
RAW WATER	334.53	158.14	3610.00	489.25	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-56

TEST NO. 51 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m.
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 27.71 Kg /cu m
 REGENERATION EFFICIENCY 34.61 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.40
20.00	ND	1.00	1.40	0.00	8.45
30.00	ND	1.00	1.50	0.00	8.35
40.00	ND	1.00	1.50	0.00	8.40
50.00	ND	1.00	1.50	0.00	8.45
56.57	ND	9.80	58.80	9.25	4.30
RAW WATER	337.76	152.07	3590.00	485.75	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-57

TEST NO. 52 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 1 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 28.20 Kg /cu m
 REGENERATION EFFICIENCY 35.22 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.35
20.00	ND	1.00	1.50	0.00	8.45
30.00	ND	1.00	1.40	0.00	8.45
40.00	ND	1.00	1.40	0.00	8.45
50.00	ND	1.00	1.60	0.00	8.40
55.20	ND	9.80	60.70	9.00	4.35
RAW WATER	340.94	169.89	3700.00	505.00	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-58

TEST NO. 53 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 20.89 Kg /cu m
 REGENERATION EFFICIENCY 26.09 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.30
20.00	ND	1.00	1.40	0.00	8.35
30.00	ND	1.00	1.50	0.00	8.30
40.00	ND	1.00	1.50	0.00	8.40
43.10	ND	9.50	57.60	9.25	4.35
RAW WATER	332.94	151.73	3550.00	480.25	2.40

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-59

TEST NO. 56 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 20.14 Kg /cu m
 REGENERATION EFFICIENCY 25.15 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.35
20.00	ND	1.00	1.40	0.00	8.40
30.00	ND	1.00	1.50	0.00	8.35
39.98	ND	9.50	57.40	9.25	4.35
RAW WATER	359.15	144.52	3650.00	502.25	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-60

TEST NO. 57 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 2 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 20.31 Kg /cu m
 REGENERATION EFFICIENCY 25.37 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.60	0.00	8.35
20.00	ND	1.00	1.50	0.00	8.35
30.00	ND	1.00	1.50	0.00	8.35
40.00	ND	1.00	1.50	0.00	8.40
41.84	ND	9.50	55.90	9.00	4.40
RAW WATER	330.94	154.56	3560.00	485.00	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-61

TEST NO. 54 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 17.70 Kg /cu m
 REGENERATION EFFICIENCY 22.11 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.40
20.00	ND	1.00	1.50	0.00	8.40
30.00	ND	1.00	1.50	0.00	8.45
34.42	ND	9.50	58.20	9.00	4.35
RAW WATER	350.56	163.61	3720.00	510.00	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-62

TEST NO. 55 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 18.09 Kg /cu m
 REGENERATION EFFICIENCY 22.59 %

EFFLUENT VOLUME BV	CHARACTERISTIC OF EFFLUENT				
	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l	pH
10.00	ND	1.00	1.50	0.00	8.10
20.00	ND	1.00	1.50	0.00	8.40
30.00	ND	1.00	1.60	0.00	8.45
35.62	ND	9.80	58.60	9.50	4.30
RAW WATER	352.56	155.27	3640.00	505.50	2.35

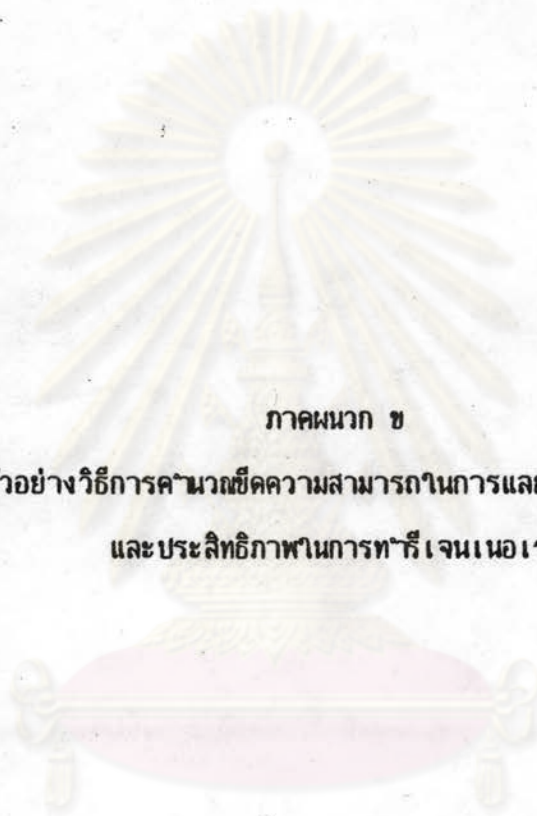
UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate

ตารางที่ ก-63

TEST NO. 58 COUNTER-CURRENT REGENERATION
 RESIN TYPE SBA FORM OH
 RAW WATER C
 REGENERANT 4% NaOH(W/V)
 REGENERATION LEVEL 64 Kg /cu m
 REGENERATION FLOW RATE 3 BV /hr
 SERVICE FLOW RATE 20 BV /hr
 RESIN CAPACITY 17.35 Kg /cu m
 REGENERATION EFFICIENCY 21.67 %

EFFLUENT	CHARACTERISTIC OF EFFLUENT				
	VOLUME BV	SULFATE mg /l	Cl mg /l	CONDUCTIVITY Micromhos/cm	ACID. mg /l
10.00	ND	1.00	1.60	0.00	8.40
20.00	ND	1.00	1.60	0.00	8.40
30.00	ND	1.00	1.50	0.00	8.55
35.04	ND	10.10	60.30	10.00	4.20
RAW WATER	333.76	161.41	3620.00	492.25	2.35

UNIT : SULFATE,Cl,ACID. in mg /l calcium carbonate



ภาคผนวก ข

ตัวอย่างวิธีการคำนวณขีดความสามารถในการแลกเปลี่ยนไอออน
และประสิทธิภาพในการทรีเจเนอเรชัน

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ข-1 ตัวอย่างวิธีการคำนวณขีดความสามารถในการแลกเปลี่ยนไอออน

$$\text{จากขีดความสามารถในการแลกเปลี่ยนไอออน} = A \times B/C$$

(กก./ลบ.ม. หินปูน)

สำหรับการทดลองที่ 1

โดยที่ A = ความกระด้างของน้ำดิบสังเคราะห์ ชนิด A
= 494.25 มก./ลิตร หินปูน

B = ปริมาณน้ำดิบสังเคราะห์ ชนิด A ที่ใช้จนถึงจุดยุติ
= 48.50 ลิตร

C = ปริมาตรของเรซินที่หมดความจ
= 412.53 มิลลิลิตร

นั่นคือ ขีดความสามารถในการแลกเปลี่ยนไอออน = $494.25 \times 48.50 / 412.53$
= 58.11 กก./ลบ.ม. หินปูน

kg/m³ (as CaCO₃)

kg CaCO₃ / m³

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ข-2 ตัวอย่างวิธีการคำนวณประสิทธิภาพในการทรีเจเนอเรชัน

$$\text{จากประสิทธิภาพในการทรีเจเนอเรชัน} = 100 \times D/E$$

(เปอร์เซ็นต์)

สำหรับการทดลองที่ 1

โดยที่ D = ชีตความสามารถในการแลกเปลี่ยนไอออนของเรซิน
= 58.11 กก./ลบ.ม. หินปูน

E = ระดับรีเจเนอเรชันของ NaCl ที่ใช้
= 96.00 กก./ลบ.ม. NaCl
= 82.21 กก./ลบ.ม. หินปูน

นั่นคือ ประสิทธิภาพในการทรีเจเนอเรชัน = $100 \times 58.11/82.21$
= 70.68 เปอร์เซ็นต์

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ประวัติผู้วิจัย

นายปริญญา ยมะสมิต เกิดเมื่อวันที่ 12 สิงหาคม 2503 ที่กรุงเทพมหานคร สำเร็จ
การศึกษาระดับปริญญาตรี จากคณะวิศวกรรมศาสตร์ สถาบันเทคโนโลยีพระจอมเกล้า
วิทยาเขตธนบุรี เมื่อปี พ.ศ. 2526 จากนั้นได้เข้าทำงานในการปราบปรามครหลวง จนถึงปัจจุบัน



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย