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APPENDIX

Table A Physical Properties and specification of activated carbon

Product Properties	Typical Analysis Value
Product Name	Filtrisorb 300
U.S. Standard Series	
Sieve Size	10
Larger than No.8	2
Smaller than No. 30	-
Larger than No. 12	-
Smaller than No. 40	1.6
Mean Particle Dia. mm.	955
Iodine Number,min.	80
Abrasion Number,min.	0.5 %
Moisture	
Total surface area	950-1050
(N ₂ ,BET method) m ² /g	26
Bulk desity, lbs/ft ³	1.3-1.4
Particle density wetted in water	0.85
g/cc.	0.8-0.9
Pore volume cc/g	2.0-2.4
Effective size mm.	
Uniformity coefficient	

Table B Physical properties of chemicals used**1. Surfactant**

Chemical Formula	
$C_{12}H_{25}OSO_3Na$: Sodium dodecyl sulfate
General Properties	
Product description	: Anionic Surfactant
Appearance (30° C)	: White powder
Odor and smell	: Mild
Standard Specification	
% Active ingredient	: 96.28
% Volatile	: 1.12
% n-Hexane soluble	: 0.39
% Sulfate	: 2.21
pH (1.0 % solution)	: 6.8-8.0

2. Organic solute

Chemical Formula	
C_6H_5OH	: Phenol
General Properties	
Molecular Weight	: 94.114
% Purity	: 99.5

Table C-1 The amount of phenol in effluent of phenol 10 mg/lit loading

hour	Outlet phenol concentration (mg/lit)		
	Adsorption	Regeneration	Readsorption
1	0.1005	67.6926*	17.9330*
2	0.2307	50.6362*	22.8623*
3	0.3884	42.6157	24.9310
4	0.5222	40.5259	26.5182
5	0.6162	31.1902	25.0050
6	0.8742	31.6538	25.5555
7	1.1840	29.0100	25.0757
8	1.3986	27.1758	25.8179
9	1.7583	26.0098	25.1565
10	2.0620	23.7546	27.4124
11	2.4174	19.4811	26.9730
12	2.7138	17.3632	26.1216
13	3.0509	17.6330	25.8496
14	3.4798	16.0743	27.2549
15	3.9621	15.1521	25.2764
16	4.5320	15.0363	25.9519
17	5.4717	12.4521	26.1279
18	6.6929	13.0048	25.6941
19	7.2168	11.2927	26.4605
20	8.2618	10.1861	25.9349
21	9.1696	9.3102	
22	9.8104	8.9502	
23	10.1352	8.3505	
24	11.3557	7.5915	
25	11.5022	7.9744	
26	11.8822	6.7564	
27	13.0683	6.5110	
28	14.1055	6.0371	
29	14.6052	5.8567	
30	15.4940	5.6908	
31	16.1582	5.5847	
32	16.6361	5.4614	
33	16.8337	5.3479	
34	17.3273	5.0226	
35	17.4221	4.7711	
35	17.4221	4.7711	
36	17.9072	4.2967	
37	18.1708	3.9993	

hour	Outlet phenol concentration (mg/lit)		
	Adsorption	Regeneration	Readsorption
38	18.3551	3.9976	
39	18.7434	3.8440	
40	19.3087	4.0314	
41	19.5588	3.9641	
42	19.3963	3.3051	
43	19.5861	3.6143	
44	19.6444	3.6011	
45	20.1477	3.8903	
46	20.3165	3.8396	
47	20.7989	3.2335	
48	21.8709	3.4747	
49	22.3710	3.0705	
50	22.7497	2.6160	
51	22.9987		
52	23.4518		
53	23.8402		
54	24.1854		
55	24.4241		
56	24.5806		
57	24.8804		
58	25.2300		
59	25.3069		
60	25.2068		
61	25.8941		
62	26.4485		
63	25.8203		
64	26.3235		
65	25.9230		
66	25.9604		
67	25.9628		
68	25.8242		
69	26.2302		
70	26.6503		
71	27.0858		

* Cup-mixing concentration in 1st or 2nd hour.
(The rest is the concentration measured at the end of each hour)

Table C-2 The amount of phenol in effluent of phenol 20 mg/lit loading

hour	Outlet phenol concentration (mg/lit)		
	Adsorption	Regeneration	Readsorption
1	0.1849	59.8938*	9.5957*
2	0.2722	47.7401*	12.8538*
3	0.2623	36.8385	15.8493
4	0.4383	33.6342	15.9047
5	0.5547	30.921	16.7276
6	0.6710	29.8144	17.2517
7	0.8189	26.8081	17.3275
8	1.0740	25.0763	17.9574
9	0.9539	22.8454	18.2715
10	1.2471	20.2073	18.2991
11	1.3722	19.8922	18.4124
12	1.7821	19.6516	18.4548
13	1.5848	17.0287	18.5427
14	2.1265	15.9199	19.0222
15	2.1306	14.5148	18.9859
16	2.1382	13.2038	19.4897
17	2.3817	12.3412	19.0542
18	2.6107	11.4871	19.1883
19	2.8395	10.9888	19.0207
20	3.0884	10.5104	18.9259
21	3.4120	9.409	19.2091
22	3.6432	8.9881	19.1565
23	3.8952	8.5525	
24	4.3504	7.9183	
25	4.6420	7.2912	
26	5.1689	6.9219	
27	5.5066	6.5787	
28	5.7200	6.4633	
29	6.1803	6.1885	
30	6.5122	5.7403	
31	6.9982	5.503	
32	7.2026	5.4045	
33	7.5707	5.1822	
34	7.9970	4.8502	
35	8.4322	4.6182	
36	8.7313	4.7476	
37	9.0955	4.3863	
38	9.6425	4.3051	



hour	Outlet phenol concentration (mg/lit)		
	Adsorption	Regeneration	Readsorption
39	10.3317	4.2711	
40	10.9807	4.0128	
41	11.3227	4.0011	
42	11.8112	3.7514	
43	11.9206	3.7871	
44	12.3359	3.6698	
45	12.4640	3.7506	
46	12.9725	3.5868	
47	12.1965	3.6044	
48	12.4680	3.3579	
49	12.6649	3.3660	
50	12.9871	3.2608	
51	13.2751		
52	13.3540		
53	13.4696		
54	13.6352		
55	13.9909		
56	15.1035		
57	13.7502		
58	13.7268		
59	14.4239		
60	15.1134		
61	15.2456		
62	15.0674		
63	15.4177		
64	15.7484		
65	15.7816		
66	15.8153		
67	16.0936		
68	16.1858		
69	16.2948		
70	16.1218		
71	16.1827		
72	16.2253		
73	16.5786		
74	16.5690		
75	16.5907		
76	16.5933		
77	16.7814		
78	16.7471		
79	16.7050		

hour	Outlet phenol concentration (mg/lit)		
	Adsorption	Regeneration	Readsorption
80	17.1588		
81	17.0159		
82	17.4050		
83	17.2508		
84	17.3900		
85	18.3046		
86	18.3925		
87	18.6246		
88	18.6934		
89	18.3327		
90	18.1403		
91	18.7923		
92	18.4748		
93	18.1298		
94	18.3578		
95	18.3080		
96	18.1465		
97	18.6394		
98	17.9543		
99	17.8960		
100	17.9818		
101	18.7034		

* Cup-mixing concentration in 1st or 2nd hour.
(The rest is the concentration measured at the end of each hour)

Table C-3 The amount of phenol in effluent of 10 mg/lit phenol loading

hour	Outlet phenol concentration (mg/lit)	hour	Outlet phenol concentration (mg/lit)	
	Adsorption		Regeneration	Readsorption
1	0	1	35.0099*	4.1154*
3	0	2	26.1183*	5.3965*
5	0	3	23.1984	6.4294
7	0	4	20.7654	6.7773
9	0	5	20.4135	7.1654
11	0	6	20.2458	7.5796
13	0	7	17.8655	7.8708
15	0	8	17.4346	7.8315
17	0	9	16.0117	8.0459
19	0	10	15.4751	7.9973
21	0	11	14.4996	7.8703
23	0	12	13.4947	8.1915
25	0	13	12.7811	8.1045
27	0	14	11.8696	8.0015
29	0	15	10.3221	8.1383
31	0	16	10.2596	8.3335
33	0	17	9.1039	8.1265
35	0	18	9.4782	8.3906
37	0.0567	19	8.1051	8.3182
39	0.0782	20	7.4745	8.4676
41	0.1106	21	7.3025	8.4133
43	0.1346	22	6.6575	8.3929
45	0.1818	23	6.4436	
47	0.2560	24	6.1482	
49	0.3045	25	5.8017	
51	0.8421	26	5.5724	
53	1.1120	27	5.5624	
55	1.2617	28	5.1179	
57	1.3211	29	4.8893	
59	1.6312	30	4.7966	
61	1.9883	31	4.6055	
63	2.3245	32	4.3550	
65	2.5640	33	4.2980	
67	2.7196	34	4.1031	
69	2.9203	35	4.2365	
71	3.2034	36	3.7866	
73	3.5294	37	3.1482	

hour	Outlet phenol concentration (mg/lit)	hour	Outlet phenol concentration (mg/lit)	
	Adsorption		Regeneration	Readsorption
75	4.2366	38	3.5037	
77	4.6983	39	3.3865	
79	4.9987	40	3.3232	
81	5.3216	41	3.2338	
83	5.8999	42	3.1803	
85	6.2311	43	3.0719	
87	6.8743	44	2.9849	
89	6.6231	45	3.0878	
91	6.9874	46	2.7986	
93	7.0213	47	2.7939	
95	6.7034	48	2.6819	
97	7.0322	49	2.6385	
99	7.1825	50	2.6160	
101	7.3121	51		
103	7.6982	52		
105	7.5698	53		
107	7.7844	54		
109	7.9652	55		
111	8.1232	56		
113	8.3458	57		
115	8.5429	58		
117	8.6580	59		
119	8.7997	60		
121	8.3564	61		
123	8.5699	62		
125	8.4659	63		
127	8.5698	64		
129	8.4652	65		
131	8.5411	66		
133	8.3926	67		
135	8.5654	68		
137	8.6591	69		
139	8.7951	70		
141	8.5693	71		
143	8.7402	72		
145	8.9936	73		
147	8.8322	74		
149	8.7512	75		
151	8.9562	76		
153	8.7411	77		

hour	Outlet phenol concentration (mg/lit)	hour	Outlet phenol concentration (mg/lit)	
	Adsorption		Regeneration	Readsorption
155	8.6354	78		
157	8.6422	79		
159	8.7624	80		
161	8.7141	81		
163	8.6354	82		
165	8.6242	83		
167	8.7059	84		
169	8.5504	85		

- * Cup-mixing concentration in 1st or 2nd hour.
(The rest is the concentration measured at the end of each hour)

Table D The % removal of phenol in regeneration step

hour	Feed pore volmes	% phenol removal at phenol loading concentration of:		
		10 mg/lit	20 mg/lit	30 mg/lit
1	129	3.47	5.77	5.90
4	517	6.14	10.01	10.21
6	776	8.46	13.57	13.48
8	1034	10.53	16.65	16.39
10	1293	12.36	19.24	18.97
12	1552	14.01	21.51	20.94
14	1810	15.46	23.48	22.67
16	2069	16.66	25.14	24.19
18	2328	17.72	26.55	25.49
20	2586	18.66	27.80	26.62
22	2845	19.48	28.90	27.56
24	3103	20.21	29.87	28.39
26	3362	20.87	30.71	29.16
28	3621	21.49	31.47	29.81
30	3879	22.05	32.17	30.39
32	4138	22.57	32.80	30.95
34	4397	23.06	33.39	31.48
36	4655	23.53	33.92	31.95
38	4914	23.90	34.42	32.35
40	5172	24.29	34.90	32.74
42	5431	24.66	35.35	33.13
44	5690	25.01	35.78	33.48
46	5948	25.35	36.20	33.86
48	6207	25.66	36.61	34.20
50	6466	25.96	36.99	34.50

Note: The % phenol removal was calculated by using Simpson's rule.

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