

## REFERENCES

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## **APPENDIX**

Table A1 Polymerization of PVC resin at 81°C

Batch no.	Unit	4B-059	4B-060	4B-061	4B-062		
Date		20-11-97	21-11-97	21-11-97	22-11-97		
Water	ml	1485	1485	1485	1485		
VCM	gm	990	990	990	990		
Water : VCM ratio		1.5	1.5	1.5	1.5		
W-plan	ml	444	444	444	444		
Peroxide initiator	phm	0.079	0.079	0.079	0.079		
Total suspending agent	phm	0.4	0.4	0.4	0.4		
Chain transfer agent	phm	no	no	no	no		
Evacuate time	min	3	3	3	3		
Agitator speed	rpm	50/670	50/670	50/670	50/670		
Reaction pressure	psi	225	225	220	226		
End pressure	psi	218	218	213	219		
Delta pressure	psi	7	7	7	7		
Reaction temp.	°C	81	81	81	81		
- Heat up time	hr:min	0:25	0:25	0:25	0:30		
- Reaction time	hr:min	5:10	4:50	4:58	4:50		
Dosing time	hr:min	2:00	2:00	2:00	2:00		
Quality of PVC resin						Mean value	SD
K-value		50.1	50.3	50.6	50.5	50.4	0.22(n=4)
Mean particle size	µm	116	118	116	120	118	1.91(n=4)
Size distribution coefficient		0.404	0.375	0.396	0.401	0.394	0.01(n=4)
Bulk density	gm/ml	0.384	0.390	0.397	0.385	0.389	0.01(n=4)
Fish eye	points	375	519	92	408	349	181.76(n=4)
Plasticizer take up	phr	13.5	13.6	13.0	11.6	12.9	0.92(n=4)
Fusion torque <sup>a</sup>	Nm	-	-	-	-	54.8	0.47(n=4)
Dynamic heat stability by Brabender <sup>a</sup>	min	-	-	-	-	19.3	-(n=1)
Melt flow index <sup>a</sup>	gm/10min	-	-	-	-	30.8	0.14(n=5)
Izod impact strength <sup>a</sup>	(kg-cm)/cm	-	-	-	-	1.52	0.42(n=3)
Heat deflection temperature <sup>a</sup>	°C	-	-	-	-	72	0.14(n=2)

<sup>a</sup> Test by using mixed PVC resin of batch no.4B-059, 4B-060, 4B-061 and 4B-062

Table A2 Polymerization of PVC resin at 77°C

Batch no.	Unit	4B-055	4B-056	4B-057	4B-058		
Date		17-11-97	18-11-97	19-11-97	20-11-97		
Water	ml	1485	1485	1485	1485		
VCM	gm	990	990	990	990		
Water : VCM ratio		1.5	1.5	1.5	1.5		
W-plan	ml	433	433	433	433		
Peroxide initiator	phm	0.098	0.098	0.098	0.098		
Total suspending agent	phm	0.4	0.4	0.4	0.4		
Chain transfer agent	phm	0.027	0.027	0.027	0.027		
Evacuate time	min	3	3	3	3		
Agitator speed	rpm	50/670	50/670	50/670	50/670		
Reaction pressure	psi	207	214	214	213		
End pressure	psi	200	207	207	206		
Delta pressure	psi	7	7	7	7		
Reaction temp.	°C	77	77	77	77		
- Heat up time	hr:min	0:30	0:25	0:28	0:30		
- Reaction time	hr:min	5:02	5:00	4:55	5:00		
Dosing time	hr:min	2:00	2:00	2:00	1:55		
Quality of PVC resin						Mean value	SD
K-value		50.1	49.3	50.6	50.3	50.1	0.56(n=4)
Mean particle size	µm	119	114	114	110	114	3.69(n=4)
Size distribution coefficient		0.363	0.384	0.363	0.370	0.370	0.01(n=4)
Bulk density	gm/ml	0.414	0.397	0.402	0.412	0.406	0.01(n=4)
Fish eye	points	103	148	49	66	92	43.90(n=4)
Plasticizer take up	phr	14.1	14.3	14.3	14.2	14.2	0.10(n=4)
<sup>b</sup> Fusion torque	Nm	-	-	-	-	54.5	0.49(n=4)
<sup>b</sup> Dynamic heat stability by Brabender	min	-	-	-	-	20.3	- (n=1)
<sup>b</sup> Melt flow index	gm/10min	-	-	-	-	30.0	0.12(n=5)
<sup>b</sup> Izod impact strength	(kg-cm)/cm	-	-	-	-	0.63	0.01(n=3)
<sup>b</sup> Heat deflection temperature	°C	-	-	-	-	72	0.28(n=2)

<sup>b</sup> Test by using mixed PVC resin of batch no. 4B-055, 4B-056, 4B-57 and 4B-058

Table A3 Polymerization of PVC resin at 73 °C

Batch no.	Unit	4B-049	4B-050	4B-051	4B-052		
Date		6-11-97	7-11-97	7-11-97	8-11-97		
Water	ml	1500	1500	1500	1500		
VCM	gm	1000	1000	1000	1000		
Water : VCM ratio		1.5	1.5	1.5	1.5		
W-plan	ml	426	426	426	426		
Peroxide initiator	phm	0.133	0.133	0.133	0.133		
Total suspending agent	phm	0.4	0.4	0.4	0.4		
Chain transfer agent	phm	0.047	0.047	0.047	0.047		
Evacuate time	min	3	3	3	3		
Agitator speed	rpm	50/670	50/670	50/670	50/670		
Reaction pressure	psi	201	200	198	200		
End pressure	psi	194	193	191	193		
Delta pressure	psi	7	7	7	7		
Reaction temp.	°C	73	73	73	73		
- Heat up time	hr:min	0:28	0:27	0:25	0:27		
- Reaction time	hr:min	5:01	4:58	5:00	4:55		
Dosing time	hr:min	1:47	2:00	1:55	2:00		
Quality of PVC resin						Mean value	SD
K-value		49.7	50.1	50.4	49.9	50.0	0.30(n=4)
Mean particle size	µm	113	110	108	103	109	4.20(n=4)
Size distribution coefficient		0.321	0.336	0.303	0.328	0.322	0.01(n=4)
Bulk density	gm/ml	0.422	0.435	0.438	0.442	0.434	0.01(n=4)
Fish eye	points	27	33	12	15	22	9.91(n=4)
Plasticizer take up	phr	15.0	16.0	14.1	14.1	14.8	0.91(n=4)
Fusion torque <sup>c</sup>	Nm	-	-	-	-	51.6	1.95(n=4)
Dynamic heat stability by Brabender <sup>c</sup>	min	-	-	-	-	19.2	- (n=1)
Melt flow index <sup>c</sup>	gm/10min	-	-	-	-	30.0	0.15(n=5)
Izod impact strength <sup>c</sup>	(kg-cm)/cm	-	-	-	-	1.41	0.17(n=3)
Heat deflection temperature <sup>c</sup>	°C	-	-	-	-	72	0.14(n=2)

<sup>c</sup> Test by using mixed PVC resin of batch no. 4B-049, 4B-050, 4B-051 and 4B-052

Table A4 Polymerization of PVC resin at 69°C

Batch no.	Unit	4B-043	4B-044	4B-047	4B-048		
Date		28-10-97	29-10-97	31-10-97	5-11-97		
Water	ml	1515	1515	1515	1515		
VCM	gm	1010	1010	1010	1010		
Water : VCM ratio		1.5	1.5	1.5	1.5		
W-plan	ml	419	419	419	419		
Peroxide initiator	phm	0.193	0.193	0.193	0.193		
Total suspending agent	phm	0.4	0.4	0.4	0.4		
Chain transfer agent	phm	0.08	0.08	0.08	0.08		
Evacuate time	min	3	3	3	3		
Agitator speed	rpm	50/670	50/670	50/670	50/670		
Reaction pressure	psi	182	182	184	187		
End pressure	psi	175	175	177	180		
Delta pressure	psi	7	7	7	7		
Reaction temp.	°C	69	69	69	69		
- Heat up time	hr:min	0:27	0:30	0:27	0:27		
- Reaction time	hr:min	5:02	5:15	5:07	5:00		
Dosing time	hr:min	1:59	2:00	2:01	2:00		
Quality of PVC resin						Mean value	SD
K-value		50.6	50.3	50.5	49.7	50.3	0.40(n=4)
Mean particle size	µm	97	104	100	104	101	3.40(n=4)
Size distribution coefficient		0.331	0.299	0.301	0.312	0.311	0.01(n=4)
Bulk density	gm/ml	0.458	0.447	0.459	0.460	0.456	0.01(n=4)
Fish eye	points	32	44	15	11	26	15.33(n=4)
Plasticizer take up	phr	17.1	16.6	16.3	12.6	15.6	2.06(n=4)
Fusion torque <sup>d</sup>	Nm	-	-	-	-	44.4	1.99(n=4)
Dynamic heat stability by Brabender <sup>d</sup>	min	-	-	-	-	19.2	-(n=1)
Melt flow index <sup>d</sup>	gm/10min	-	-	-	-	28.8	0.13(n=5)
Izod impact strength <sup>d</sup>	(kg-cm)/cm	-	-	-	-	0.66	0.05(n=3)
Heat deflection temperature <sup>d</sup>	°C	-	-	-	-	72	0.14(n=2)

<sup>d</sup> Test by using mixed PVC resin of batch no. 4B-043, 4B-044, 4B-047 and 4B-048

Table A5 Relationship between K-value and polymerization degree of PVC<sup>(12)</sup>

K-value(DIN 53726)	Degree of polymerization(JIS K6721)
45.3	275
46.2	310
47.1	350
48.4	380
49.3	415
50.1	450
51.3	495
52.4	525
53.6	560
54.7	600
56.1	640
57.2	680
58.2	720
59.6	760
60.5	800
61.7	840
62.9	885
64.1	930
64.9	975
66.1	1025
67.1	1070
68.2	1120
69.2	1175
70.2	1230
71.5	1300
72.4	1350
73.3	1420
74.3	1490
74.9	1570



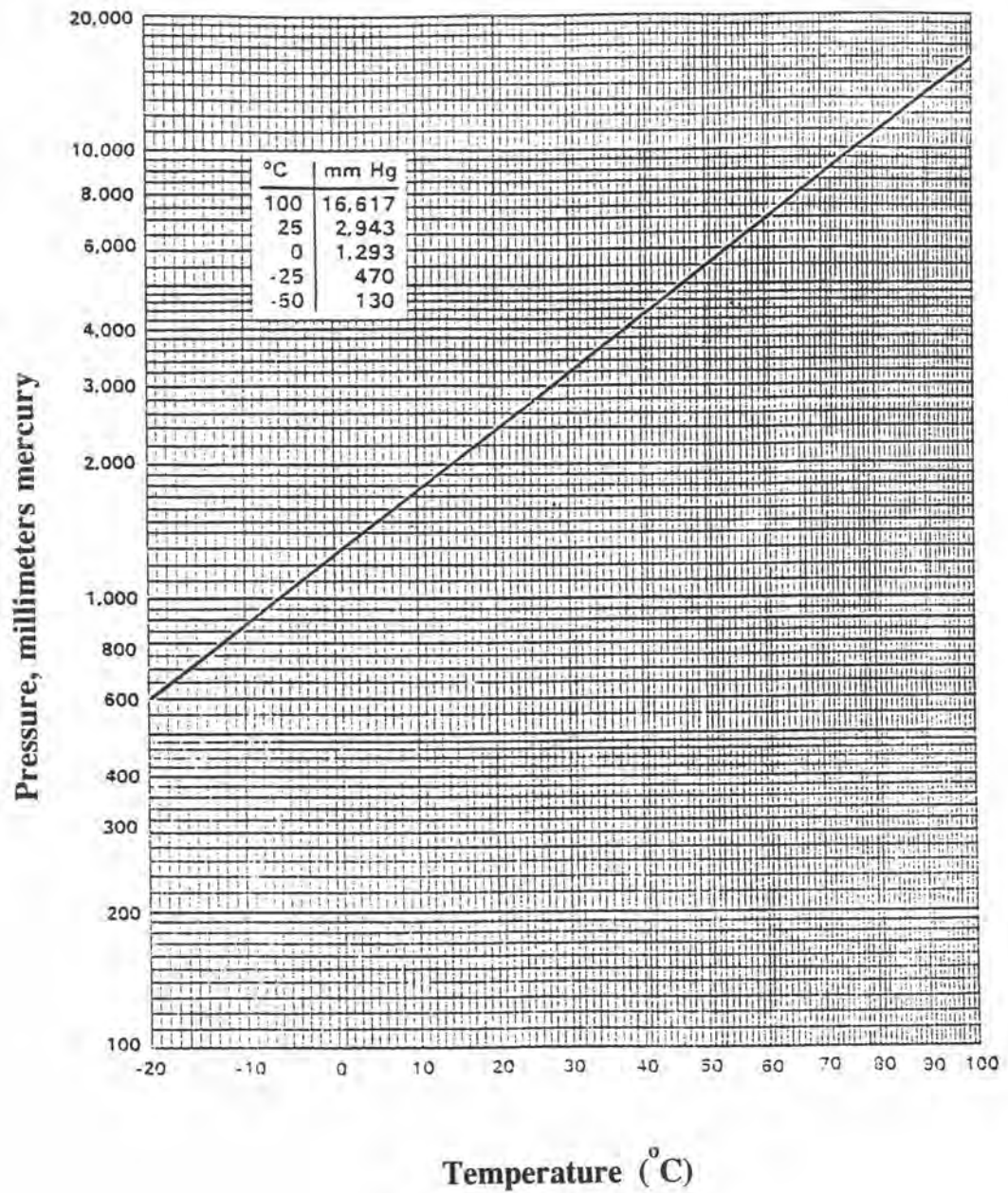


Figure A1 Vapor pressure of VCM at various temperatures (15)

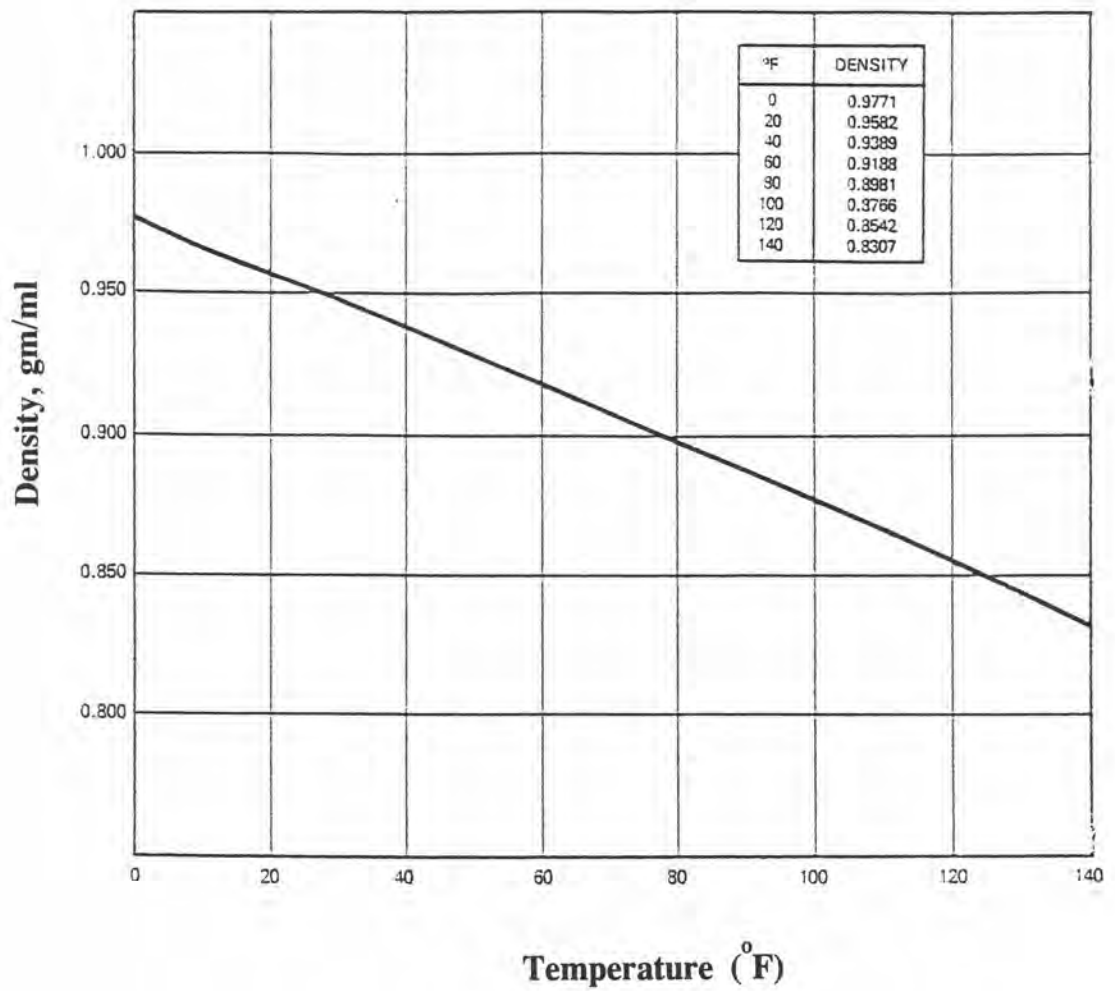


Figure A2 Density of liquid VCM at various temperature (15)

## VITA

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