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APPENDICE

APPENDIX A
FORMULATIONS FOR UHMW PVC RESIN PRODUCTION

Table A-1 : Formulation for Resin Production of UHMW PVC at 40°C

Batch no.	Unit	Ref.-1	Ref.-2
Demineralized water	mL.	9480	9480
VCM	g	4120	4120
Initiator	phr.	0.25	0.25
Suspending agent	phr.	0.18	0.18
Comonomer	phr.	0	0
Reaction time	min.	355	370
Conversion	%	77	76

Table A-2 : Formulation for Resin Production of UHMW PVC at 43°C

Batch no.	Unit	43-1	43-2	43-3	43-4	43-5	43-6	43-7
Demineralized water	mL.	9450	9450	9450	9450	9450	9450	9450
VCM	g	4110	4110	4110	4110	4110	4110	4110
Initiator	phr.	0.225	0.213	0.213	0.213	0.213	0.223	0.213
Suspending agent	phr.	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Comonomer	phr.	0	0.01	0.04	0.055	0.075	0.075	0.1
Reaction time	min.	318	369	390	378	385	350	394
Conversion	%	NA	NA	NA	NA	NA	80	NA

Remark : NA = Not Available

Table A-3 : Formulation for Resin Production of UHMW PVC at 46°C

Batch no.	Unit	46-1	46-2	46-3	46-4	46-5
Demineralized water	mL.	9430	9430	9430	9430	9430
VCM	g	4100	4100	4100	4100	4100
Initiator	phr.	0.16	0.16	0.16	0.16	0.16
Suspending agent	phr.	0.18	0.18	0.18	0.18	0.18
Comonomer	phr.	0	0.05	0.123	0.123	0.2
Reaction time	min.	349	348	333	340	373
Conversion	%	NA	NA	NA	76	NA

Remark : NA = Not Available

Table A-4 : Formulation for Resin Production of UHMW PVC at 49°C

Batch no.	Unit	49-1	49-2	49-3	49-4	49-5	49-6	49-7
Demineralized water	mL.	9384	9384	9384	9384	9384	9384	9384
VCM	g	4080	4080	4080	4080	4080	4080	4080
Initiator	phr.	0.12	0.108	0.108	0.108	0.108	0.108	0.108
Suspending agent	phr.	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Comonomer	phr.	0	0.1	0.16	0.166	0.166	0.175	0.25
Reaction time	min.	309	324	350	350	365	362	373
Conversion	%	NA	NA	NA	NA	75	NA	NA

Remark : NA = Not Available

Table A-5 : Formulation for Resin Production of UHMW PVC at 52°C

Batch no.	Unit	52-1	52-2	52-3	52-4	52-5
Demineralized water	mL.	9361	9361	9361	9361	9361
VCM	g	4070	4070	4070	4070	4070
Initiator	phr.	0.07	0.07	0.07	0.07	0.07
Suspending agent	phr.	0.18	0.18	0.18	0.18	0.18
Comonomer	phr.	0	0.2	0.2	0.22	0.3
Reaction time	min.	348	380	369	386	437
Conversion	%	NA	NA	78	NA	NA

Remark : NA = Not Available

Table A-6 : Formulation for Resin Production of UHMW PVC at 58°C

Batch no.	Unit	58-1	58-2	58-3	58-4	58-5
Demineralized water	mL.	9292	9292	9292	9292	9292
VCM	g	4040	4040	4040	4040	4040
Initiator	phr.	0.051	0.044	0.044	0.044	0.044
Suspending agent	phr.	0.18	0.18	0.18	0.18	0.18
Comonomer	phr.	0	0.27	0.28	0.28	0.31
Reaction time	min.	315	355	375	352	368
Conversion	%	NA	NA	NA	77	NA

Remark : NA = Not Available

APPENDIX B
PROPERTY OF UHMW PVC RESIN AND DRY BLEND

Table B-1 : Property of UHMW PVC Resins at \overline{DP} between 2450 to 2550

Property	Unit	Comonomer amount (phr.)											
		0.000				0.075				0.123			
		X ₁	X ₂	X	SD	X ₁	X ₂	X	SD	X ₁	X ₂	X	SD
Mean particle size	micrometer	122	134	128	6	133	127	130	3	130	134	132	2
Size distribution coefficient		0.280	0.230	0.255	0.025	0.275	0.282	0.280	0.004	0.276	0.280	0.278	0.002
Bulk density	g/mL	0.358	0.363	0.360	0.003	0.352	0.349	0.350	0.002	0.352	0.348	0.350	0.002
Cold plasticizer absorption	%	35.21	34.41	34.81	0.40	31.52	29.58	30.55	0.97	29.00	31.20	30.10	1.10
Fisheye per 300 cm ²	points	27	-	27	-	43	-	43	-	36	-	36	-

Table B-1 : Property of UHMW PVC Resins at \overline{DP} between 2450 to 2550 (Continued)

Property	Unit	Comonomer amount (phr.)											
		0.166				0.200				0.280			
		X ₁	X ₂	X	SD	X ₁	X ₂	X	SD	X ₁	X ₂	X	SD
Mean particle size	micrometer	127	121	124	3	124	120	122	2	133	125	129	4
Size distribution coefficient		0.289	0.314	0.302	0.012	0.316	0.305	0.310	0.006	0.290	0.350	0.320	0.030
Bulk density	g/mL	0.358	0.342	0.350	0.008	0.345	0.335	0.340	0.005	0.350	0.345	0.348	0.002
Cold plasticizer absorption	%	27.25	29.40	28.32	1.08	25.90	26.70	26.30	0.40	23.95	24.60	24.28	0.30
Fisheye per 300 cm ²	points	36	-	36	-	47	-	47	-	43	-	43	-

Table B-2 : Property of Dry Blend of UHMW PVC at \overline{DP} between 2450 to 2550

Property	Unit	Comonomer amount (phr.)											
		0.000				0.075				0.123			
		X ₁	X ₂	X	SD	X ₁	X ₂	X	SD	X ₁	X ₂	X	SD
Hardness (Shore A, 15 sec.)		77	75	76	1.0	76	75	75.5	0.5	75	74	74.5	0.5
Tensile strength	N/mm ²	25.28	25.09	25.19	0.10	23.36	23.72	23.54	0.18	23.06	22.88	22.97	0.09
Elongation	%	330	325	327.5	2.5	320	350	335	15	350	345	347.5	2.5
Brittleness temperature	°C	-34	-36	-35	1.0	-34	-36	-35	1.0	-33	-35	-34	1.0
Volume resistivity	x10 ⁵ MΩ.m	2.44	2.06	2.25	0.19*	3.69	3.61	3.65	0.04*	5.49	5.59	5.54	0.05*
Heat deformation	%	4.01	4.13	4.07	0.06	4.34	4.26	4.3	0.04	4.52	4.47	4.49	0.02
Dynamic heat stability													
-Burnt time	min.	45	-	45	-	60	-	60	-	60	-	60	-

Remark : SD = * x 10⁴

Table B-2 : Property of Dry Blend of UHMW PVC at \bar{DP} between 2450 to 2550 (Continued)

Property	Unit	Comonomer amount (phr.)											
		0.166				0.200				0.280			
		X ₁	X ₂	X	SD	X ₁	X ₂	X	SD	X ₁	X ₂	X	SD
Hardness (Shore A, 15 sec.)		74	73	73.5	0.5	74	73	73.5	0.5	73	73	73	0.0
Tensile strength	N/mm ²	22.34	22.15	22.25	0.10	21.89	22.39	22.14	0.25	19.36	19.63	19.49	0.14
Elongation	%	350	360	355	5.0	350	380	365	15.0	375	410	39205	17.5
Brittleness temperature	°C	-34	-35	-34.5	0.5	-34	-36	-35	1.0	-33	-35	-34	1.0
Volume resistivity	x10 ⁵ M.Ω.m	4.06	4.00	4.03	0.03*	4.77	4.69	4.73	0.04*	10.95	10.67	10.81	0.14*
Heat deformation	%	6.44	6.52	6.48	0.04	6.69	6.73	6.71	0.02	7.69	7.75	7.72	0.03
Dynamic heat stability													
-Burnt time	min.	60	-	60	-	65	-	65	-	65	-	65	-

Remark : SD = * x 10⁴

APPENDIX C
RELATION BETWEEN COMONOMER AMOUNT AND REACTION TIME
AT DIFFERENT POLYMERIZATION TEMPERATURES

Figs. C-1 to C-5 show the relation between comonomer amount and the reaction time. At each particular polymerization temperature, only the batches having the same level of the initiator amount are plotted. Increasing the comonomer amount need a slightly longer reaction time.

The polymerization rate falls as the free VCM concentration falls below the 75/25 PVC/VCM equilibrium concentration.⁽¹⁾ The reaction pressure which is the vapour pressure of VCM falls also. In case of adding more comonomer, the comonomer is copolymerized with VCM, which decrease the VCM consumption rate to take a longer time for pressure to drop.

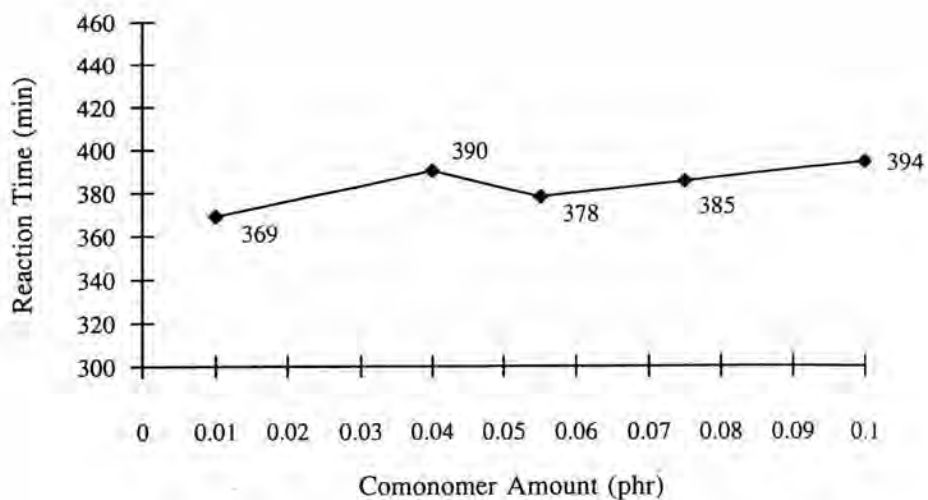


Fig. C-1 : Relation between Comonomer Amount and Reaction Time at the Polymerization Temperature of 43°C

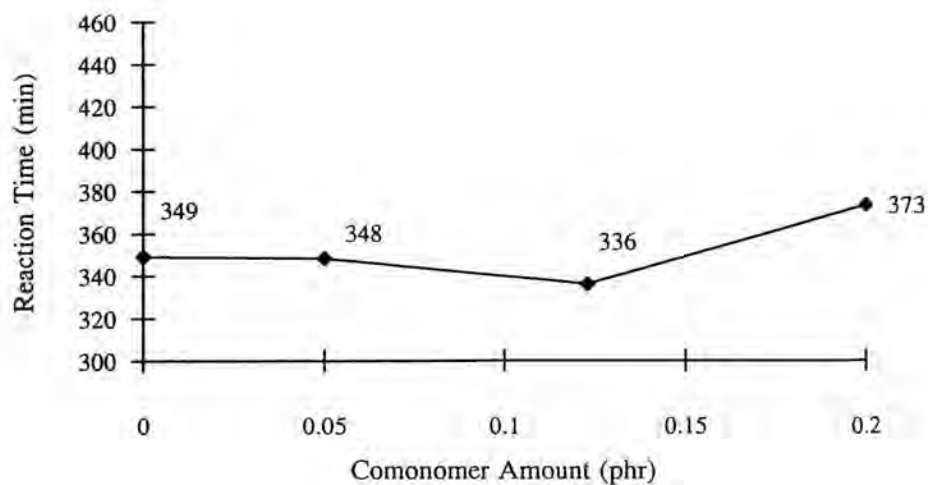


Fig. C-2 : Relation between Comonomer Amount and Reaction Time at the Polymerization Temperature of 46°C

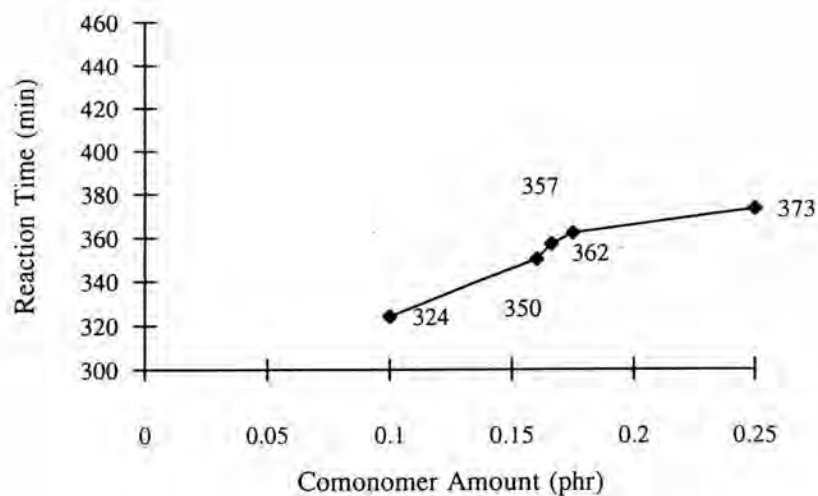


Fig. C-3 : Relation between Comonomer Amount and Reaction Time at the Polymerization Temperature of 49°C

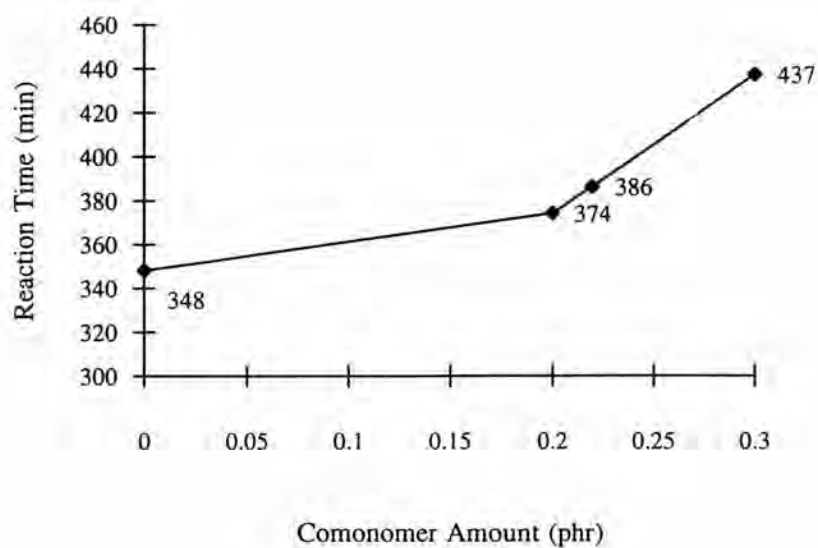


Fig. C-4 : Relation between Comonomer Amount and Reaction Time at the Polymerization Temperature of 52°C

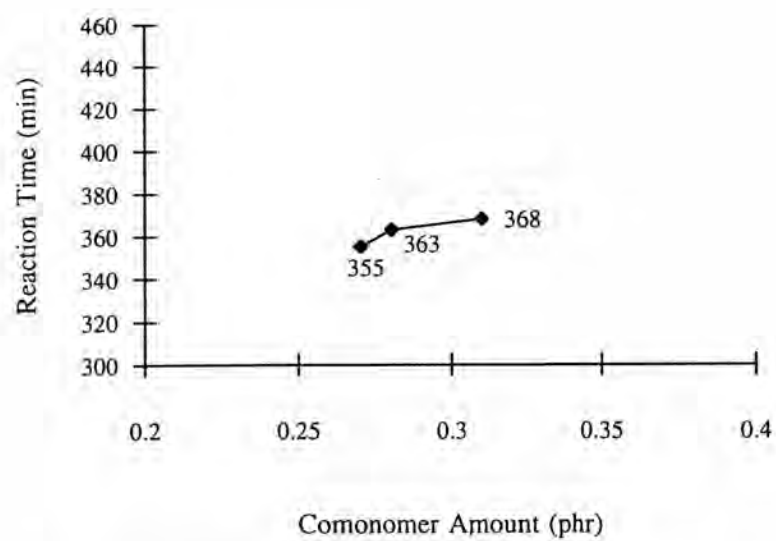


Fig. C-5 : Relation between Comonomer Amount and Reaction Time at Polymerization Temperature of 58°C

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CURRICULUM VITAE

Miss Sukanya Assawachaiudom was born on November 10, 1967, in Bangkok. After the graduation with a B.Sc. in Material Science from the Faculty of Science, Chulalongkorn University, she works for Thai Plastic and Chemicals (Public) Company Limited as a research chemist for PVC resin development during 1990-1996, as of 1996, she has been working in the Technology and Engineering Division. Presently, she is also a graduate student at the Division of Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University for her Masters Degree in Polymer.