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APPENDICES

APPENDIX A

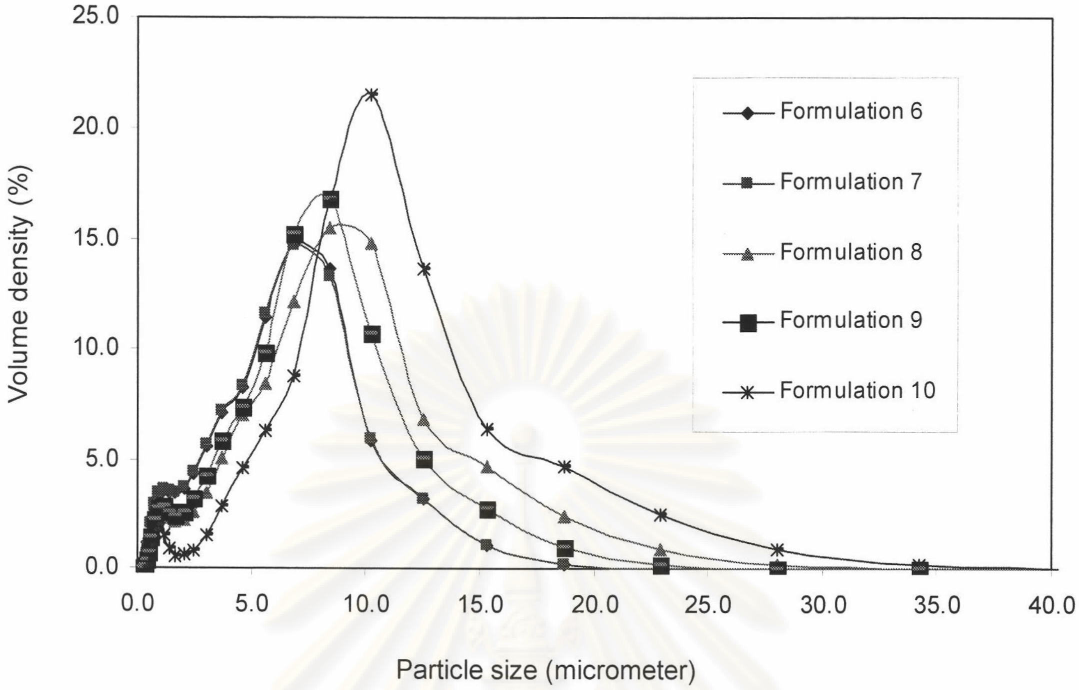


Figure A.1: %Volume density of polyurea microcapsules prepared by 0.07 mole of HDI and MDI.

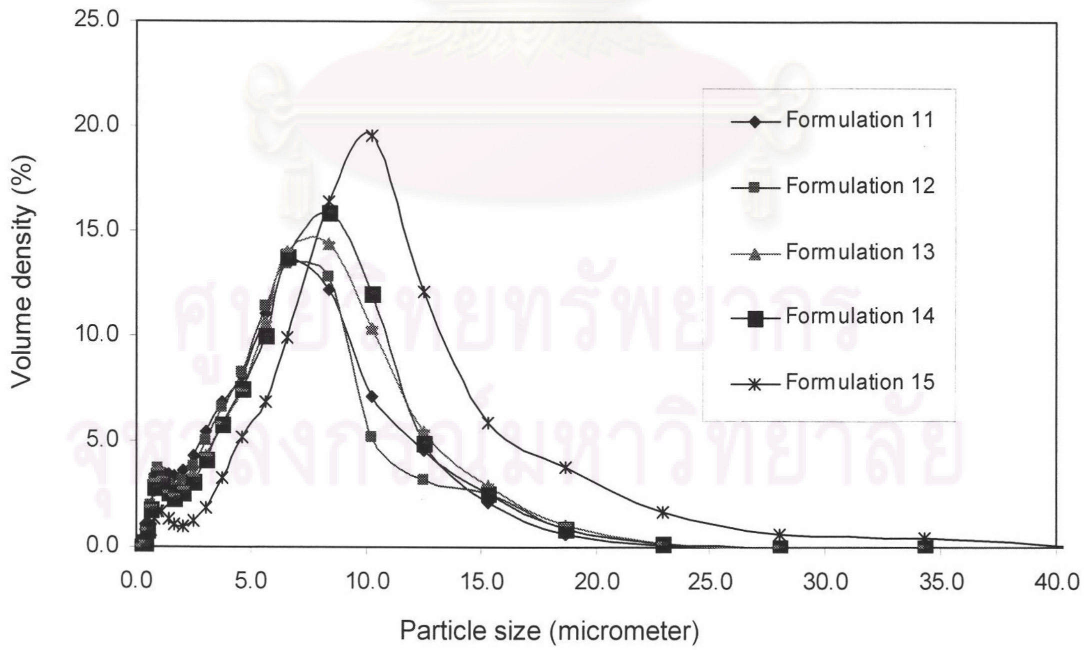


Figure A.2: %Volume density of polyurea microcapsules prepared by 0.05 mole of HDI and MDI.

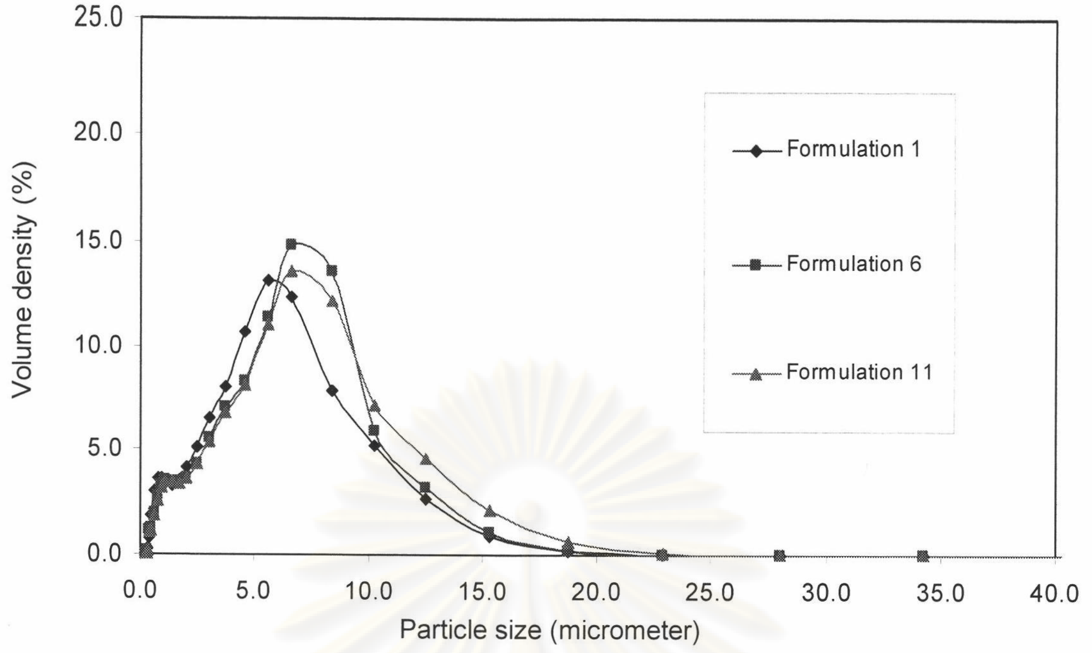


Figure A.3: %Volume density of polyurea microcapsules prepared by different concentrations of HDI.

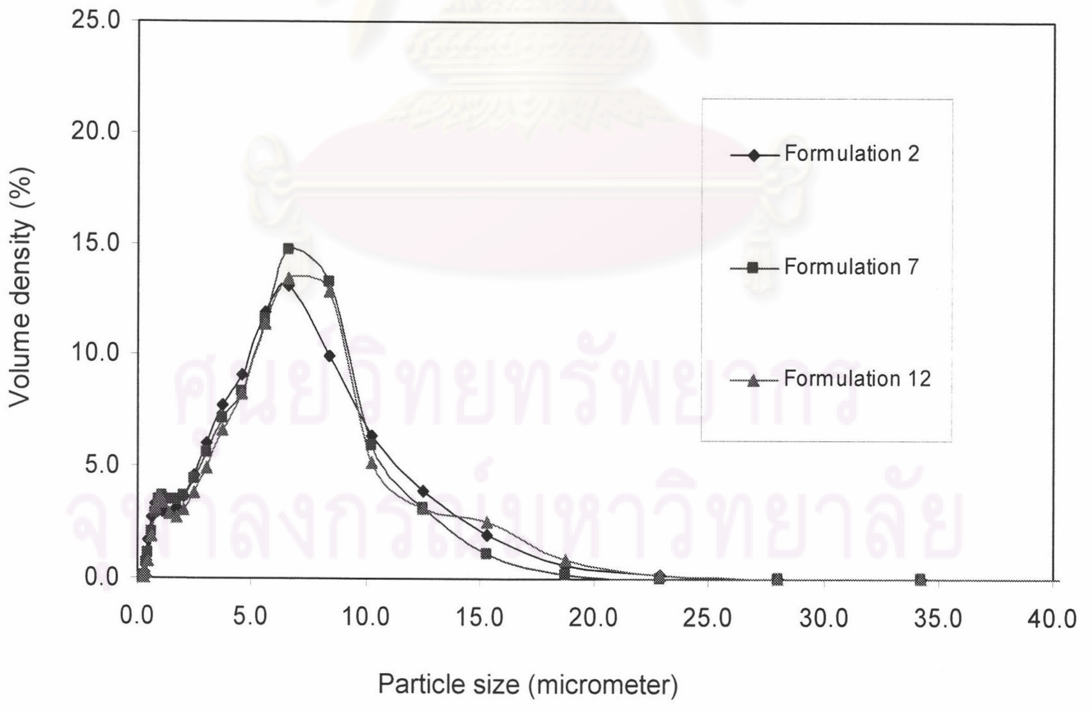


Figure A.4: %Volume density of polyurea microcapsules prepared by different concentrations of 80:20 mole ratio HDI and MDI.

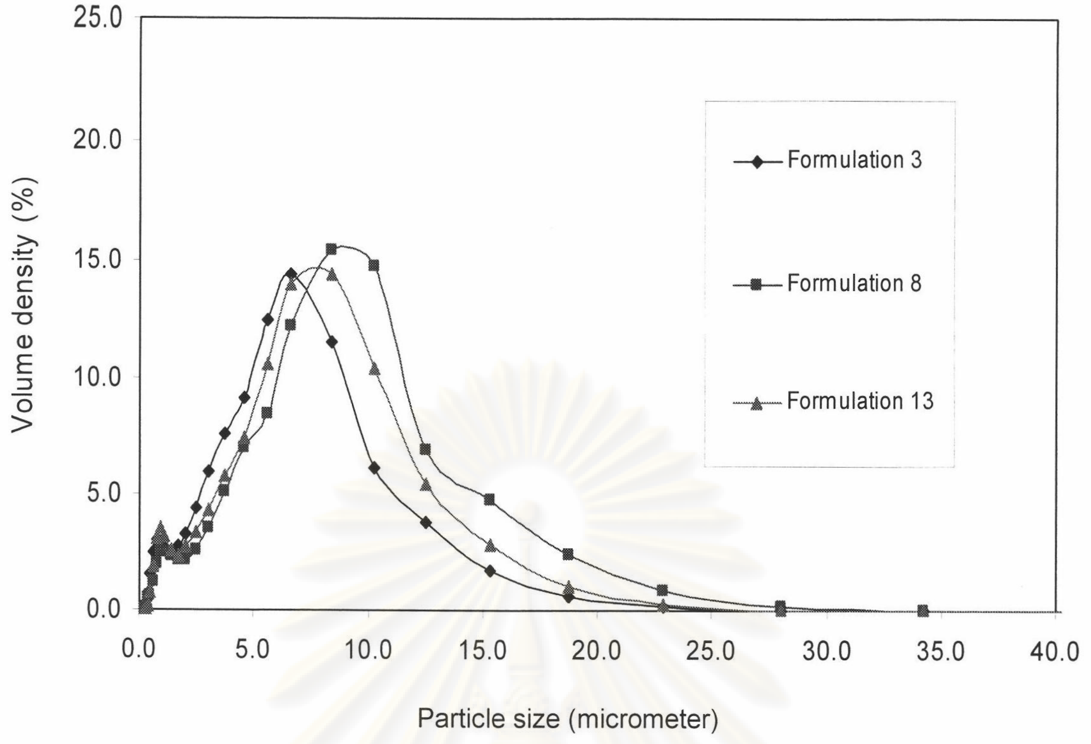


Figure A.5: %Volume density of polyurea microcapsules prepared by different concentrations of 60:40 mole ratio HDI and MDI.

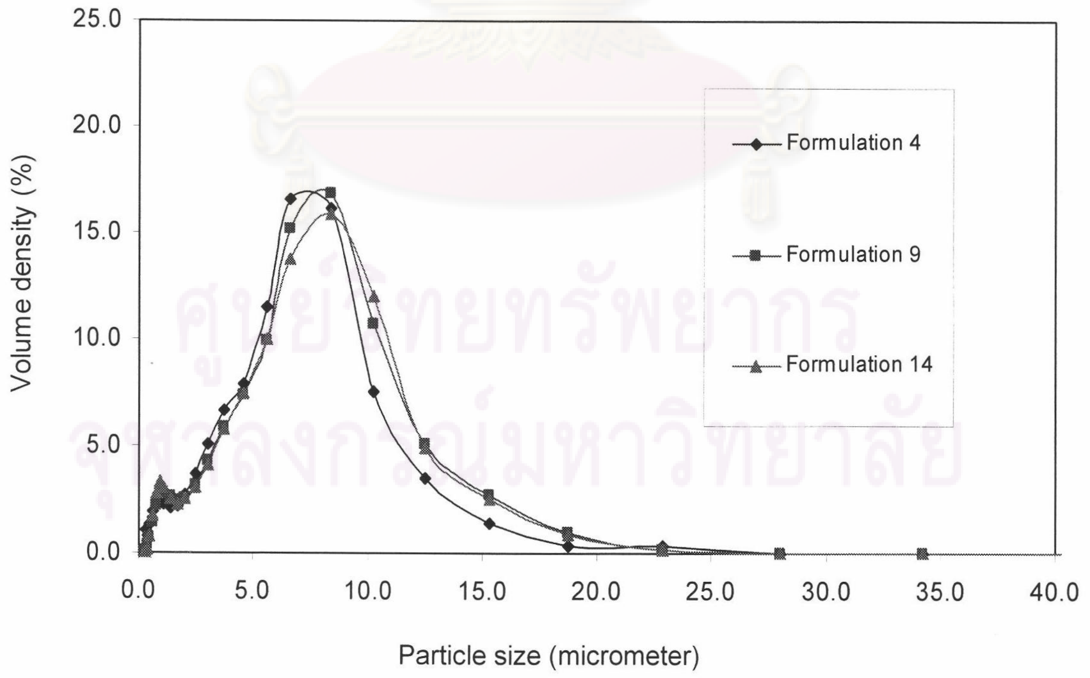


Figure A.6: %Volume density of polyurea microcapsules prepared by different concentrations of 30:70 mole ratio HDI and MDI.

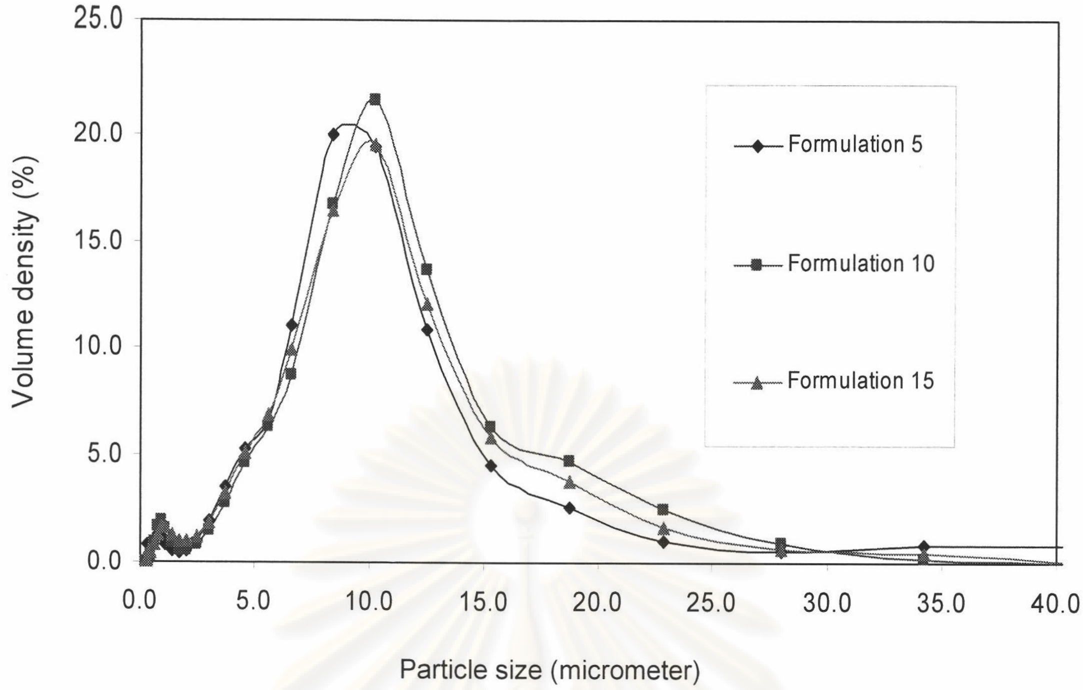


Figure A.7: %Volume density of polyurea microcapsules prepared by different concentrations of MDI.

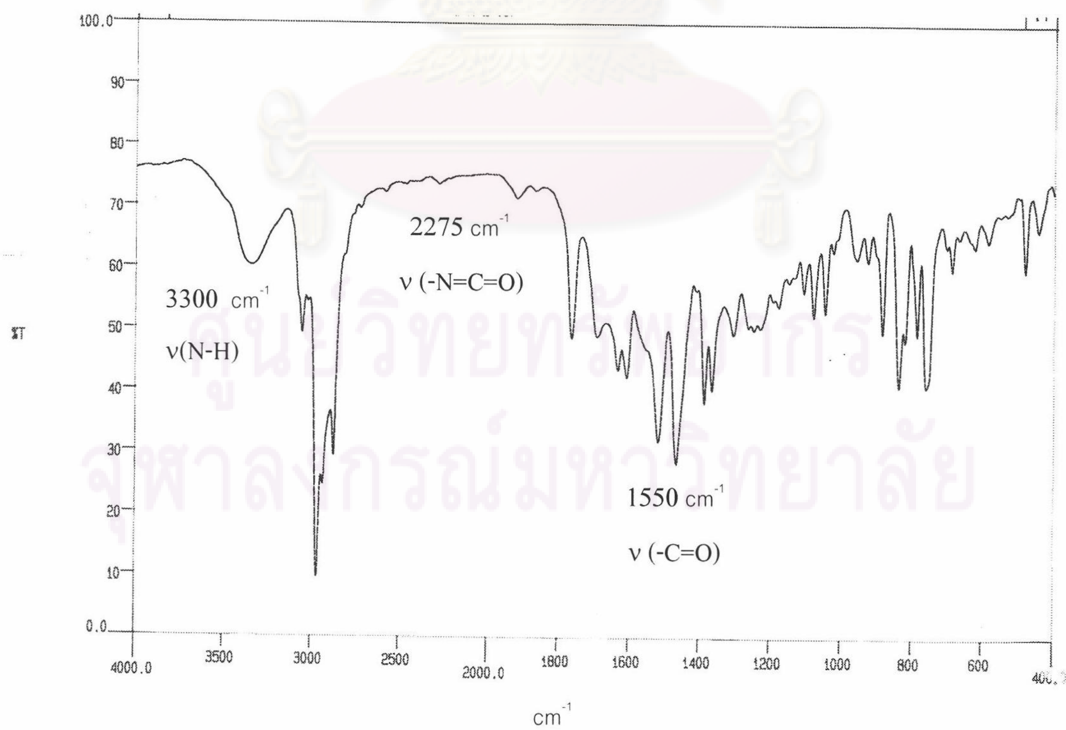


Figure A.8. FTIR spectrum of polyurea microcapsules from 0.08 mole HDI, 0.02 mole MDI and 0.01 mole EDA.

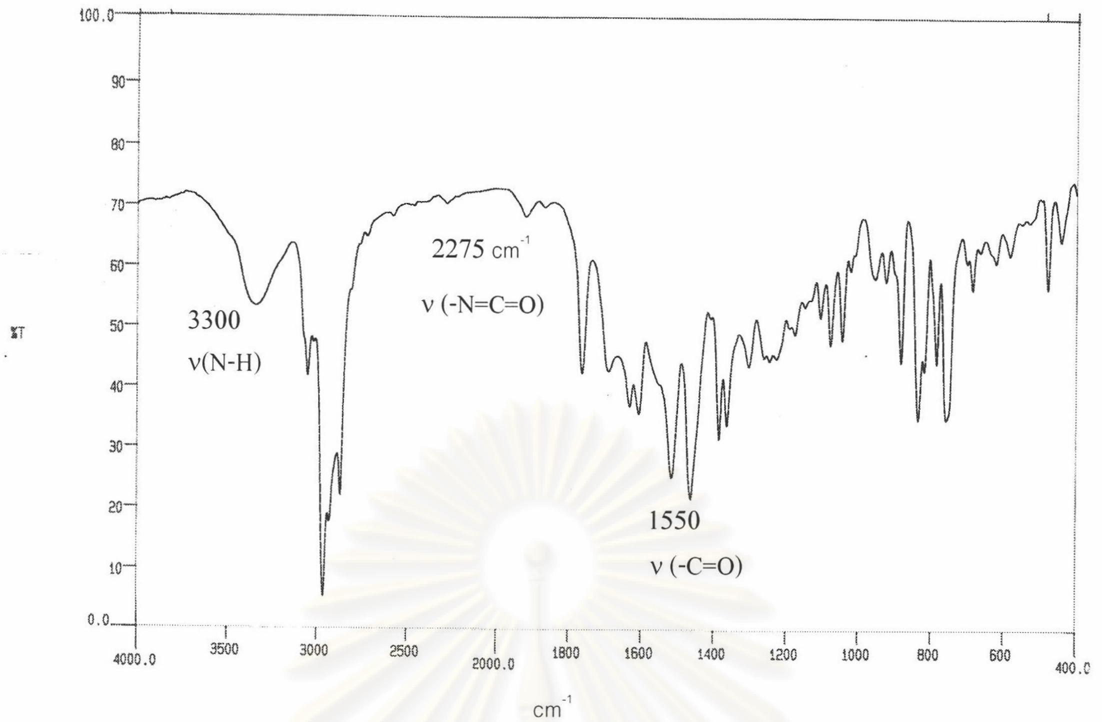


Figure A.9. FTIR spectrum of polyurea microcapsules from 0.08 mole HDI, 0.02 mole MDI and 0.02 mole EDA.

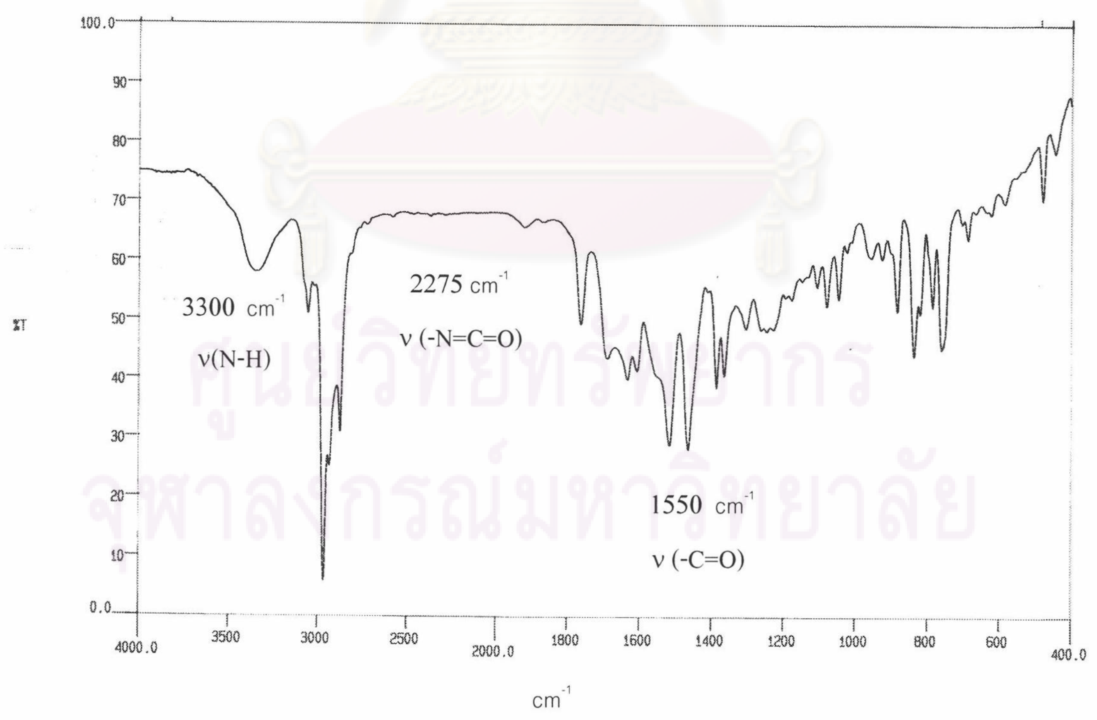


Figure A.10. FTIR spectrum of polyurea microcapsules from 0.08 mole HDI, 0.02 mole MDI and 0.03 mole EDA.

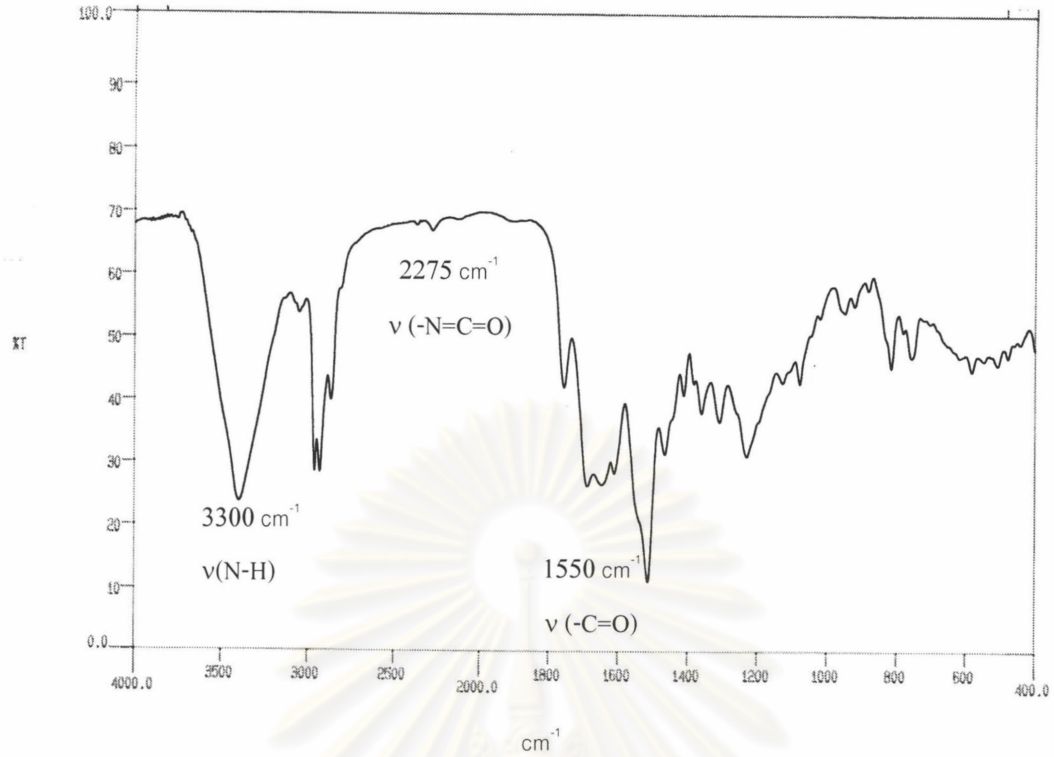


Figure A.11. FTIR spectrum of polyurea microcapsules from 0.06 mole HDI, 0.04 mole MDI and 0.01 mole EDA.

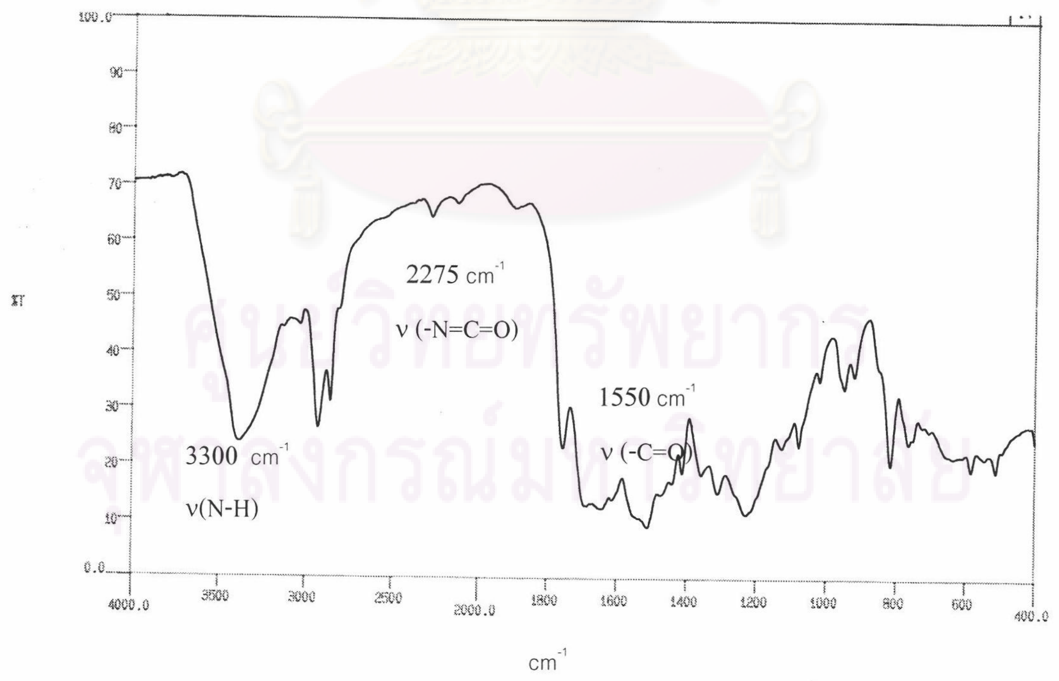


Figure A.12: FTIR spectrum of polyurea microcapsules from 0.06 mole HDI, 0.04 mole MDI and 0.02 mole EDA.

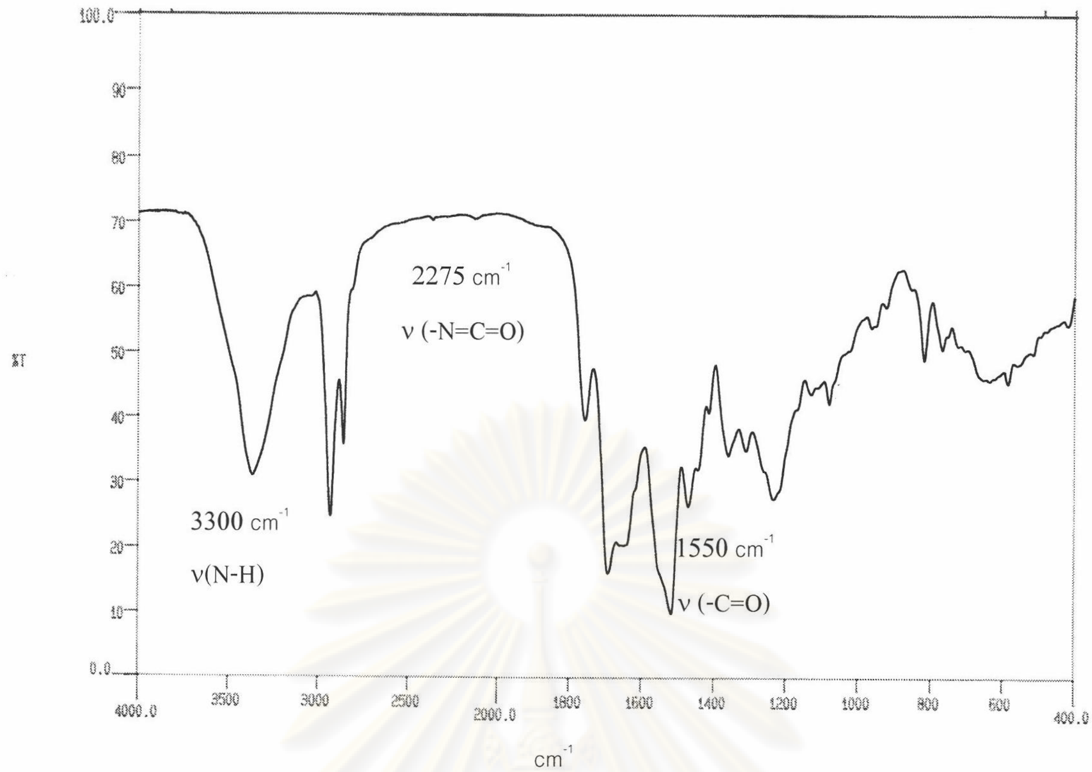


Figure A.13: FTIR spectrum of polyurea microcapsules from 0.06 mole HDI, 0.04 mole MDI and 0.03 mole EDA.

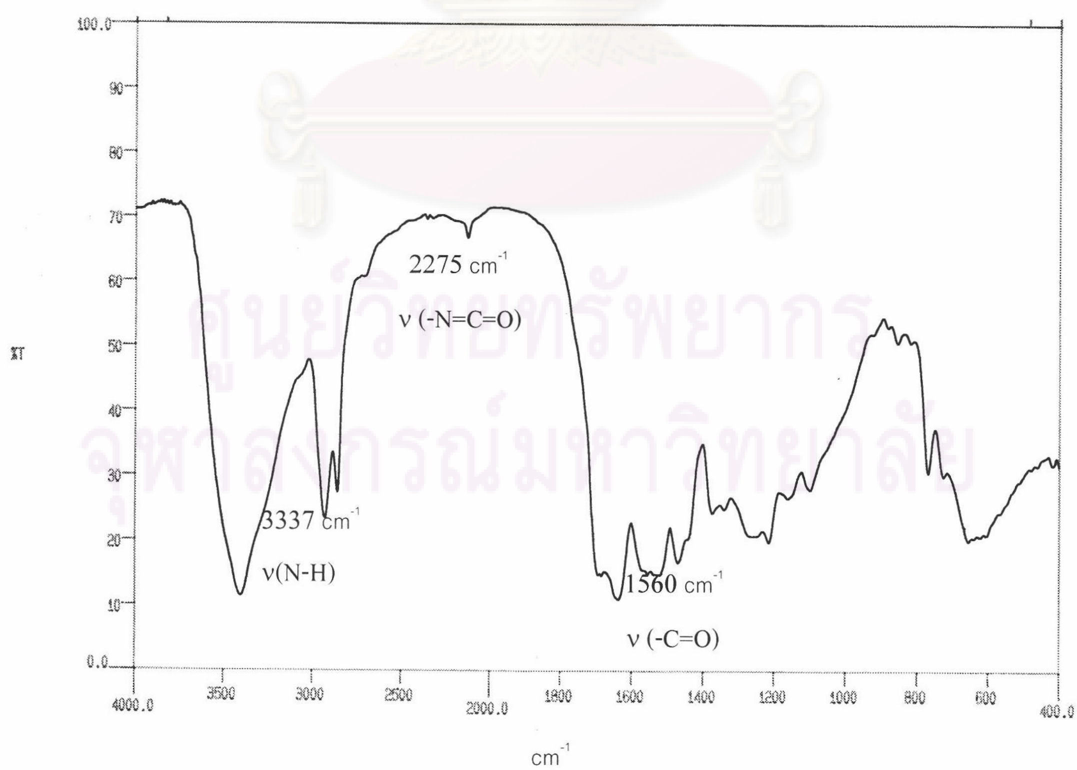


Figure A.14 FTIR spectrum of polyurea microcapsules from 0.10 mole HDI.

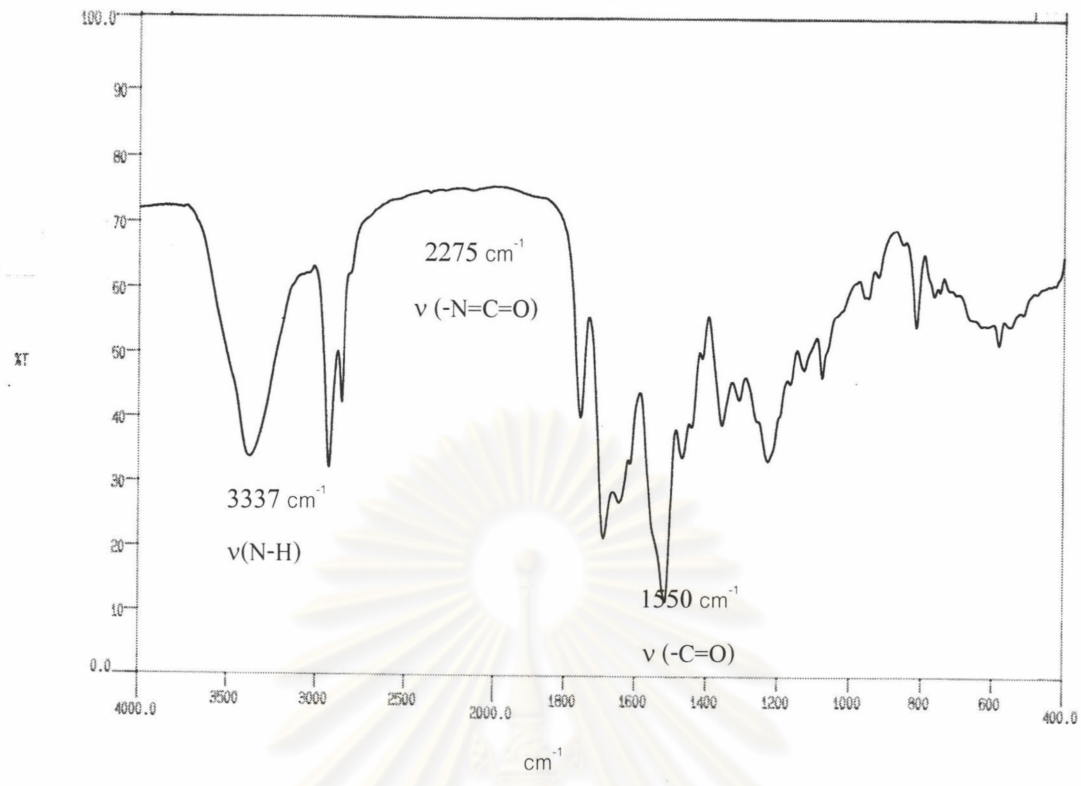


Figure A.15: FTIR spectrum of polyurea microcapsules from 0.08 mole HDI and 0.02 mole MDI.

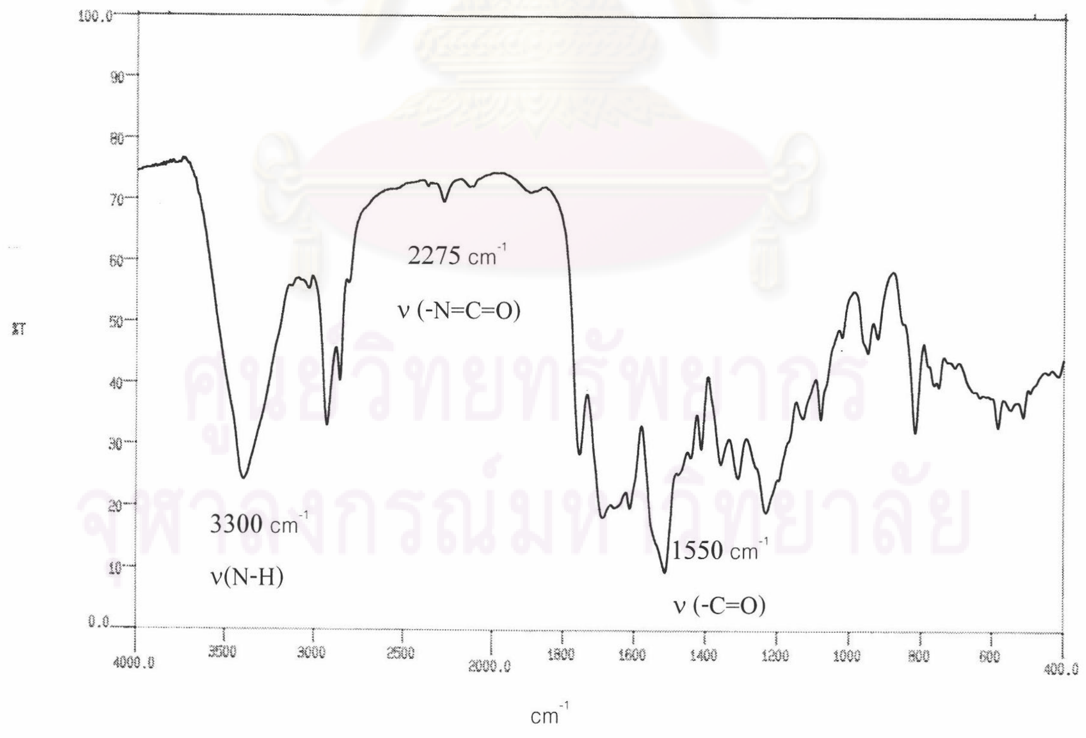


Figure A.16 : FTIR spectrum of polyurea microcapsules from 0.06 mole HDI and 0.04 mole MDI .

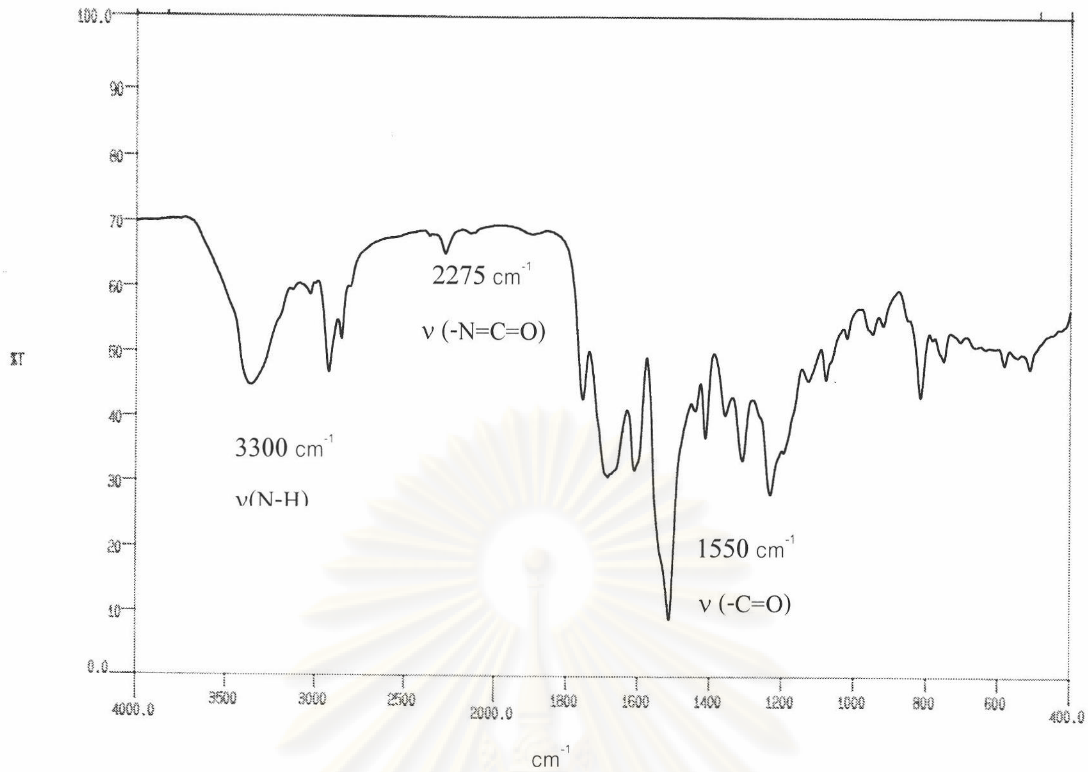


Figure A.17: FTIR spectrum of polyurea microcapsules from 0.03 mole HDI and 0.07 mole MDI .

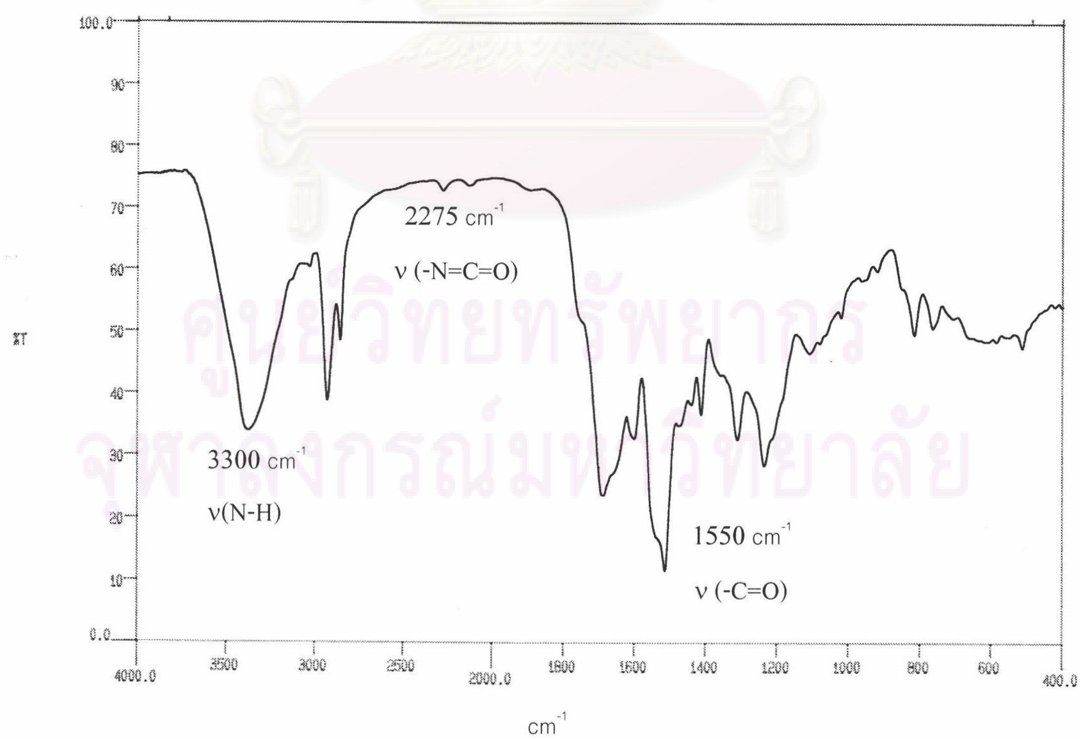


Figure A.18. FTIR spectrum of polyurea microcapsules from 0.10 mole MDI .

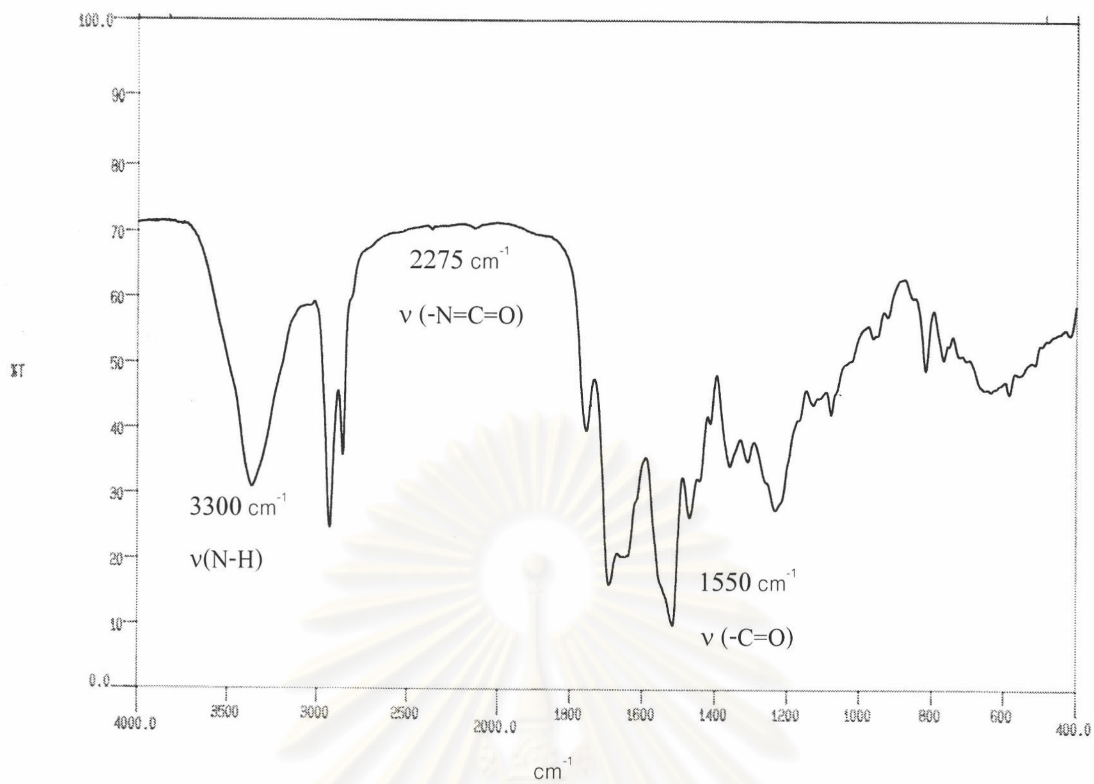


Figure A.19. FTIR spectrum of polyurea microcapsules from 0.07 mole HDI.

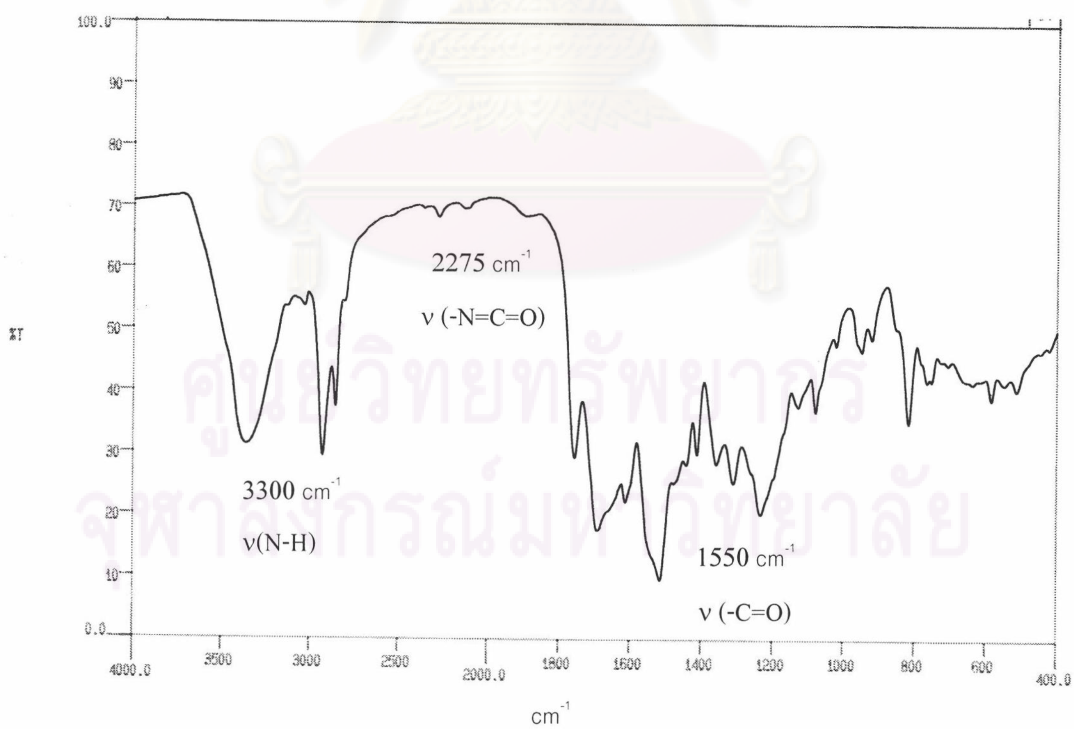
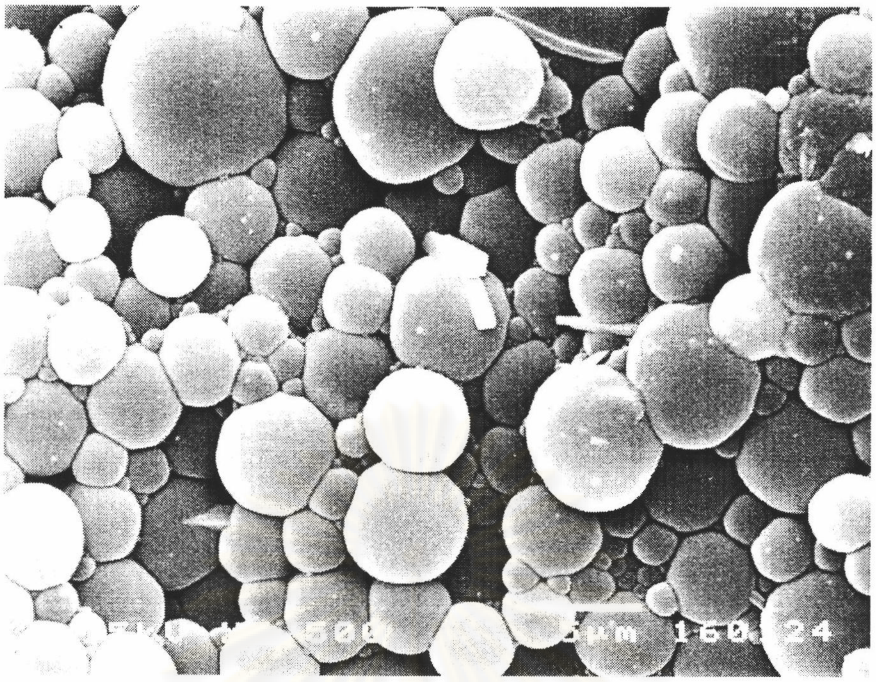


Figure A.20: FTIR spectrum of polyurea microcapsules from 0.06 mole HDI and 0.01 mole MDI .



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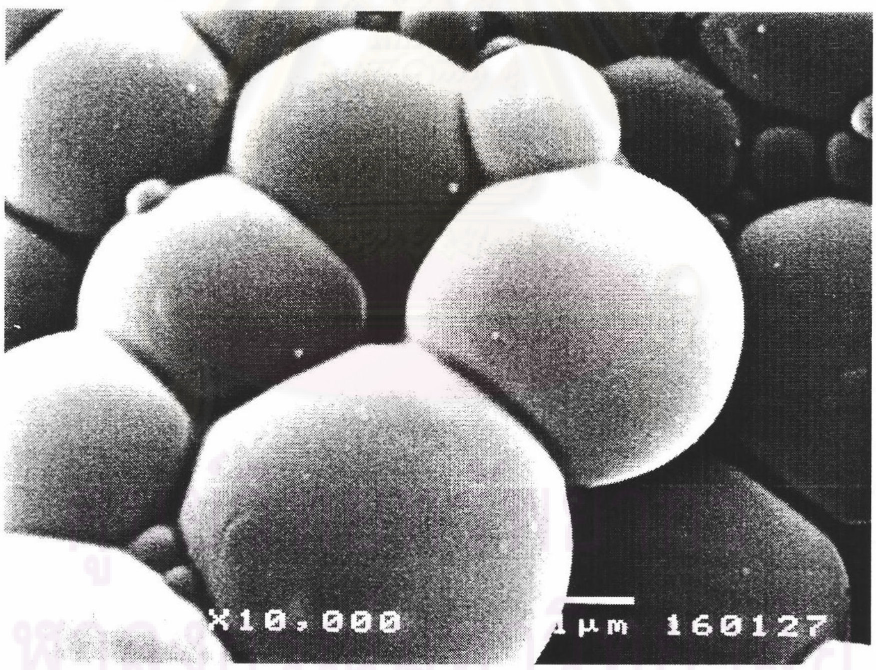
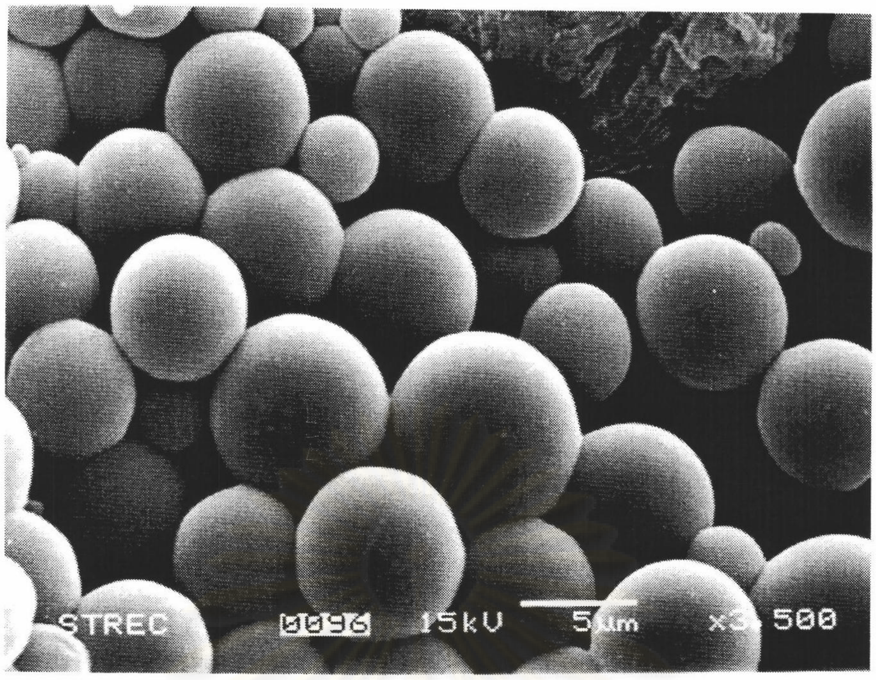


(b)

Figure A.21 Scanning electron micrographs of polyurea microcapsules formulation 6: 0.07 mole HDI in (a) and (b) with different magnifications.



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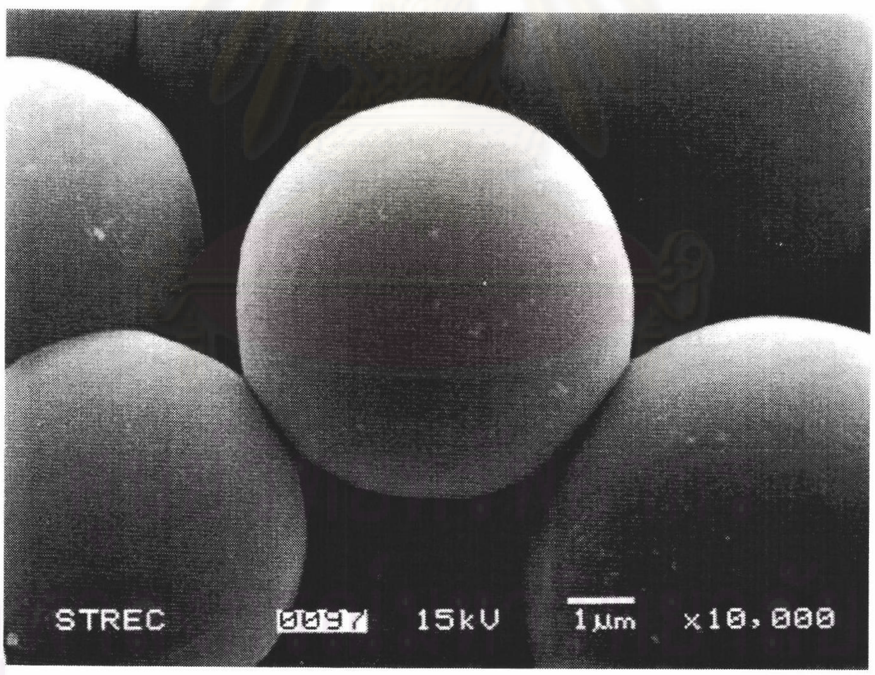
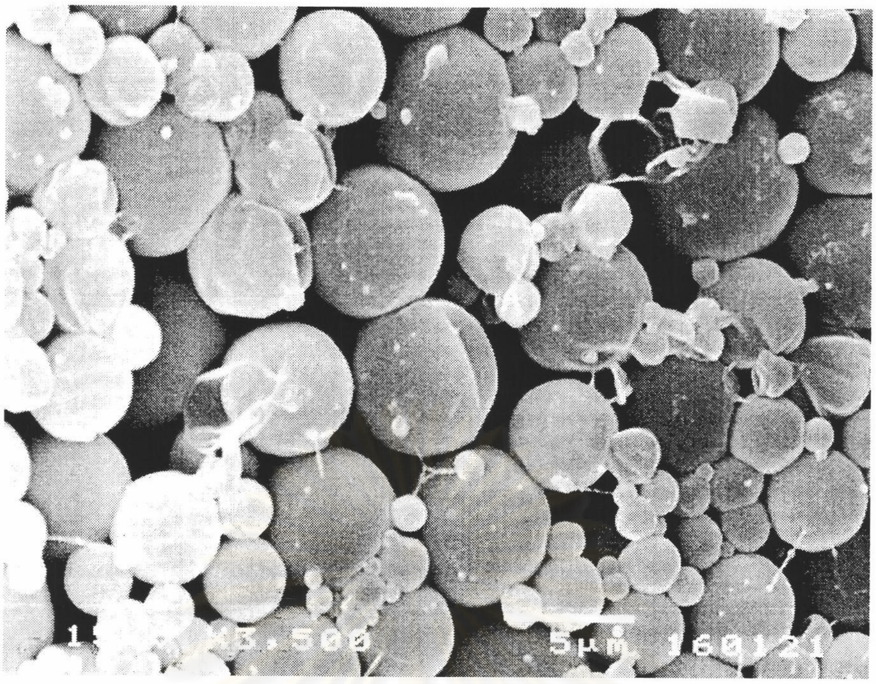


(b)

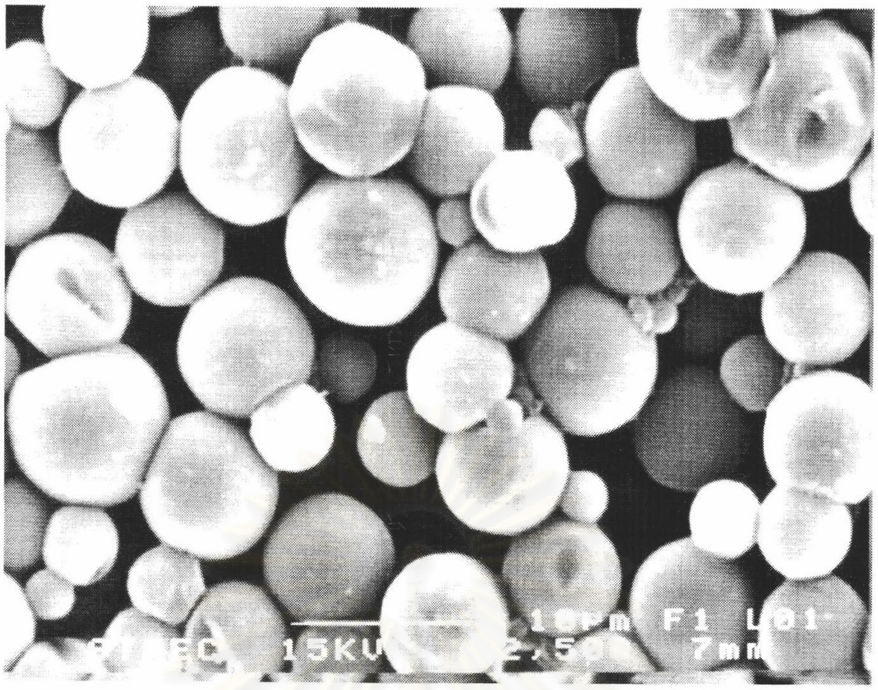
Figure A.22 Scanning electron micrographs of polyurea microcapsules formulation 7: 0.06 mole HDI and 0.01 mole MDI in (a) and (b) with different magnifications.



(a)

(b)

Figure A.23 Scanning electron micrographs of polyurea microcapsules formulation 8: 0.04 mole HDI and 0.03 mole MDI in (a) and (b) with different magnifications.



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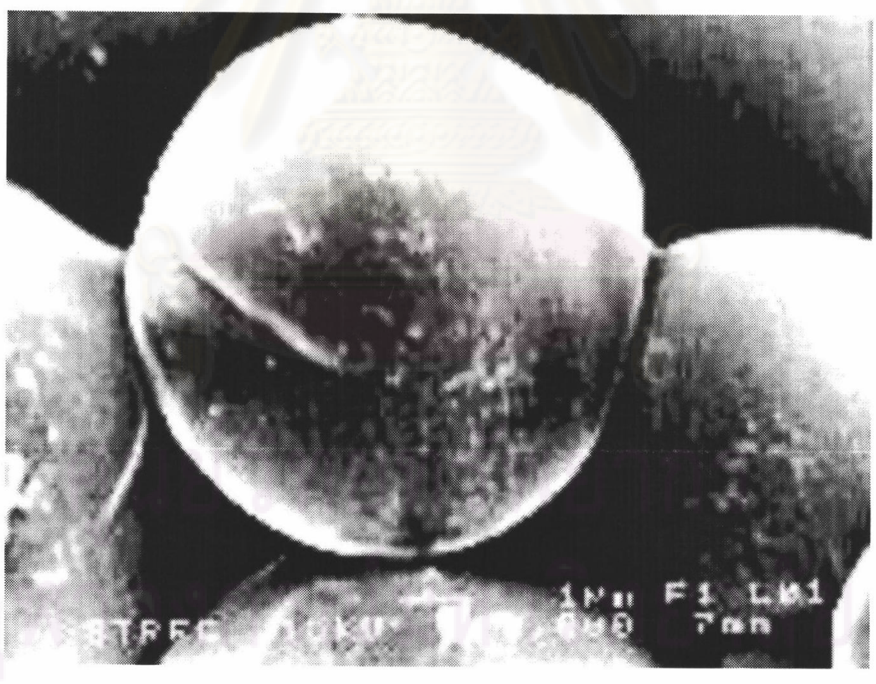

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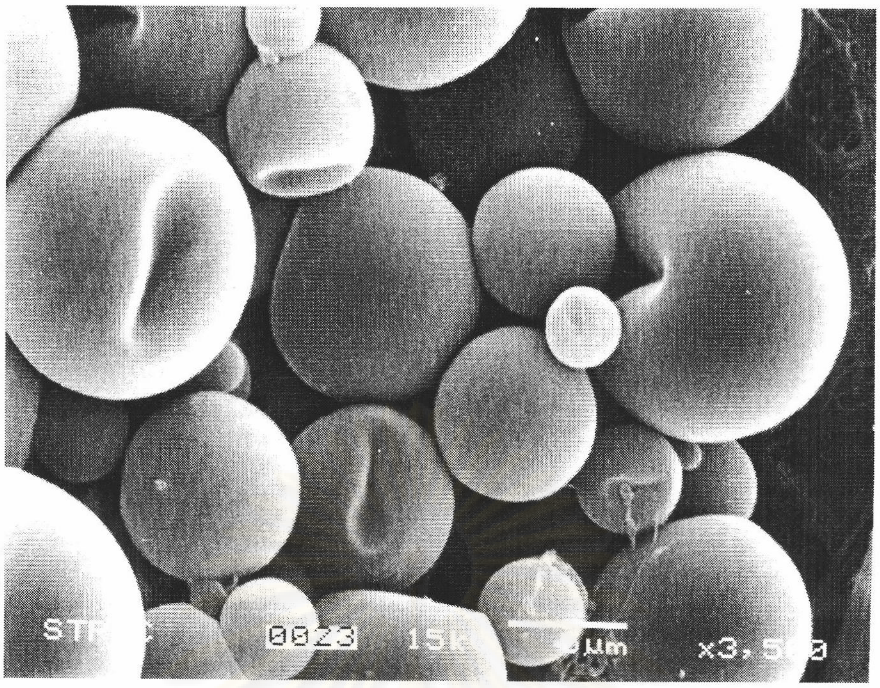
Figure A.24 Scanning electron micrographs of polyurea microcapsule formulation 9: 0.05 mole HDI and 0.02 mole MDI in (a) and (b) with different magnifications.



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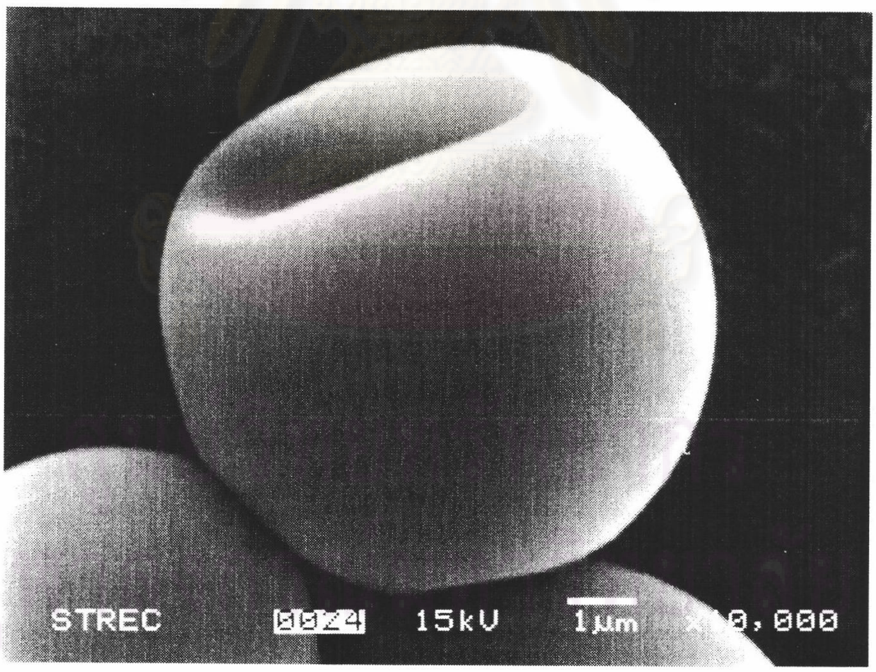

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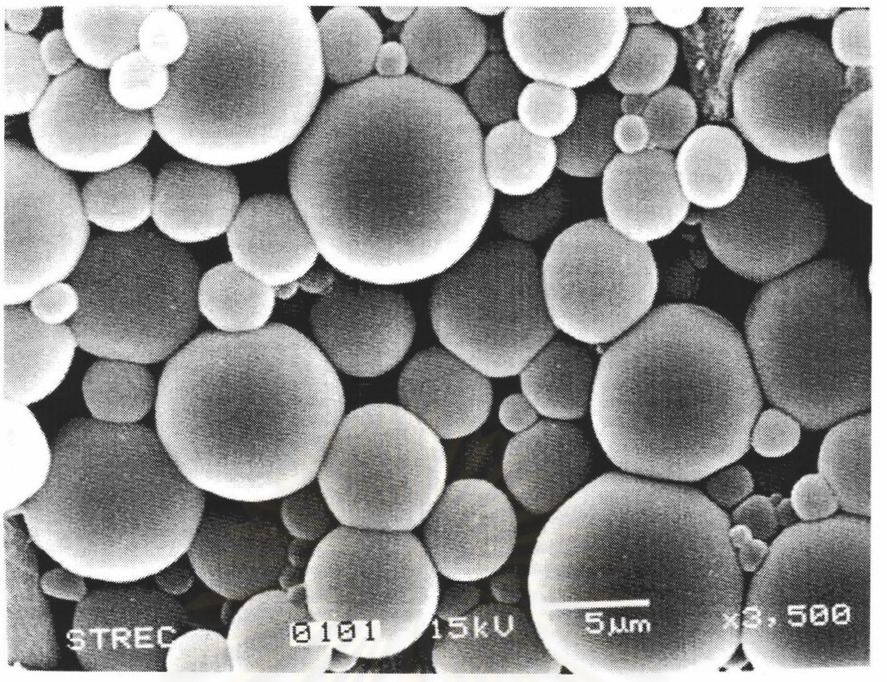
Figure A.25 Scanning electron micrographs of polyurea microcapsules formulation 10: 0.07 mole MDI in (a) and (b) with different magnifications.



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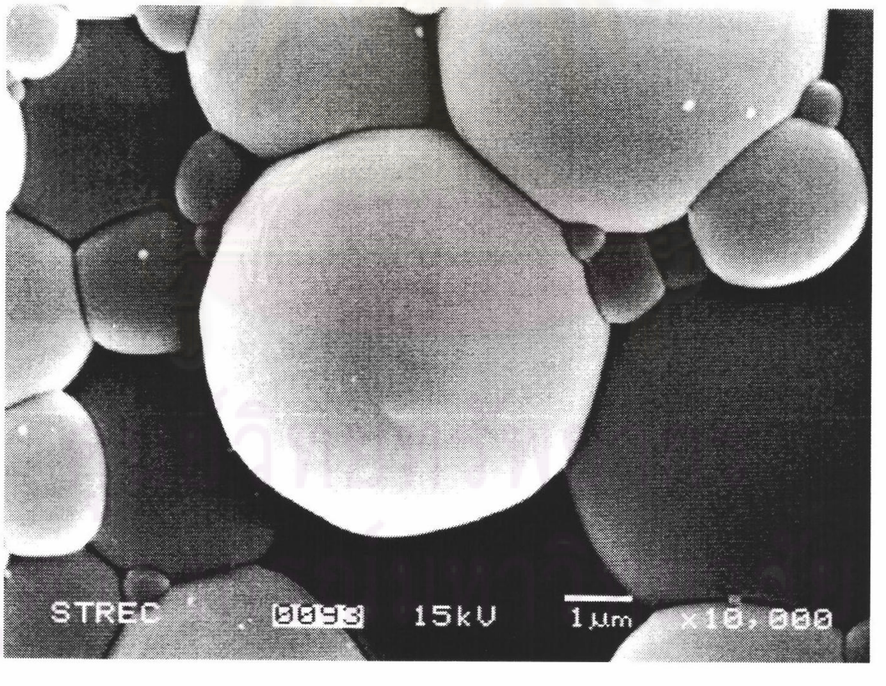

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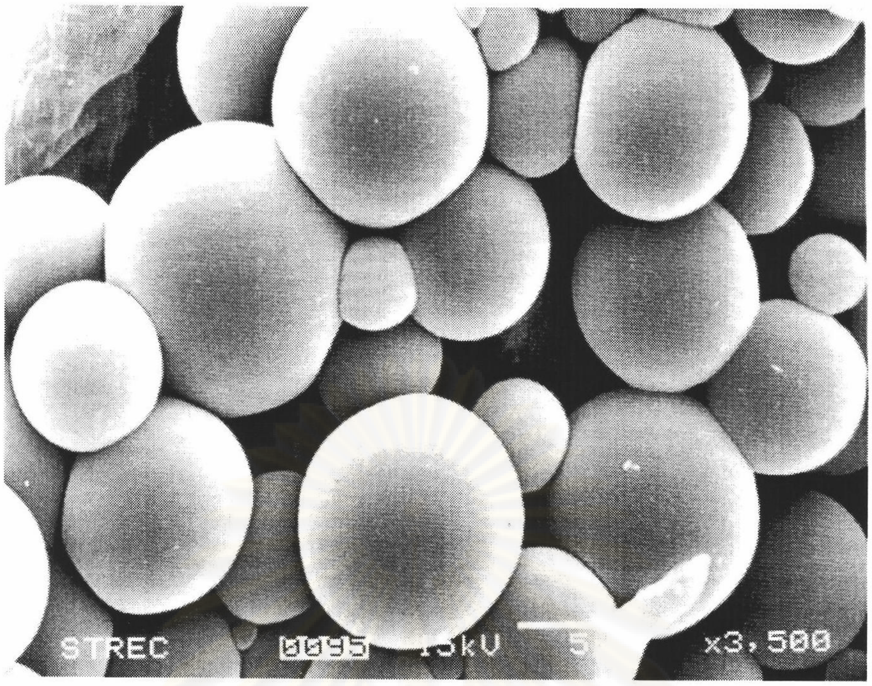

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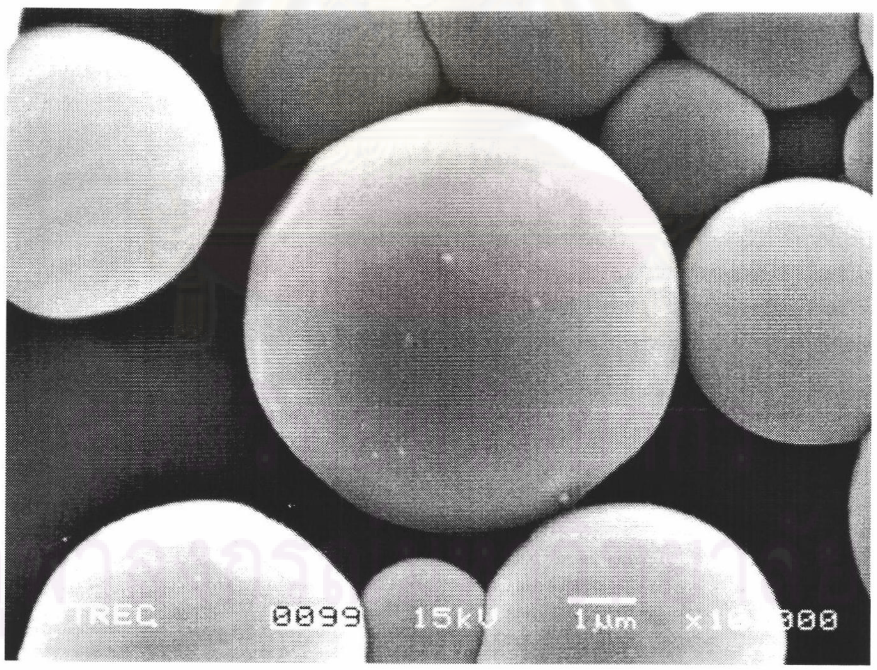

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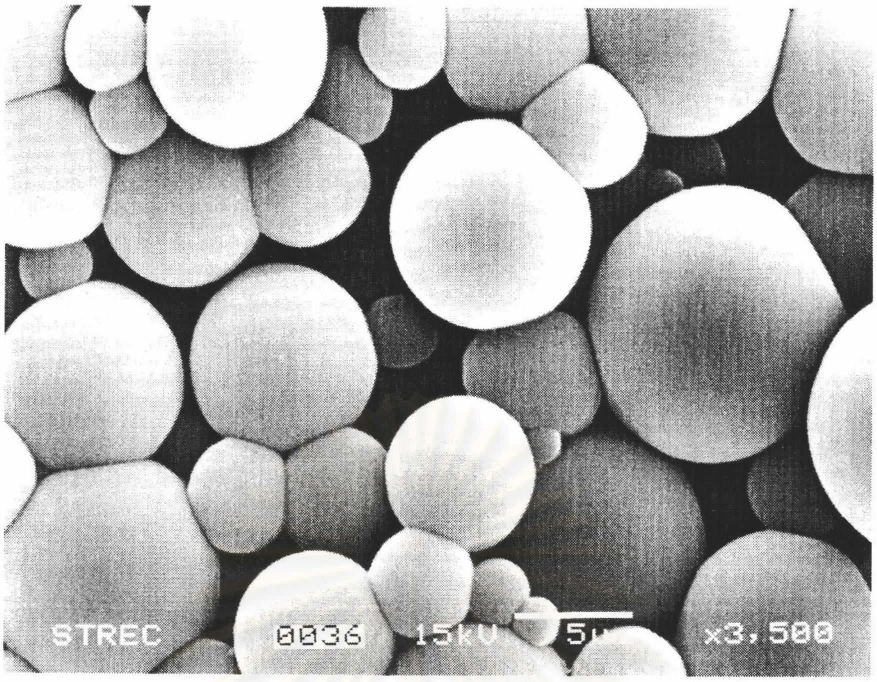
Figure A.27 Scanning electron micrographs of polyurea microcapsules formulation 12: 0.04 mole HDI and 0.01 MDI in (a) and (b) with different magnifications



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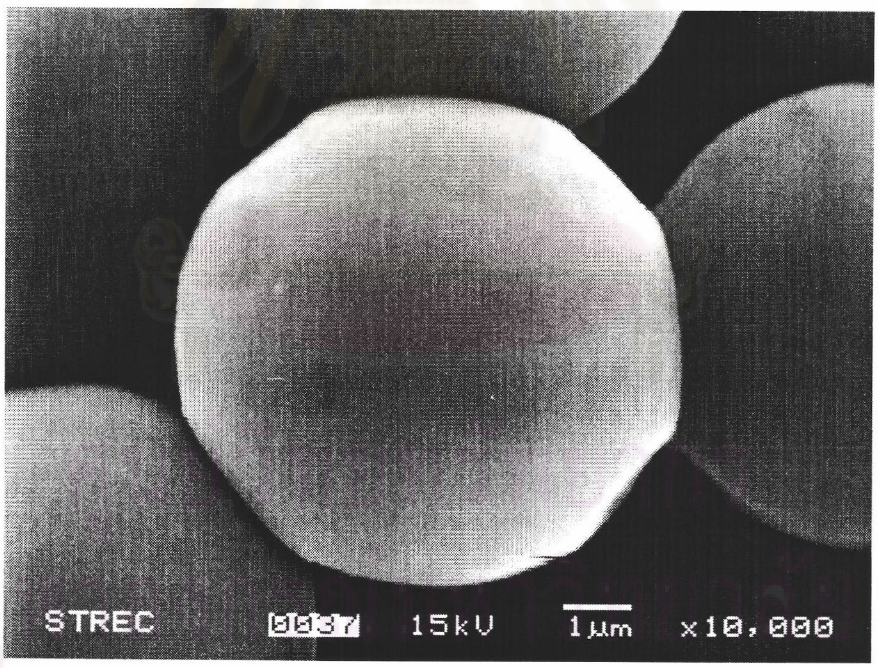

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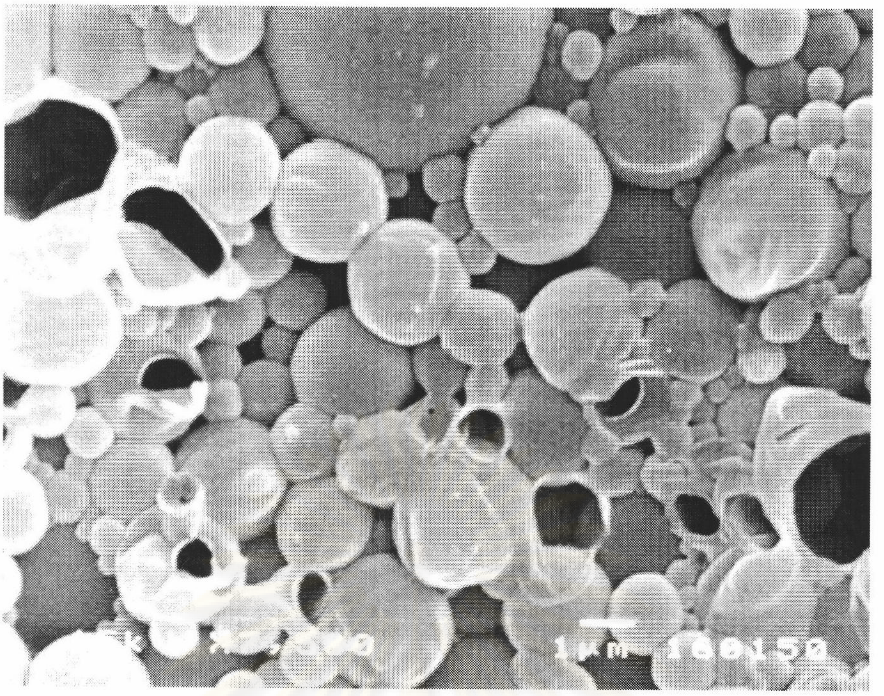
Figure A.28 Scanning electron micrographs of polyurea microcapsules formulation 13: 0.03 mole HDI and 0.02 mole MDI in (a) and (b) with different magnifications.



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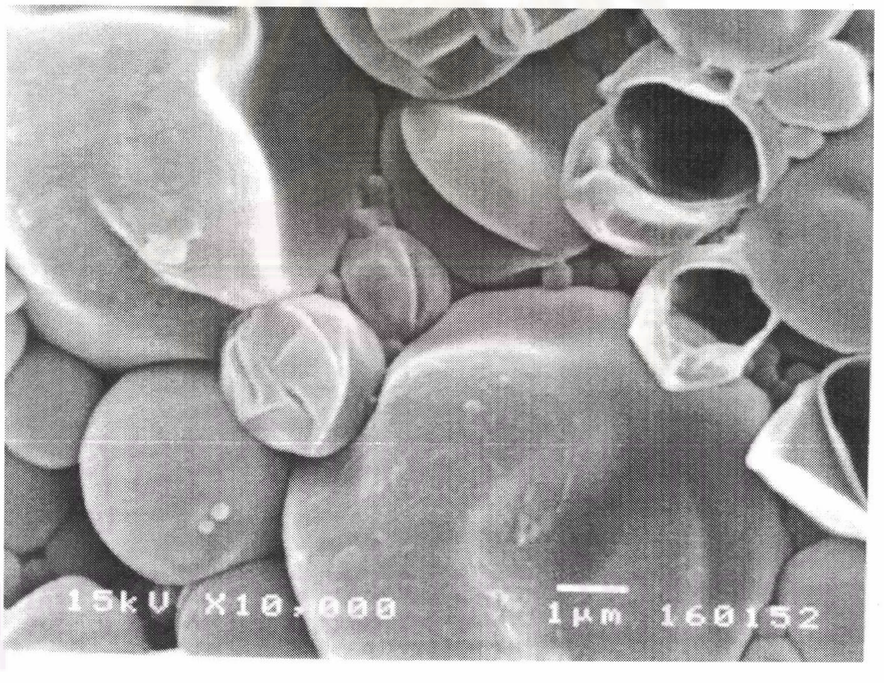
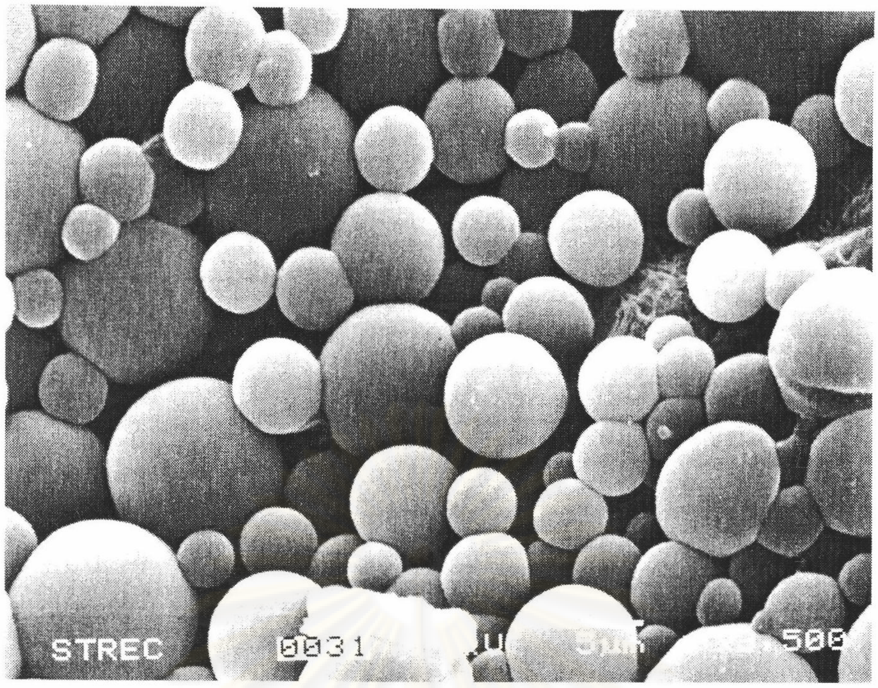


(b)

Figure A.29 Scanning electron micrographs of polyurea microcapsules formulation 15: 0.05 mole MDI in (a) and (b) with different magnifications.



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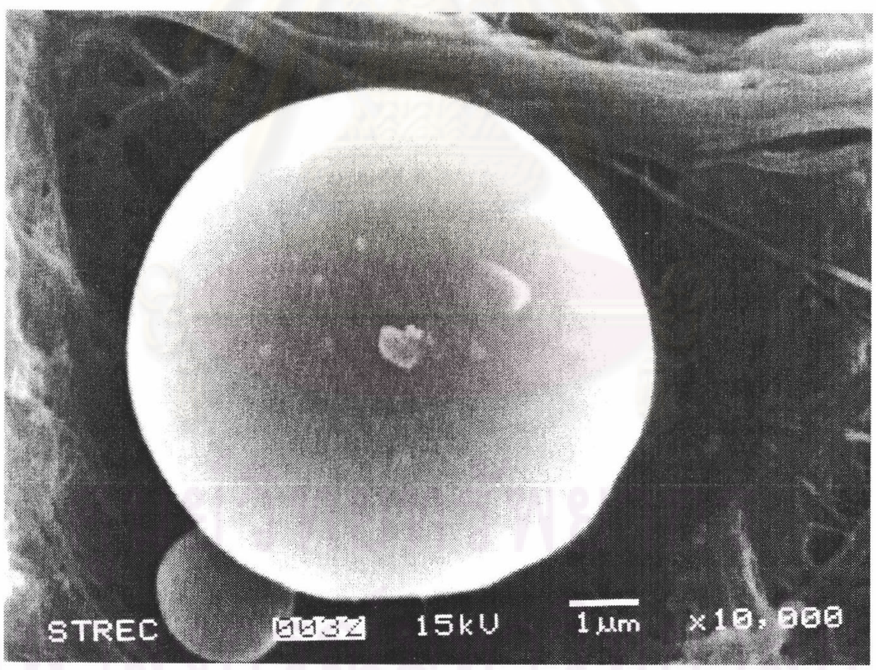
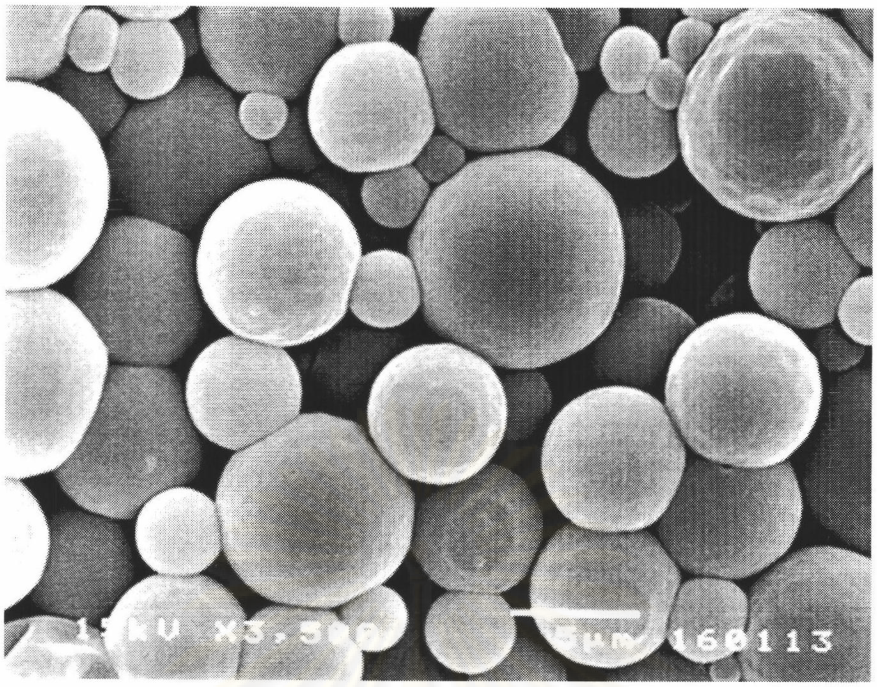


(b)

Figure A.30 Scanning electron micrographs of polyurea microcapsules formulation 16: 0.08 mole HDI, 0.02 mole MDI and 0.01 mole EDA in (a) and (b) with different magnifications.



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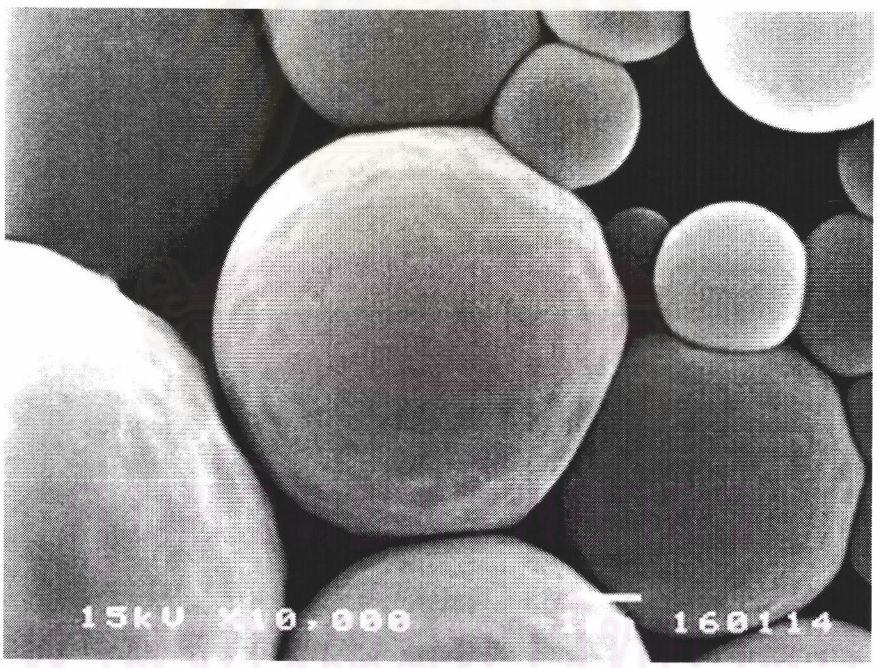
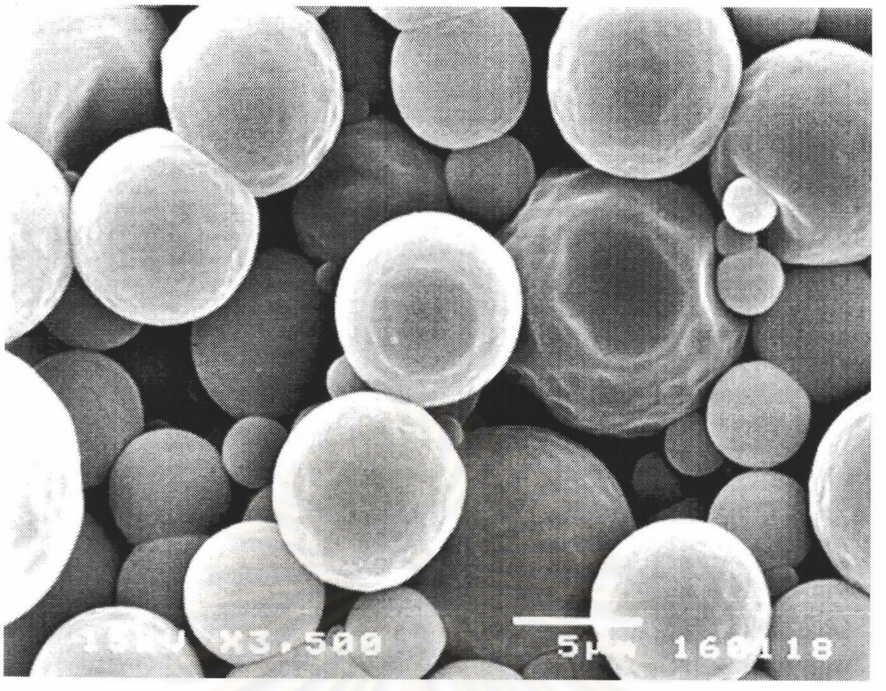


(b)

Figure A.31 Scanning electron micrographs of polyurea microcapsules formulation 17: 0.08 mole HDI, 0.02 mole MDI and 0.02 mole EDA in (a) and (b) with different magnifications.



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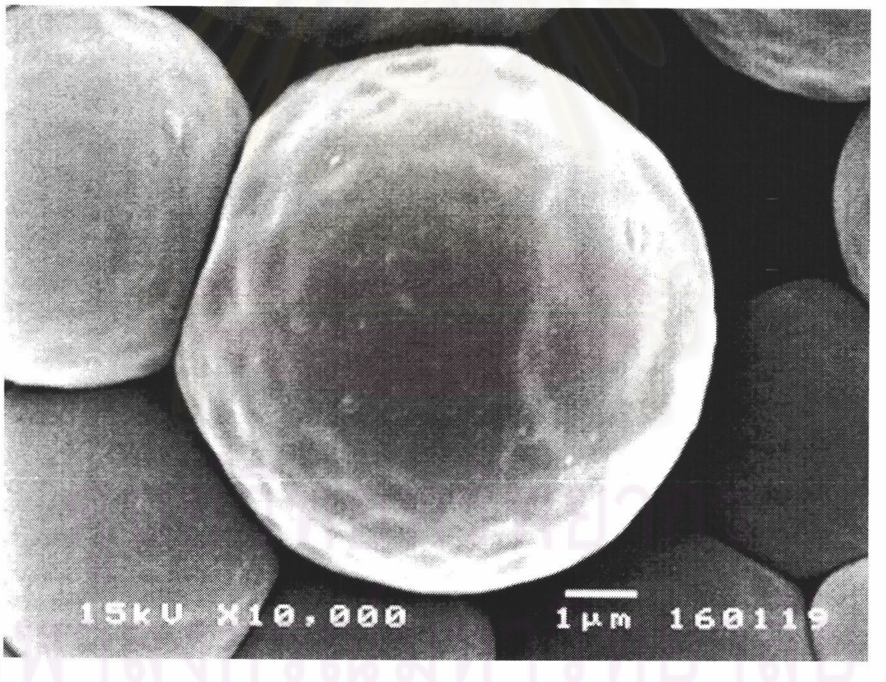
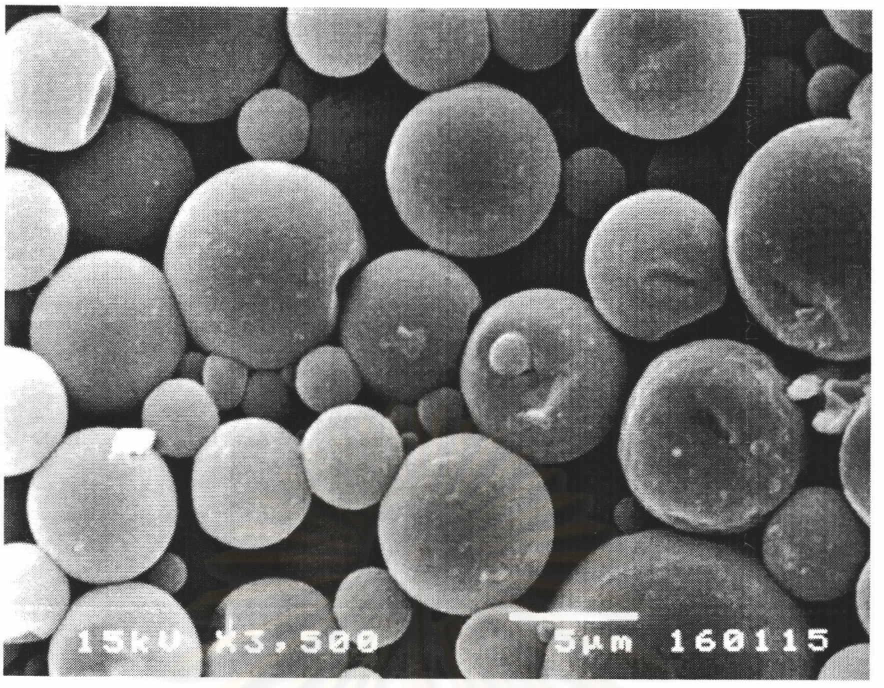


(b)

Figure A.32 Scanning electron micrographs of polyurea microcapsules formulation 18: 0.08 mole HDI, 0.02 mole MDI and 0.03 mole EDA in (a) and (b) with different magnifications.



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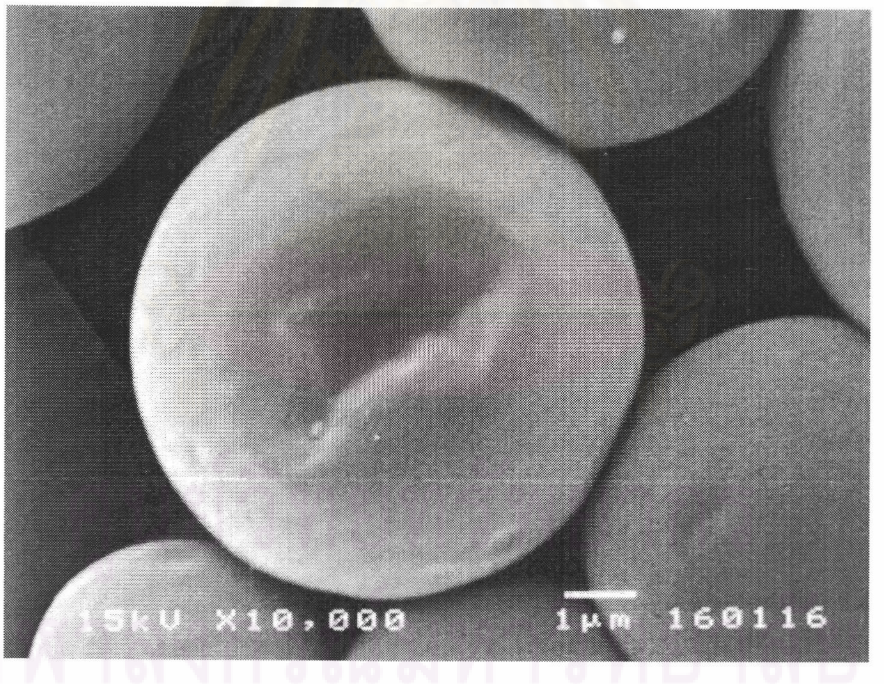
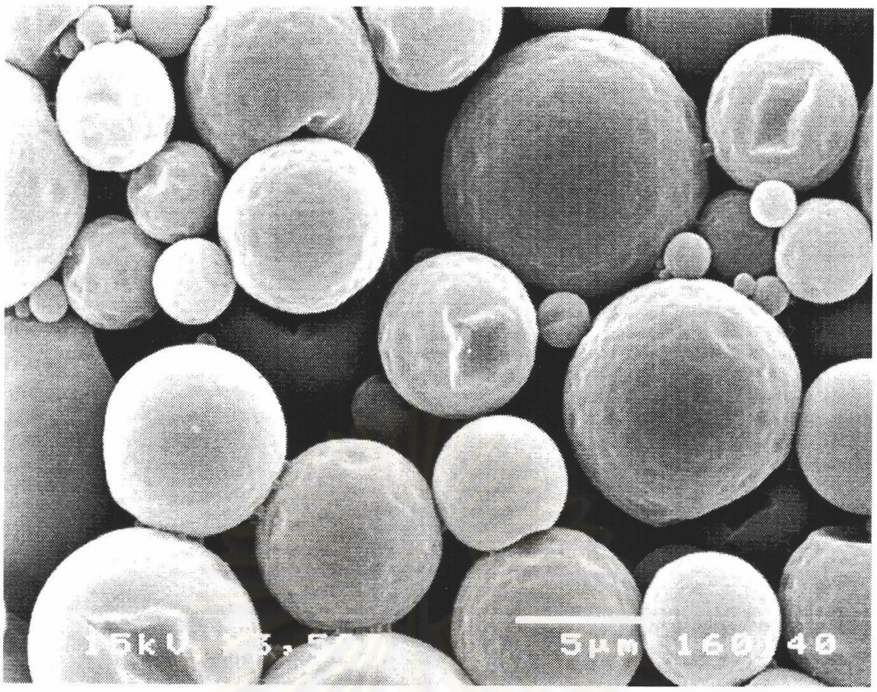


(b)

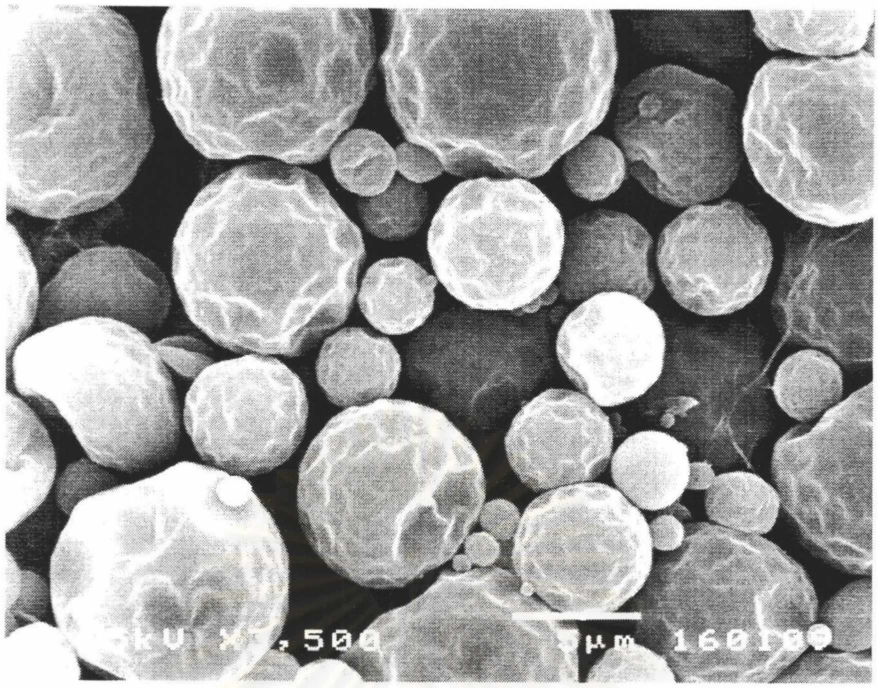
Figure A.33 Scanning electron micrographs of polyurea microcapsules formulation 22: 0.03 mole HDI, 0.07 mole MDI and 0.01 mole EDA in (a) and (b) with different magnifications.



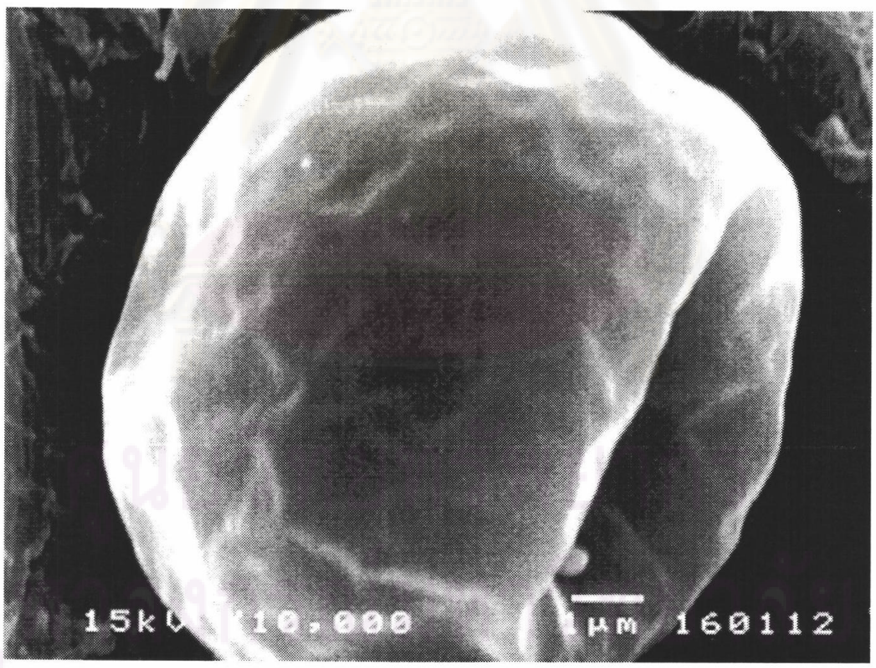
(a)

(b)

Figure A.34 Scanning electron micrographs of polyurea microcapsules formulation 23: 0.03 mole HDI, 0.07 mole MDI and 0.02 mole EDA in (a) and (b) with different magnifications.



(a)



(b)

Figure A.35 Scanning electron micrographs of polyurea microcapsules formulation 24: 0.03 mole HDI, 0.07 mole MDI and 0.03 mole EDA in (a) and (b) with different magnifications.

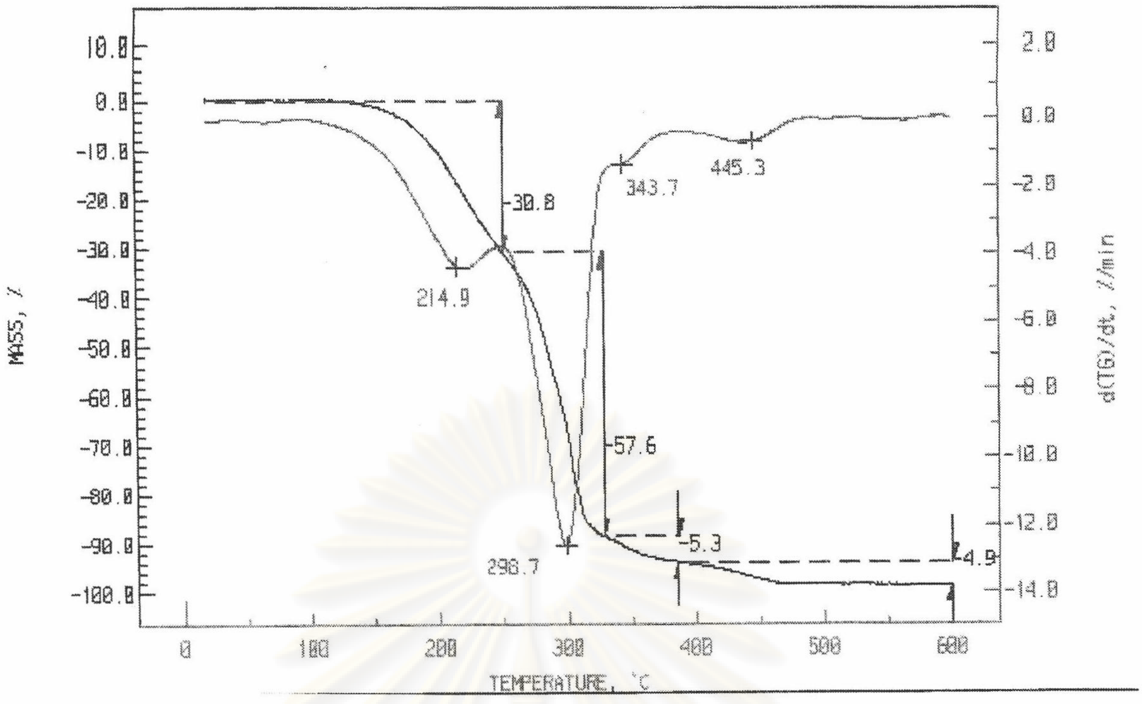


Figure A.36: TGA thermograms of polyurea microcapsules from 0.10 mole HDI.

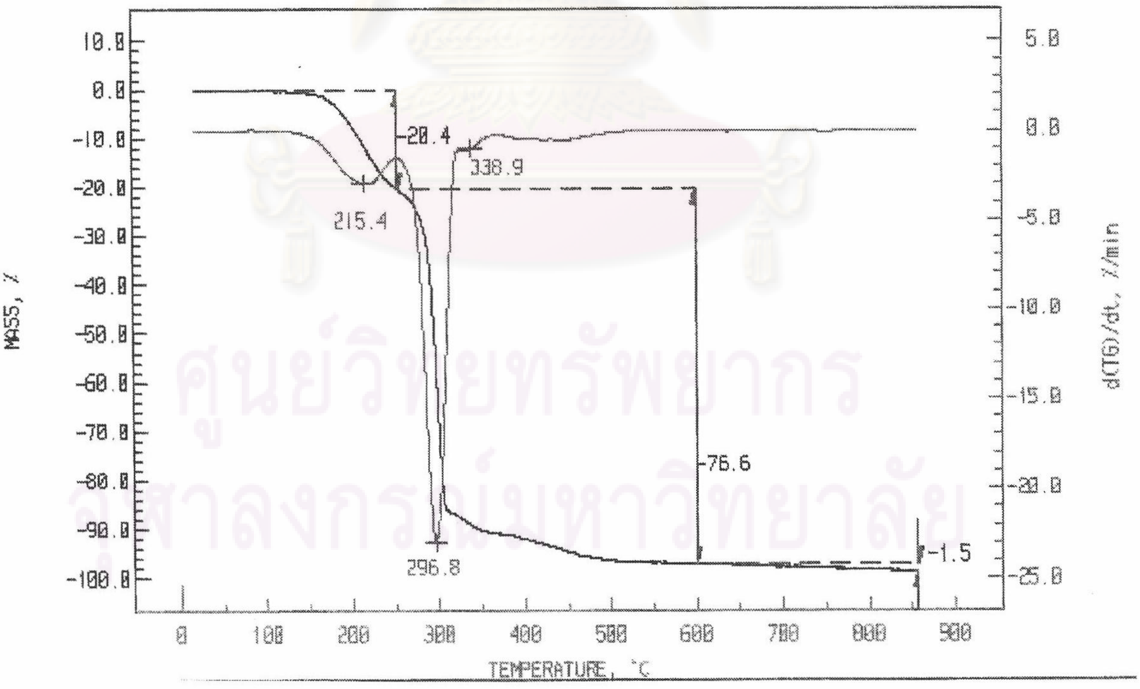


Figure A.37: TGA thermograms of polyurea microcapsules from 0.08 mole HDI and 0.02 mole MDI.

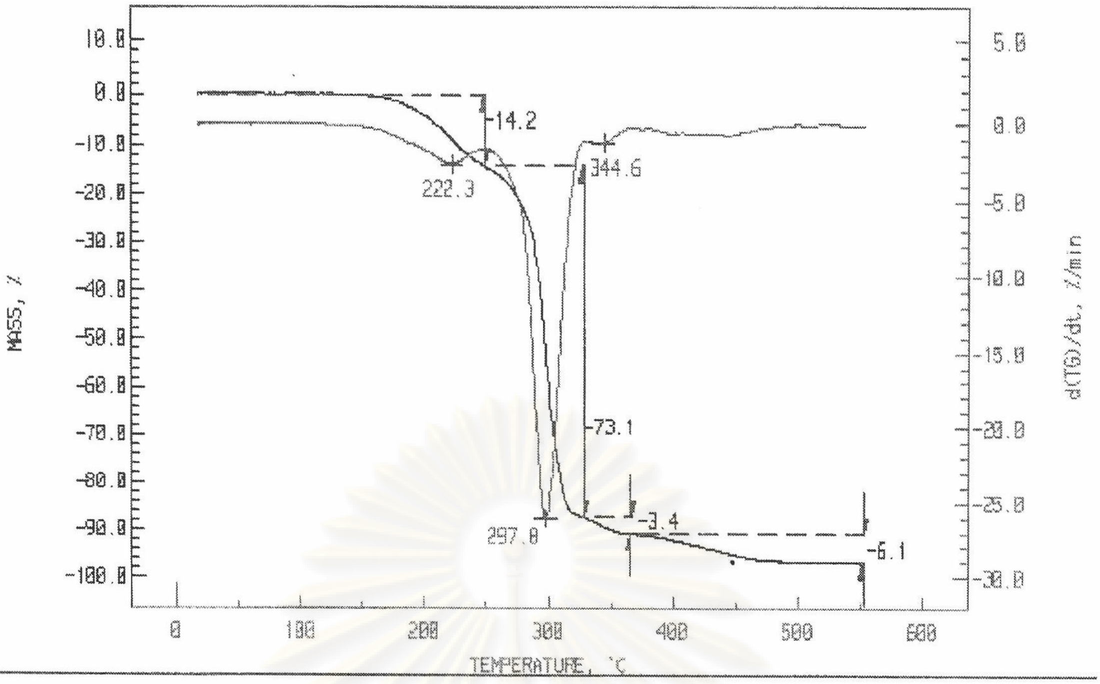


Figure A.38: TGA thermograms of polyurea microcapsules from formulation 0.06 mole HDI and 0.04 mole MDI.

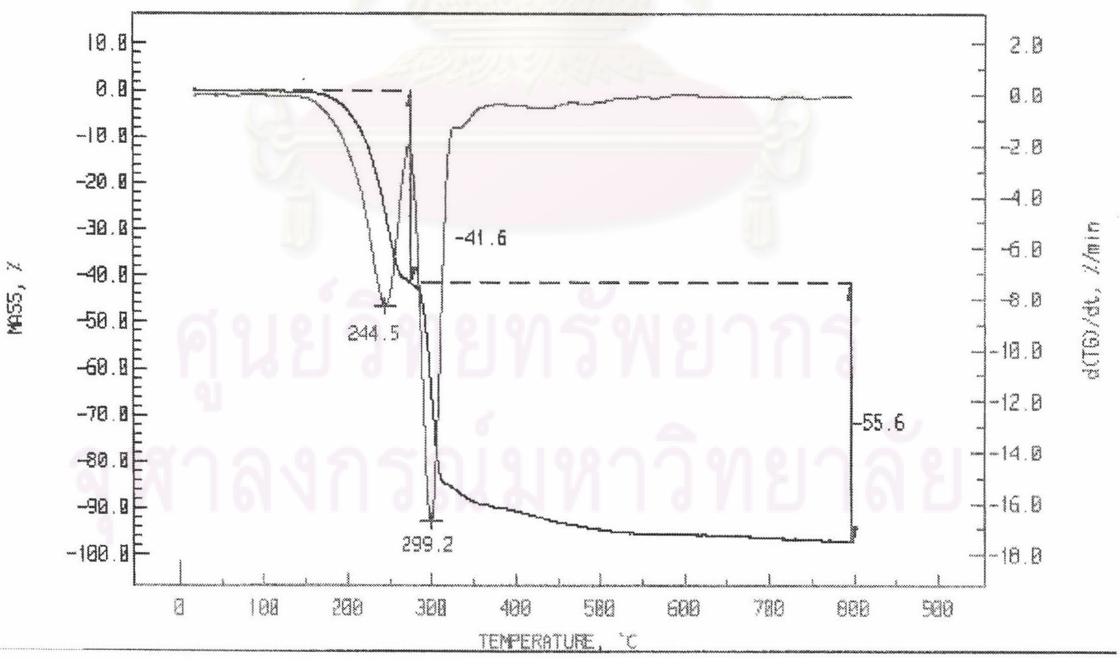


Figure A.39: TGA thermograms of polyurea microcapsules from 0.03 mole MDI and 0.07 mole HDI.

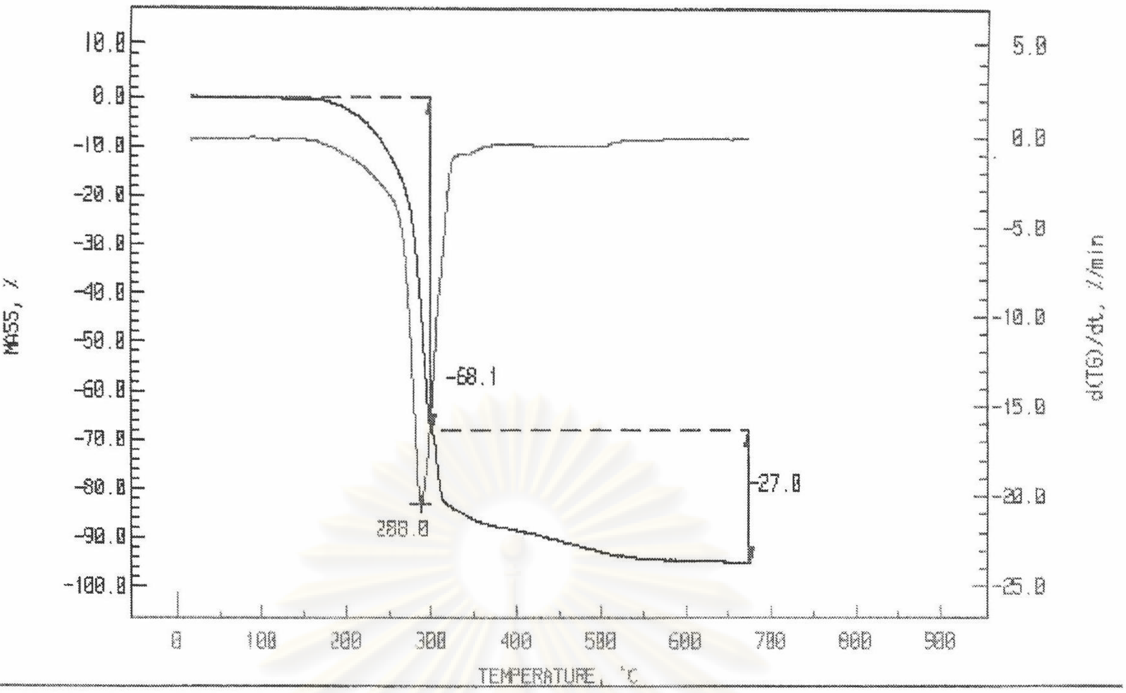


Figure A.40: TGA thermograms of polyurea microcapsules from 0.10 mole MDI.

APPENDIX B

Table B.1: Particle size distribution of microcapsules formulations 1-5 after emulsifying for 4 min.

Particle size (μm)	Volume density (%)				
	Formulation 1	Formulation 2	Formulation 3	Formulation 4	Formulation 5
51.218	0.000	0.000	0.000	0.000	0.876
41.886	0.000	0.000	0.000	0.000	0.801
34.254	0.000	0.013	0.030	0.000	0.563
28.012	0.014	0.128	0.157	0.340	1.015
22.908	0.176	0.604	0.611	0.355	2.565
18.734	0.879	1.932	1.755	1.433	4.590
15.320	2.609	3.923	3.765	3.546	10.905
12.529	5.239	6.336	6.103	7.517	19.433
10.246	7.905	9.984	11.548	16.113	19.938
8.379	12.404	13.084	14.443	16.564	11.049
6.582	13.125	11.947	12.476	11.526	6.635
5.604	10.671	9.068	9.104	7.877	5.331
4.583	8.000	7.716	7.588	6.708	3.510
3.748	6.530	6.079	5.938	5.114	1.948
3.065	5.110	4.601	4.373	3.718	1.002
2.506	4.126	3.646	3.307	2.744	0.597
2.050	3.527	3.120	2.726	2.183	0.479
1.676	3.238	2.878	2.503	2.068	0.568
1.371	3.321	2.968	2.629	2.310	0.875
1.121	3.617	3.274	2.947	2.546	1.215
0.917	3.627	3.331	3.015	2.413	1.270
0.750	2.970	2.754	2.498	1.893	0.985
0.613	1.832	1.707	1.553	1.292	0.644
0.501	0.804	0.749	0.687	0.801	0.418
0.410	0.236	0.219	0.203	1.084	0.859
0.335	0.040	0.037	0.034	0.134	0.086
0.274	0.003	0.002	0.002	0.026	0.019
0.224	0.000	0.000	0.000	0.000	0.000

Table B.2: Particle size distribution of microcapsules formulations 6-10 after emulsifying for 4 min.

Particle size (μm)	Volume density (%)				
	Formulation 6	Formulation 7	Formulation 8	Formulation 9	Formulation 10
41.886	0.000	0.000	0.000	0.000	0.000
34.254	0.000	0.000	0.033	0.000	0.206
28.012	0.000	0.000	0.211	0.015	0.903
22.908	0.000	0.000	0.866	0.202	2.493
18.734	0.197	0.196	2.383	0.963	4.710
15.320	1.070	1.067	4.694	2.715	6.340
12.529	3.176	3.148	6.830	5.078	13.691
10.246	5.894	5.921	14.772	10.709	21.524
8.379	13.644	13.298	15.482	16.815	16.757
6.852	14.827	14.672	12.185	15.206	8.761
5.604	11.418	11.591	8.452	9.884	6.279
4.583	8.262	8.333	6.973	7.354	4.616
3.748	7.061	7.139	5.087	5.866	2.807
3.065	5.586	5.636	3.495	4.299	1.475
2.506	4.369	4.395	2.571	3.157	0.804
2.050	3.649	3.680	2.179	2.558	0.578
1.676	3.414	3.450	2.119	2.419	0.576
1.371	3.469	3.525	2.307	2.592	0.903
1.121	3.505	3.636	2.532	2.803	1.545
0.917	3.266	3.480	2.463	2.716	1.985
0.750	2.699	2.895	1.949	2.180	1.713
0.613	1.959	2.005	1.228	1.388	0.944
0.501	1.204	1.105	0.622	0.683	0.313
0.410	1.127	0.655	0.479	0.328	0.055
0.335	0.173	0.124	0.068	0.062	0.000
0.274	0.030	0.019	0.012	0.009	0.000
0.224	0.000	0.000	0.000	0.000	0.000

Table B.3: Particle size distribution of microcapsules formulations 11-15 after emulsifying for 4 min.

Particle size (μm)	Volume density (%)				
	Formulation 11	Formulation 12	Formulation 13	Formulation 14	Formulation 15
41.886	0.000	0.000	0.000	0.000	0.000
34.254	0.000	0.000	0.000	0.000	0.472
28.012	0.008	0.013	0.017	0.013	0.641
22.908	0.117	0.165	0.217	0.186	1.709
18.734	0.655	0.837	1.018	0.897	3.779
15.320	2.125	2.524	2.876	2.571	5.848
12.529	4.601	3.117	5.433	4.906	12.108
10.246	7.121	5.199	10.392	11.991	19.530
8.379	12.203	12.808	14.409	15.844	16.443
6.582	13.595	13.455	14.028	13.744	9.900
5.604	11.052	11.418	10.599	10.007	6.834
4.583	8.104	8.212	7.371	7.467	5.142
3.748	6.805	6.616	5.759	5.794	3.238
3.065	5.428	4.957	4.287	4.160	1.871
2.506	4.312	3.807	3.328	3.076	1.197
2.050	3.597	3.095	2.707	2.501	0.981
1.676	3.344	2.725	2.361	2.318	1.040
1.371	3.418	2.872	2.546	2.576	1.318
1.121	3.476	3.420	3.179	3.095	1.640
0.917	3.215	3.697	3.562	3.313	1.690
0.750	2.600	3.123	3.057	2.795	1.329
0.613	1.840	1.902	1.862	1.735	0.811
0.501	1.114	0.793	0.766	0.755	0.420
0.410	1.081	0.213	0.200	0.217	0.567
0.335	0.161	0.300	0.027	0.036	0.059
0.274	0.028	0.001	0.001	0.002	0.012
0.224	0.000	0.000	0.000	0.000	0.000

Table B.4 The comparative reactivity of the common isocyanates.

Isocyanate	Velocity Constants	
	k_1	k_2
2,4-toluene	42.5	1.6
Diphenylmethane	16.0	8.6
1,5-napthalene	6.1	-
2,6-toluene	5.0	2.0
p-Xylene	3.0	-
Dicyclohexylmethane	0.3	-
Hexamethylene	0.2	-

Reaction used is that with methyl cellosolve. [41]

VITAE

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