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APPENDICES

Appendix A

Determination of Degree of Deacetylation of Chitosan

Determination of Degree of Deacetylation of chitosan

Method of calculation

Sample : CS2(see Table in following page)

Sample solution

Weight of sample (chitosan hydrochloride) 1.008 gm

dissolved in water to 250 ml

Titration

Chitosan hydrochloride solution used 50.0 ml

Volume of standard NaOH(0.0979N) used 6.99 ml

Calculation

Chitosan hydrochloride 1 mol.(197.61672 gm) = NaOH 1 mol

The amount of monomer having NH_2 group in asample 1.008 gm

= 0.003422 mol

= 0.6762 gm

The amount of monomer having $NHCOCH_3$ group in sample 1.008 gm

= 1.008-0.6762 gm

= 0.3318 gm

(monomer having $-NHCOCH_3$ 1 mol=203.19296 gm) = 0.001632 mol

The total amount of monomer in sample 1.008 gm = 0.003422+0.001632 mol

= 0.005064 mol

The degree of deacatylation =(0.003422/0.005064)x100 %

= 67.7 %monomer : 100 monomer

By this method, the degree of deacetylation of various chitosans was calculated and the values are given in the table in the following page

Determination of degree of deacetylation of chitosan

Chitosan	wt. of CS.HCl (gm)	vol .of NaOH used (ml)	Deacetylation (%)	mean (%)
CS 2	1.008	(1) 7.01	67.76	67.69
		(2) 7.07	68.47	
		(3) 6.90	66.84	
CS3 .5	1.000	(1) 7.35	71.75	71.75
		(2) 7.34	71.75	
		(3) 7.36	71.35	
CS7	1.000	(1) 7.40	72.35	72.35
		(2) 7.30	71.41	
		(3) 7.50	73.32	
CS10	1.002	(1) 8.05	78.43	78.61
		(2) 8.05	78.43	
		(3) 8.10	79.06	

Appendix B

Calibration Curve

Calibration Curve

The concentration versus absorbance of propranolol hydrochloride in buffer pH 1.5 and buffer pH 6.8 at 290 nm were presented in Table 13 and 14 showed a linear relationship with the correlation coefficient =0.999967 and =0.999973, respectively.The standard curve of propranolol HCl was illustrated in Figure 32.

The concentration versus absorbance of propranolol hydrochloride in buffer pH 1.2 and buffer pH 7.5 at 290 nm were presented in Table 15 and 16 showed a linear relationship with the correlation coefficient = 0.99973 and 0.999792, respectively. The standard curve of propranolol HCl was illutrated in Figure 33.

Table 20 Absorbance of propranolol hydrochloride in buffer pH 1.5 determined at 290 nm

Concentration(mcg/ml)	Absorbance
0	0
10	0.1965
15	0.2940
20	0.3925
25	0.4880
30	0.5875
35	0.6795
40	0.7795
45	0.8760

Table 21 Absorbance of propranolol hydrochloride in buffer pH 6.8 determined at 280 nm

Concentration (mcg/ml)	Absorbance
0	0
10	0.1915
15	0.2885
20	0.3885
25	0.4840
30	0.5835
35	0.6820
40	0.7775
45	0.8770

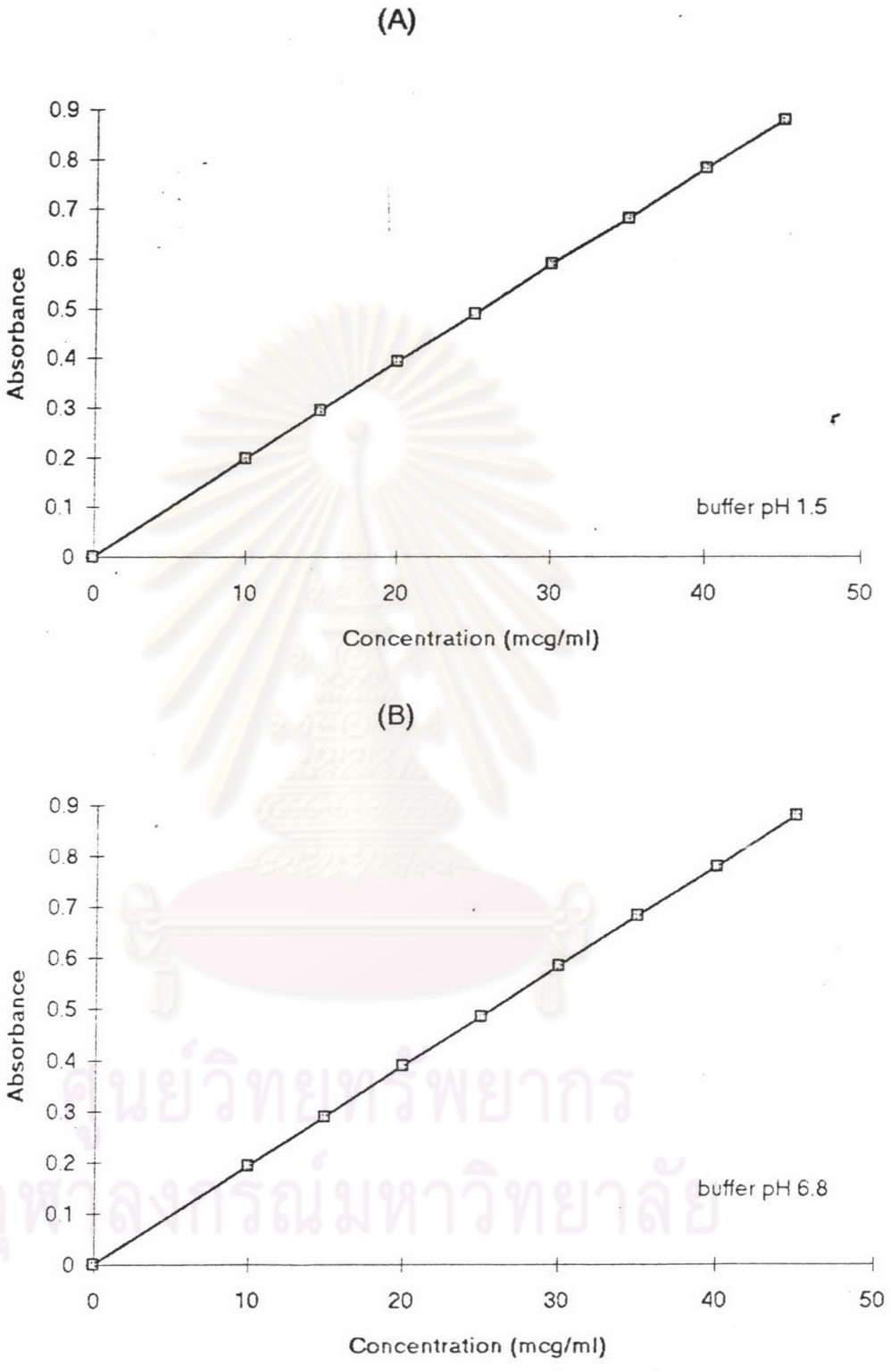


Figure 32 Calibration curve of propranolol HCl in

A) buffer pH 1.5

B) buffer pH 6.8

Table 22 Absorbance of propranolol hydrochloride in buffer pH 1.2 determined at 290 nm

Concentration (mcg/ml)	Absorbance
0	0
10	0.1950
15	0.2935
20	0.3955
25	0.4915
30	0.5925
35	0.6935
40	0.7915
45	0.8895

Table 23 Absorbance of propranolol hydrochloride in buffer pH 7.5 determined at 290 nm

Concentration (mcg/ml)	Absorbance
0	0
10	0.1950
15	0.2925
20	0.3920
25	0.4920
30	0.5795
35	0.6780
40	0.7735
45	0.8825

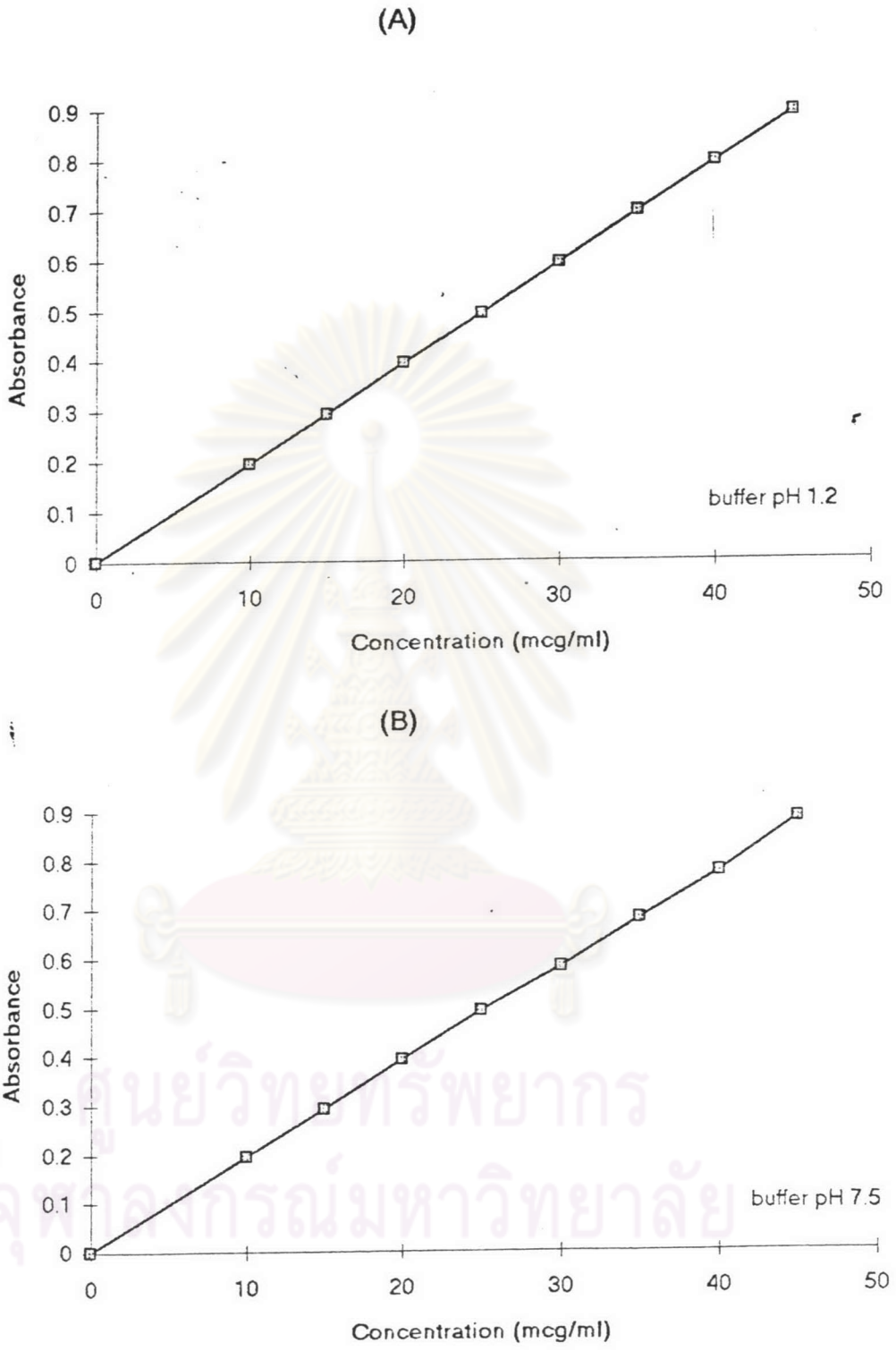


Figure 33 Calibration curve of propranolol HCl in

A) buffer pH 1.2

B) buffer pH 7.5

Appendix C

Particle Size Distribution of Co-spray Dried Powder

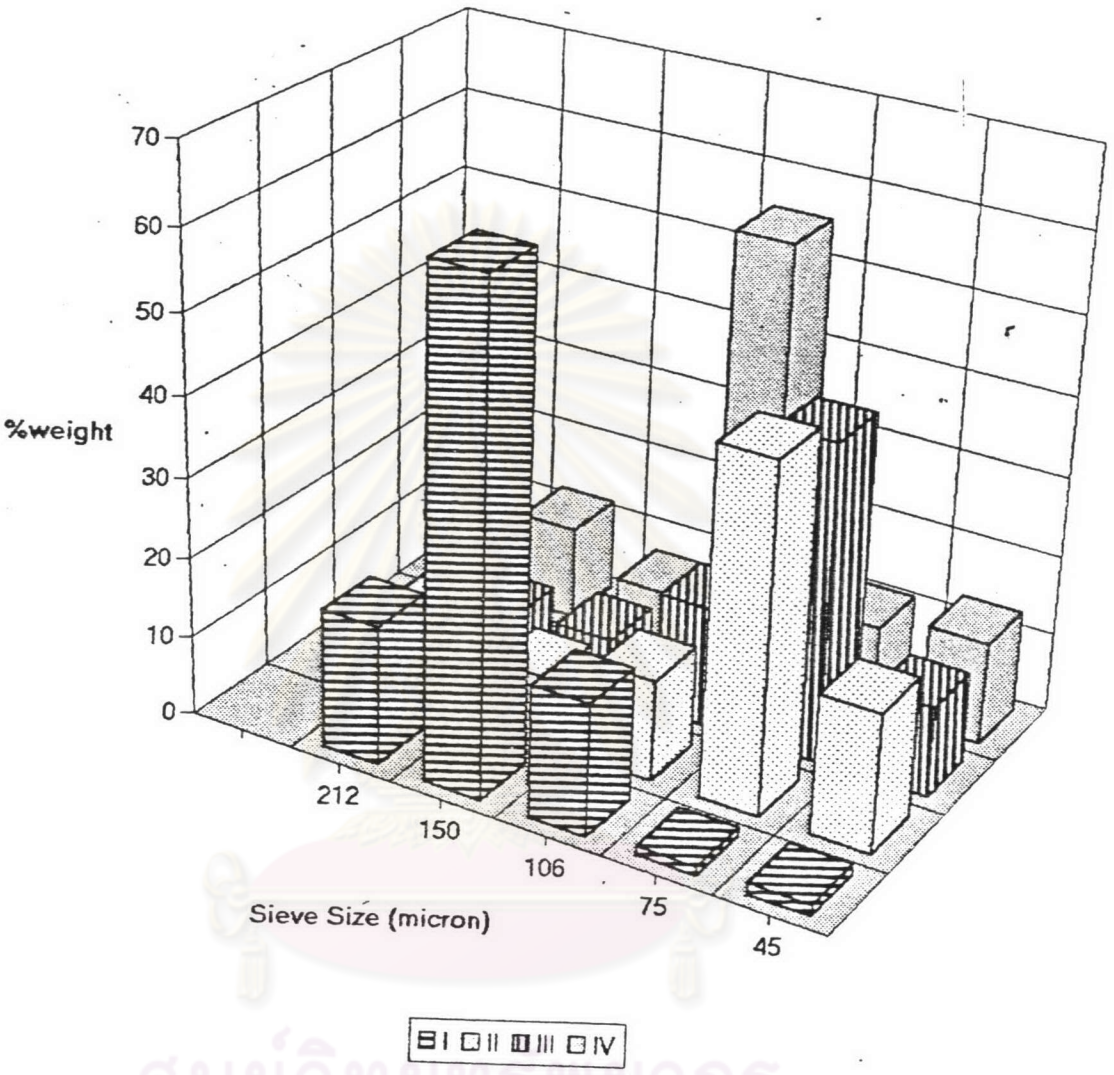


Figure 34 Particle size distribution of Formulations I-IV co-spray dried powder

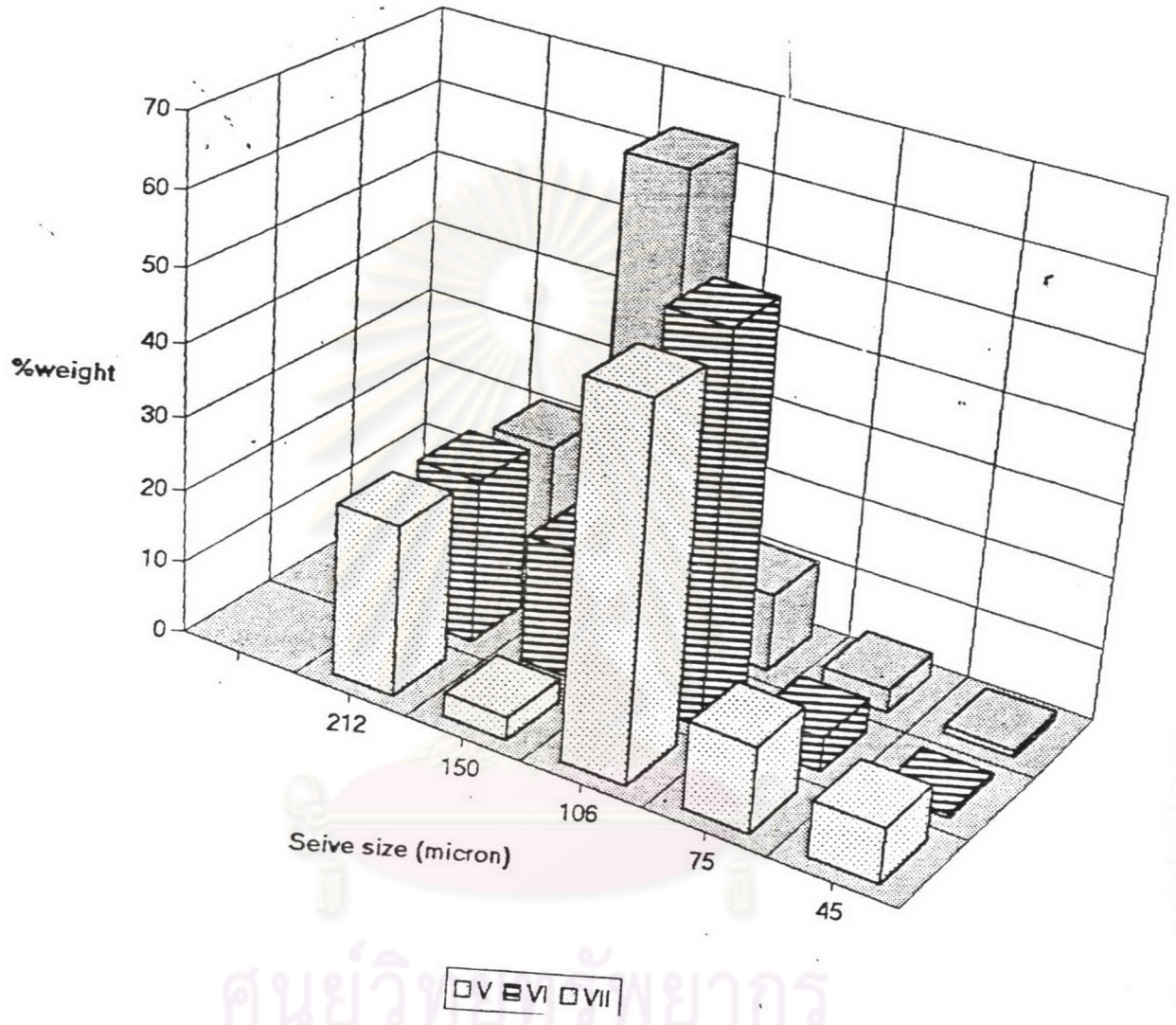


Figure 35 Particle size distribution of Formulations V-VII co-spray dried powder

Appendix D

Amount percent of Drug Release, Release Rate

Release Rate against Amount and Reciprocal of Amount

Table 24 Amount of Propranolol Hydrochloride Releasing from Formulation I - III in buffer pH 1.5 and buffer pH 6.8

			Dissolution medium					
			Buffer pH1.5			Buffer pH6.8		
Formulation	Time(hr)	Time 1/2	Mean(%)	S.D.	LOG % drug remained	Mean(%)	S.D.	LOG % drug remained
	0	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.5	0.71	16.88	1.07	1.92	20.93	2.87	1.90
	1	1.00	27.70	1.21	1.86	35.59	4.61	1.81
	1.5	1.22	35.69	1.45	1.81	47.83	5.12	1.72
	2	1.41	41.55	1.19	1.77	56.86	5.17	1.63
I	3	1.73	51.16	1.28	1.69	70.56	4.84	1.47
	4	2.00	58.67	1.30	1.62	80.03	3.98	1.36
	5	2.24	64.94	0.98	1.54	86.52	3.27	1.13
	6	2.45	70.44	0.76	1.47	90.61	2.73	0.97
	7	2.65	75.49	0.55	1.39	93.23	2.26	0.83
	8	2.83	79.89	0.67	1.30	94.90	1.93	0.71
	9	3.00	83.78	0.80	1.21	96.36	1.67	0.60
	10	3.16	87.33	0.98	1.10	97.17	1.41	0.45
	11	3.32	90.77	2.03	0.96	98.18	1.40	0.26
	12	3.46	94.68	3.11	0.72	98.92	1.23	0.03
	0	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.5	0.71	25.95	0.50	1.87	28.75	3.36	1.85
	1	1.00	37.64	0.47	1.79	45.81	4.54	1.73
	1.5	1.22	50.14	2.68	1.70	57.34	5.07	1.63
	2	1.41	60.21	1.54	1.60	65.99	5.13	1.53
II	3	1.73	74.56	1.81	1.40	80.52	2.95	1.29
	4	2.00	83.82	2.11	1.21	89.51	1.91	1.02
	5	2.24	89.72	1.89	1.01	94.93	1.26	0.70
	6	2.45	94.24	1.65	0.76	97.92	0.85	0.32
	7	2.65	97.94	1.85	0.31	99.65	0.68	-0.46
	8	2.83	100.26	1.55	-	-	0.53	-
	9	3.00	-	1.54	-	-	0.49	-
	10	3.16	-	-	-	-	0.49	-
	11	3.32	-	-	-	-	-	-
	12	3.46	-	-	-	-	-	-
	0	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.5	0.71	26.76	0.44	1.86	27.60	3.48	1.86
	1	1.00	38.68	1.01	1.79	41.66	5.39	1.76
	1.5	1.22	52.10	3.09	1.68	52.96	5.69	1.67
	2	1.41	62.29	2.22	1.58	62.30	6.39	1.58
III	3	1.73	78.50	2.38	1.33	76.02	6.45	1.38
	4	2.00	86.94	0.92	1.12	86.51	4.33	1.13
	5	2.24	94.01	2.75	0.78	93.20	2.15	0.83
	6	2.45	97.36	1.75	0.42	96.77	1.44	0.51
	7	2.65	100.14	1.40	-	99.08	0.93	-0.04
	8	2.83	-	0.93	-	-	-	-
	9	3.00	-	0.77	-	-	-	-
	10	3.16	-	0.59	-	-	-	-
	11	3.32	-	-	-	-	-	-
	12	3.46	-	-	-	-	-	-

Table 25 Amount of Propranolol Hydrochloride Releasing from Formulation IV in buffer pH 1.5 and in buffer pH 6.8

			Dissolution medium					
			Buffer pH1.5			Buffer pH6.8		
Formulation	Time(hr)	Time1/2	Mean(%)	S.D.	LOG % drug remained	Mean(%)	S.D.	LOG % drug remained
	0	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.5	0.71	30.58	1.02	1.84	26.10	3.76	1.87
	1	1.00	45.16	1.22	1.74	38.44	5.34	1.79
	1.5	1.22	59.05	4.52	1.61	49.16	3.48	1.71
	2	1.41	71.78	3.68	1.45	56.77	2.90	1.64
IV	3	1.73	87.64	2.25	1.09	67.83	2.77	1.51
	4	2.00	95.39	0.83	0.66	76.37	2.82	1.37
	5	2.24	98.64	1.37	0.13	82.48	2.74	1.24
	6	2.45	100.02	1.93	-	86.51	2.64	1.13
	7	2.65	-	2.04	-	89.51	2.62	1.02
	8	2.83	-	-	-	91.24	2.45	0.94
	9	3.00	-	-	-	92.85	2.43	0.85
	10	3.16	-	-	-	93.85	2.31	0.79
	11	3.32	-	-	-	-	-	-
	12	3.46	-	-	-	-	-	-

Table 26 Amount of Propranolol Hydrochloride Releasing from Formulation V -VII in buffer pH 1.5 and in buffer pH 6.8

			Dissolution medium					
			Buffer pH1.5			Buffer pH6.8		
Formulation	Time(hr)	Time1/2	Mean(%)	S.D.	LOG % drug remained	Mean(%)	S.D.	LOG % drug remained
V	0	0.00	0.00	0.00	2.00	0	0.00	2.00
	0.5	0.71	16.43	0.73	1.92	21.16	2.18	1.90
	1	1.00	26.86	1.13	1.86	36.01	3.57	1.81
	1.5	1.22	34.31	1.53	1.82	47.17	5.07	1.72
	2	1.41	40.60	1.98	1.77	56.28	4.85	1.64
	3	1.73	50.88	2.62	1.69	70.05	5.16	1.48
	4	2.00	59.25	2.98	1.61	79.68	4.58	1.31
	5	2.24	66.67	3.15	1.52	86.23	2.99	1.14
	6	2.45	77.46	5.44	1.35	90.13	2.14	0.99
	7	2.65	89.62	3.63	1.02	92.62	1.64	0.87
	8	2.83	97.93	1.58	0.32	94.35	1.27	0.75
	9	3.00	99.49	1.05	-0.29	95.29	1.02	0.67
	10	3.16	100.05	1.34	-	96.15	0.86	0.58
	11	3.32	-	-	-	97.13	0.85	0.46
	12	3.46	-	-	-	98.96	0.92	0.02
VI	0	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.5	0.71	14.51	0.64	1.93	20.06	1.50	1.90
	1	1.00	23.86	0.87	1.88	34.48	1.55	1.82
	1.5	1.22	31.18	0.94	1.84	41.24	4.48	1.77
	2	1.41	36.75	1.02	1.8	53.06	3.59	1.67
	3	1.73	46.55	1.06	1.73	67.36	2.66	1.51
	4	2.00	54.44	1.14	1.66	77.38	2.51	1.35
	5	2.24	61.27	1.33	1.59	84.61	2.21	1.19
	6	2.45	67.73	1.70	1.51	89.49	1.93	1.02
	7	2.65	73.68	2.22	1.42	93.02	1.82	0.84
	8	2.83	79.06	2.34	1.32	95.44	1.66	0.66
	9	3.00	86.02	6.08	1.14	97.58	1.57	0.38
	10	3.16	94.68	7.44	0.72	98.88	1.44	0.05
	11	3.32	-	3.10	-	99.77	1.44	-
	12	3.46	-	2.08	-	-	1.37	-
VII	0	0.00	0	0.00	2.00	0.00	0	2.00
	0.5	0.71	13.52	0.53	1.94	23.41	2.91	1.88
	1	1.00	22.36	0.70	1.89	37.09	4.7	1.80
	1.5	1.22	29.21	0.87	1.85	47.02	5.7	1.72
	2	1.41	34.8	1.00	1.81	55.17	6.44	1.65
	3	1.73	43.89	0.93	1.75	68.45	5.87	1.50
	4	2.00	51.51	0.85	1.68	77.92	3.44	1.34
	5	2.24	58.07	0.75	1.62	83.80	2.36	1.21
	6	2.45	63.4	0.68	1.56	87.76	1.82	1.09
	7	2.65	68.8	0.78	1.49	90.43	1.49	0.98
	8	2.83	73.54	0.80	1.42	92.10	1.34	0.90
	9	3.00	83.78	7.07	1.21	93.58	1.26	0.81
	10	3.16	94.03	6.13	0.78	94.35	1.17	0.75
	11	3.32	99.22	2.24	-0.11	95.18	1.17	0.68
	12	3.46	101.02	1.09	-	95.92	1.15	0.61

Table 27 Amount of Propranolol Hydrochloride Releasing from Formulation V-VII in pH Change Method

Formulation	Time(hr)	Time1/2	Mean(%	S.D.	LOG % drug
	0	0.00	0.00	0.00	2.00
	0.5	0.71	17.15	0.68	1.92
	1	1.00	27.45	1.15	1.86
	1.5	1.22	35.09	1.55	1.81
	2	1.41	46.28	0.25	1.73
V	3	1.73	60.22	3.49	1.60
	4	2.00	80.40	2.58	1.29
	5	2.24	90.20	1.82	0.99
	6	2.45	95.62	1.52	0.64
	7	2.65	98.73	1.35	0.10
	8	2.83	100.00	1.35	-
	9	3.00	-	-	-
	10	3.16	-	-	-
	11	3.32	-	-	-
	12	3.46	-	-	-
	0	0.00	0.00	0.00	2.00
	0.5	0.71	13.91	0.24	1.93
	1	1.00	23.05	0.34	1.89
	1.5	1.22	29.53	0.47	1.85
	2	1.41	40.51	0.28	1.77
VI	3	1.73	51.58	0.28	1.68
	4	2.00	68.41	4.08	1.50
	5	2.24	82.24	0.81	1.25
	6	2.45	90.08	0.50	1.00
	7	2.65	96.08	1.61	0.59
	8	2.83	99.54	0.89	-0.34
	9	3.00	-	-	-
	10	3.16	-	-	-
	11	3.32	-	-	-
	12	3.46	-	-	-
	0	0.00	0.00	0.00	2.00
	0.5	0.71	13.21	0.67	1.94
	1	1.00	22.01	0.76	1.89
	1.5	1.22	28.72	0.90	1.85
	2	1.41	39.47	0.46	1.78
VII	3	1.73	51.00	0.41	1.69
	4	2.00	66.10	4.84	1.53
	5	2.24	82.02	0.72	1.25
	6	2.45	89.39	0.66	1.02
	7	2.65	94.12	0.92	0.77
	8	2.83	97.35	0.99	0.42
	9	3.00	98.96	1.11	0.02
	10	3.16	99.88	1.04	-0.92
	11	3.32	100.35	0.91	
	12	3.46	-	1.20	

Table 28 Amount of Propranolol Hydrochloride Releasing from Formulation VII in pH Change Method

Formulation	Time(hr)	Time1/2	Mean(%	S.D.	LOG % d remained
	0	0.00	0.00	0.00	2.00
	0.5	0.71	12.90	0.18	1.94
	1	1.00	19.06	0.18	1.91
	1.5	1.22	28.20	0.56	1.86
	2	1.41	34.69	0.24	1.81
VII	3	1.73	44.56	0.58	1.74
pH (1.2, 7.5)	4	2.00	58.15	3.94	1.62
	5	2.24	72.84	2.61	1.43
	6	2.45	81.78	1.33	1.26
	7	2.65	88.32	1.22	1.07
	8	2.83	90.97	1.81	0.96
	9	3.00	93.95	1.11	0.78
	10	3.16	94.89	1.04	0.71
	11	3.32	95.67	0.91	0.64
	12	3.46	95.98	1.20	0.60

Table 29 Release rate of propranolol hydrochloride from Formulation I - VII in buffer pH 1.5

	Release Rate (%/hour)						
Mean Time	I	II	III	IV	V	VI	VII
0.25	33.76	51.90	53.52	61.61	32.86	29.02	27.52
0.75	21.64	23.38	23.84	29.16	20.86	18.70	17.68
1.25	15.98	25.00	26.84	27.78	14.90	14.64	13.70
1.75	11.72	20.14	20.38	25.46	12.58	11.14	11.18
2.5	9.61	14.35	16.21	15.86	10.28	9.80	9.09
3.5	7.51	9.26	8.94	7.75	8.37	7.89	7.62
4.5	6.27	5.90	7.07	3.25	7.42	6.83	6.56
5.5	5.50	4.52	3.35	1.38	10.79	6.46	5.33
6.5	5.05	3.70	2.78		12.16	5.95	5.40
7.5	4.40	2.32			8.31	5.38	4.74
8.5	3.89					6.96	10.24
9.5	3.55					8.66	10.25
10.5	3.44						5.19
11.5	3.91						2.20

Table 30 Release rate of propranolol hydrochloride from Formulation I -VII in buffer pH 6.8

	Release Rate (%/hour)						
Mean Time	I	II	III	IV	V	VI	VII
0.25	41.86	57.50	55.20	52.20	42.32	40.12	46.82
0.75	29.32	34.12	28.12	24.68	29.70	28.84	27.36
1.25	24.48	23.06	22.60	21.44	22.32	13.52	19.86
1.75	18.06	17.30	18.68	15.22	18.22	23.64	16.30
2.5	13.88	14.53	13.72	11.06	13.77	14.30	13.28
3.5	9.47	8.99	10.49	8.54	9.63	10.02	9.47
4.5	6.49	5.42	6.69	6.11	6.55	7.23	5.88
5.5	4.09	2.99	3.57	4.03	3.90	4.88	3.96
6.5	2.62	1.73	2.31	3.00	2.49	3.53	2.67
7.5	1.67	1.16	1.38	1.73	1.73	2.42	1.67
8.5	1.46			1.61	0.94	2.14	1.48
9.5	0.81			1.04	0.86	1.30	0.77
10.5	1.01				0.98	0.89	0.83
11.5	0.74				1.83		0.74

Table 31 Release rate of propranolol hydrochloride from Formulation V- VII in pH change method

	Release Rate (%/hour)			
Mean Time	V	VI	VII	VII (pH1.2,7.5)
0.25	34.30	27.82	26.42	25.80
0.75	20.60	18.28	17.60	12.32
1.25	15.28	12.96	13.42	18.28
1.75	22.38	21.96	21.50	12.98
2.5	13.94	11.07	11.53	9.87
3.5	20.18	16.83	15.10	13.59
4.5	9.80	13.83	15.92	14.69
5.5	5.42	7.84	7.37	8.94
6.5	3.10	6.00	4.73	6.54
7.5	1.27	3.46	3.23	2.65
8.5			1.61	2.98
9.5			0.92	0.94
10.5				0.78
11.5				0.31

Table 32 Percentage of labeled amount of propranolol hydrochloride dissolved at the various time

Time (hours)	Amount dissolved
1	not more than 20%
3	between 20% and 45%
6	between 45% and 80%
12	not less than 80%

Table 33 Value for rate, amount released, and the corresponding reciprocal for the release of Formulations I-IV

Formulation	Dissolution medium					
	buffer pH1.5			buffer pH6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
I	33.76	16.88	0.059	41.86	20.93	0.048
	21.64	27.70	0.036	29.32	35.59	0.028
	15.98	35.69	0.028	24.48	47.83	0.02
	11.72	41.55	0.024	18.06	56.86	0.018
	9.61	51.16	0.02	13.70	70.56	0.014
	7.51	58.67	0.017	9.47	80.03	0.012
	6.27	64.94	0.015	6.49	86.52	0.012
	5.50	70.44	0.014	4.09	90.61	0.011
	5.05	75.49	0.013	2.62	93.23	0.011
	4.40	79.89	0.012	1.67	94.90	0.01
	3.89	83.78	0.012	1.46	96.36	0.01
	3.55	87.33	0.011	0.81	97.17	0.01
	3.44	92.77	0.011	1.01	98.18	0.01
	3.91	94.68	0.01	0.74	98.92	0.01
II	51.90	25.95	0.038	57.50	28.75	0.035
	23.38	37.64	0.026	34.12	45.81	0.022
	25.00	50.14	0.02	23.06	57.34	0.017
	20.14	60.21	0.017	17.30	65.99	0.015
	14.35	74.56	0.013	14.53	80.52	0.012
	9.26	83.82	0.012	8.99	89.51	0.011
	5.90	89.72	0.011	5.42	94.93	0.01
	4.52	94.24	0.011	2.99	97.92	0.01
	3.70	97.94	0.01	1.73	99.65	0.01
	2.32	100.26	0.01			
III	53.52	26.76	0.037	56.20	27.60	0.036
	23.84	38.68	0.026	28.12	41.66	0.024
	26.84	52.10	0.019	22.60	52.96	0.019
	20.83	62.29	0.016	18.68	62.30	0.016
	16.21	78.50	0.013	13.72	76.02	0.013
	8.44	86.94	0.012	10.49	86.51	0.012
	7.07	94.01	0.011	6.69	93.20	0.011
	3.35	97.36	0.01	3.57	96.77	0.01
	2.78	100.14	0.01	2.31	99.08	0.01
IV	61.16	30.58	0.033	52.20	26.10	0.038
	29.16	45.16	0.022	24.68	38.44	0.026
	27.78	59.05	0.017	21.44	49.16	0.02
	25.46	71.78	0.014	15.22	56.77	0.018
	15.86	87.64	0.011	11.06	67.83	0.015
	7.75	95.39	0.01	8.54	76.37	0.013
	3.25	98.64	0.01	6.11	82.48	0.012
	1.38	100.02	0.01	4.03	86.51	0.012
				3.00	89.51	0.011
				1.73	91.24	0.011
				1.61	92.85	0.011

Table 34 Value for rate, amount released, and the corresponding reciprocal for the release of Formulations V-VII

Formulation	Dissolution medium					
	buffer pH1.5			buffer pH6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
V	32.86	16.43	0.061	42.32	21.16	0.047
	20.86	26.86	0.037	29.70	36.01	0.028
	14.90	34.31	0.029	22.32	47.17	0.021
	12.58	40.60	0.025	18.22	56.28	0.018
	10.28	50.88	0.02	13.77	70.05	0.014
	8.37	59.25	0.017	9.63	79.68	0.012
	7.42	66.67	0.015	6.55	86.23	0.012
	10.79	77.46	0.013	3.90	90.13	0.011
	12.16	89.62	0.011	2.49	92.62	0.011
	8.31	97.93	0.01	1.73	94.35	0.01
	1.56	99.49	0.01	0.94	95.29	0.01
	0.56	100.05	0.01	0.86	96.15	0.01
				0.98	97.13	0.01
				1.83	98.96	0.01
VI	29.02	14.51	0.069	27.82	13.91	0.072
	18.70	23.86	0.042	18.28	23.05	0.043
	14.64	31.18	0.032	12.96	29.53	0.034
	11.14	36.75	0.027	21.96	40.51	0.025
	9.80	46.55	0.021	11.07	51.58	0.019
	7.89	54.44	0.018	16.83	68.41	0.015
	6.83	61.27	0.016	13.83	82.24	0.012
	6.46	67.73	0.015	7.84	90.08	0.011
	5.95	73.68	0.014	6.00	96.08	0.01
	5.38	79.06	0.013	3.46	99.54	0.01
	6.96	86.02	0.012	1.73	101.27	0.01
	8.66	94.68	0.01			
VII	27.04	13.52	0.074	46.82	23.41	0.043
	17.68	22.36	0.045	27.36	37.09	0.027
	13.70	29.21	0.034	19.86	47.02	0.021
	11.18	34.80	0.029	16.30	55.17	0.018
	9.09	43.89	0.023	13.28	68.45	0.015
	7.62	51.51	0.019	9.47	77.92	0.013
	6.56	58.07	0.017	5.88	83.80	0.012
	5.33	63.40	0.016	3.96	87.76	0.011
	5.40	68.80	0.014	2.67	90.43	0.011
	4.74	73.54	0.014	1.67	92.10	0.011
	10.24	83.78	0.012	1.48	93.58	0.011
	10.25	94.03	0.011	0.77	94.35	0.01
	5.19	99.22	0.01	0.83	95.18	0.01
	2.20	101.42	0.01	0.74	95.92	0.01

Table 35 Values for rate, amount release, and the corresponding reciprocal for the release of Formulation V-VII from pH change

Formulation	dQ/dt	Q	1/Q
	34.30	17.15	0.058
	20.60	27.45	0.036
	15.28	35.09	0 .028
	22.38	46.28	0.022
V	13.94	60.22	0.017
	20.18	80.40	0.012
	9.80	90.20	0.011
	5.42	95.62	0.01
	3.11	98.73	0.01
	1.27	100.00	0.01
	27.82	13.91	0.072
	18.28	23.05	0.043
	12.96	29.53	0.034
	21.96	40.51	0.025
VI	11.07	51.58	0.019
	16.83	68.41	0.015
	13.83	82.24	0.012
	7.84	90.08	0.011
	6.00	96.08	0.01
	3.46	99.54	0.01
	1.73	101.27	0.01
	26.42	13.21	0.076
	17.60	22.01	0.045
	13.42	28.72	0.035
	21.50	39.47	0.025
	11.53	51.00	0.02
VII	15.10	66.10	0.015
	15.92	82.02	0.012
	7.37	89.39	0.011
	4.73	94.12	0.011
	3.23	97.35	0.01
	1.61	98.96	0.01
	0.92	99.88	0.01
	0.47	100.35	0.01
	25.80	12.90	0.078
	12.32	19.06	0.052
	18.28	28.20	0.035
	12.98	34.69	0.029
	9.87	44.56	0.022
	13.59	58.15	0.017
VII(1.2.7.5)	14.69	72.84	0.014
	8.94	81.78	0.012
	6.54	88.32	0.011
	2.65	90.97	0.011
	2.98	93.95	0.011
	0.94	94.89	0.01
	0.78	95.67	0.01
	0.31	95.98	0.01

Appendix E

Data in Statistical Processes

Table 36 Comparison of linearity between plots of rate of release against reciprocal amount and amount of propranolol hydrochloride releasing from the matrices in buffer pH 6.8

Formulation	Matrices	Correlation coefficient of rate	
		versus Q	versus1/Q
I	1	0.9871	0.7523
	2	0.9839	0.8387
	3	0.9454	0.8113
	4	0.9927	0.8202
	5	0.9154	0.9366
	6	0.9918	0.8672
V	1	0.9195	0.8744
	2	0.993	0.8162
	3	0.9589	0.8896
	4	0.9724	0.7374
	5	0.9637	0.9568
VI	1	0.9439	0.8032
	2	0.9892	0.9846
	3	0.9915	0.9704
	4	0.9892	0.9831
	5	0.9905	0.9828
	6	0.9588	0.8651
VII	1	0.9684	0.9545
	2	0.9399	0.9802
	3	0.8842	0.9408
	4	0.9429	0.9759
	5	0.9054	0.9201
	6	0.9767	0.9384

T-test(unpaired)

$$t = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}}$$

$$S_p^2 = \frac{(n_1-1)S_1^2 + (n_c-1)S_2^2}{n_1+n_2-2}$$

$$S = \sqrt{\frac{\Sigma(X_i - \overline{X})^2}{(n-1)}}$$

S_p^2 - *pooled variance*

degree of freedom - n_1+n_2-2

Hypothesis $H_0 : \mu_1 - \mu_2 = 0$

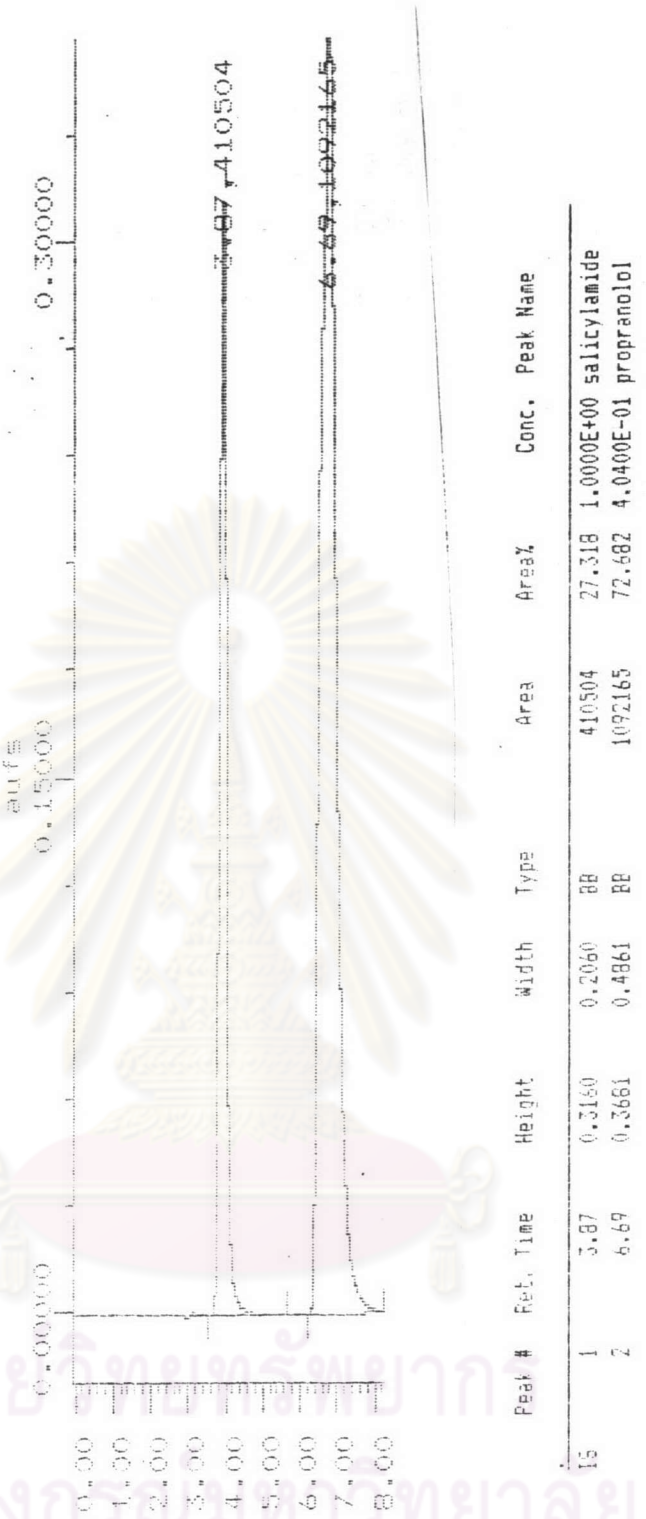
$H_a : \mu_1 - \mu_2 \neq 0$

Table 37 t-test of linearity between rate of release against reciprocal amount and amount (data from Table 36)

products	t-value	Significance test
Formulation I	4.651	S
Formulation V	2.741	S
Formulation VI	1.381	NS
Formulation VII	-0.884	NS

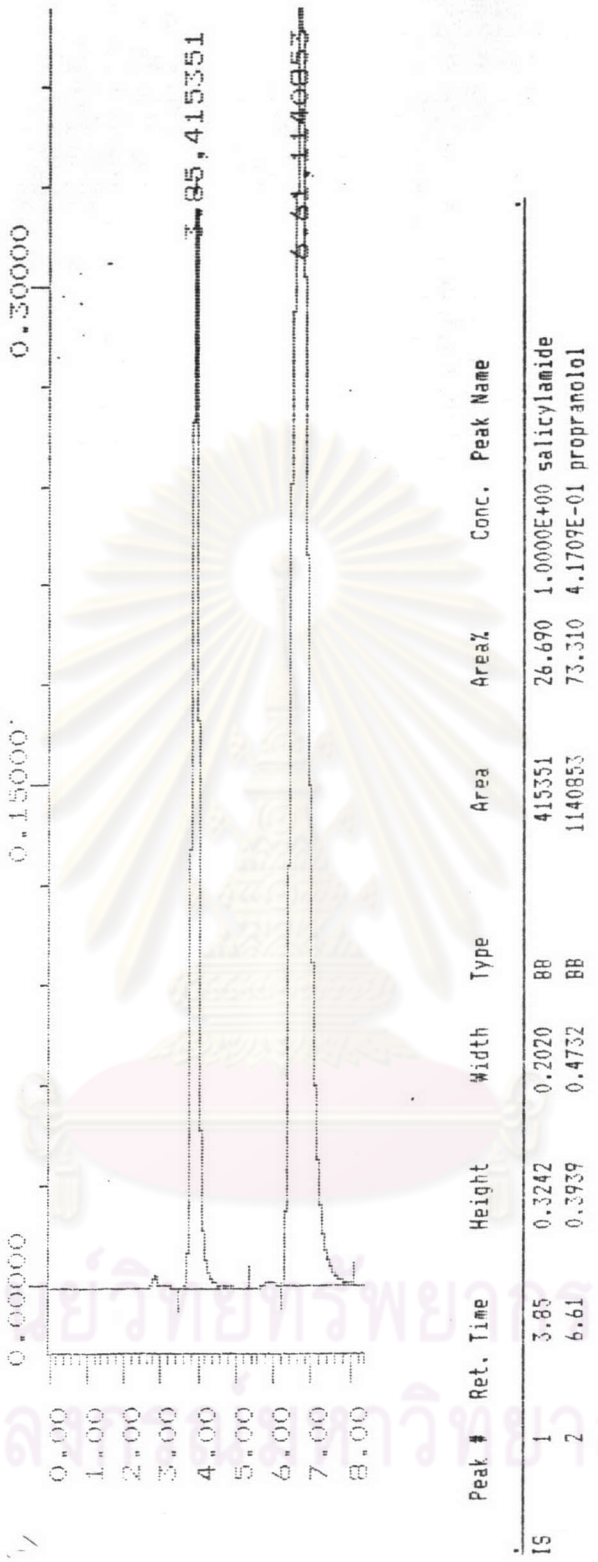
Appendix F

High Pressure Liquid Chromatogram of Propranolol Hydrochloride



Peak #	Ret. Time	Height	Width	Type	Area	Area%	Conc.	Peak Name
IS								
1	3.87	0.3160	0.2060	BB	410504	27.318	1.0000E+00	salicylamide
2	6.69	0.3661	0.4861	BB	1092165	72.682	4.0400E-01	propranolol

Figure 36 High pressure liquid chromatogram of propranolol hydrochloride standard



	Peak #	Ret. Time	Height	Width	Type	Area	Area%	Conc.	Peak Name
IS	1	3.85	0.3242	0.2020	BB	415351	26.690	1.0000E+00	salicylamide
	2	6.61	0.3939	0.4732	BB	1140853	73.310	4.1709E-01	propranolol

Figure 37 High pressure liquid chromatogram of propranolol hydrochloride from co-spray dried powder of Formulation I

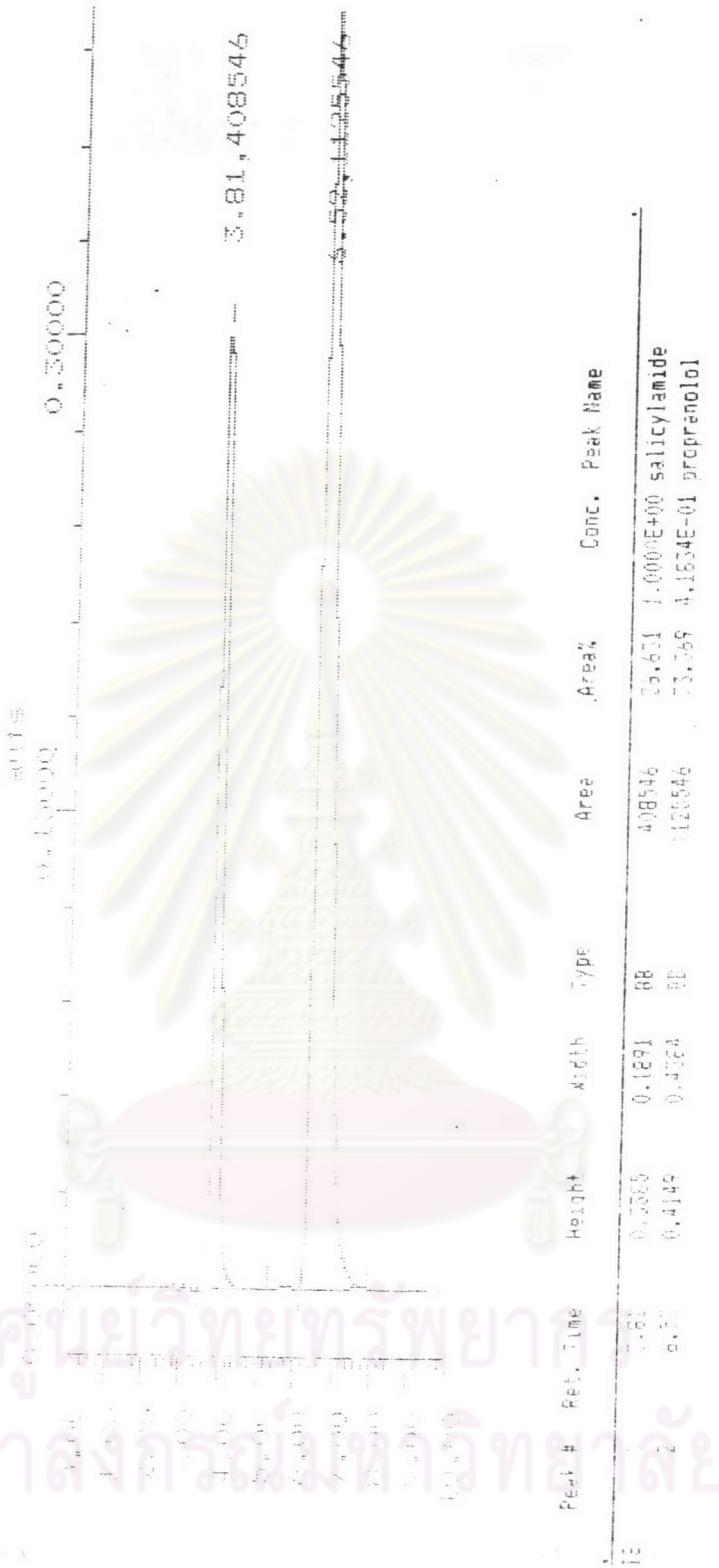


Figure 38 High pressure liquid chromatogram of propranolol hydrochloride from co-spray dried powder of Formulation II

Biography

Miss sasitorn prugmahachaikul was born on February 16,1962. She got her degree in bachelor of Science in Pharmacy in 1985 from Faculty of Pharmacy, Chulalongkorn University, bangkok, Thailand.