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APPENDICES

Appendix A

Calibration Curve

The concentration versus absorbance of theophylline in 0.1 N. HCl acid at 268.5 nm. and in phosphate buffer pH 6.8 at 270.3 nm. were presented in Table 30 and 31, showed a linear relationship with the correlation coefficient = 0.9994 and 0.9997, respectively. The standard curve of theophylline after regression analysis was illustrated in Figure 88.

Table 30. Absorbance of theophylline in 0.1 N. HCl acid determined at 268.5 nm.

Concentration(µg/ml)	Absorbance
0	0.000
4	0.219
6	0.328
8	0.433
10	0.559
12	0.655
14	0.758

Table 31. Absorbance of theophylline in phosphate buffer pH 6.8 determined at 270.3 nm.

Concentration(µg/ml)	Absorbance
0	0.000
4	0.238
6	0.346
8	0.460
10	0.577
12	0.688
14	0.797

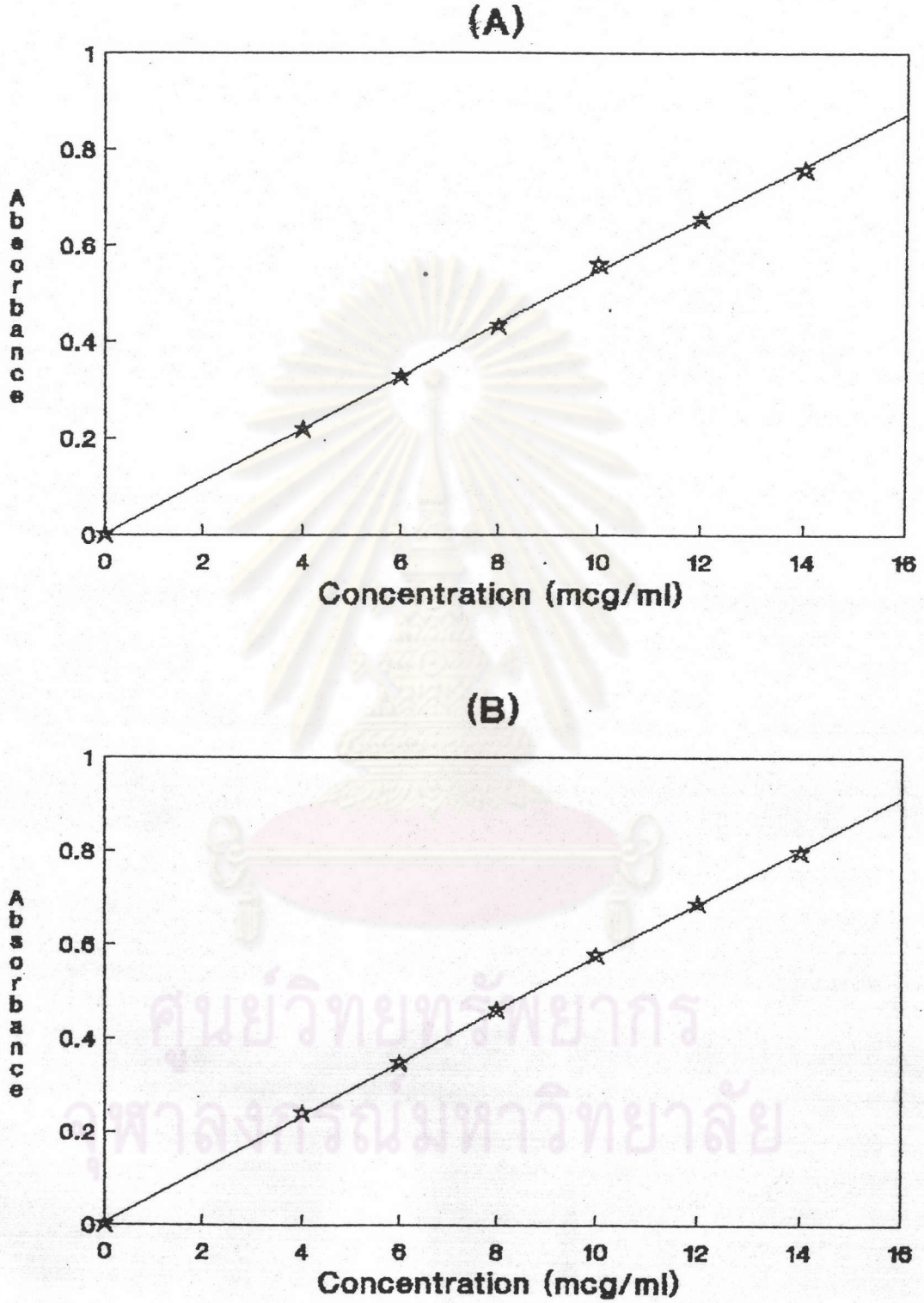

Figure 88. Calibration Curve of Theophylline in
A) 0.1 N. HCl at 268.5 nm.
B) Phosphate Buffer pH 6.8 at 270.3 nm.

Appendix B

Important Physical Properties of Materials

The considerable physical properties of chemical agent were listed in Table 32(American Pharmaceutical Association, 1986).

Table 32. Summary the important physical properties of used agent for spray-drying.

Chemical Agent	Properties
- Theophylline	melting point 269-274°C
- Ethylcellulose	glass transition temperature(T_g) 135°C softening point 152-162°C
- Hydroxypropyl methylcellulose	browning temperature 190-200°C charring temperature 225-230°C
- Hydroxypropyl methylcellulose phthalate	softening point 200-210°C
- Lactose	melting point of α monohydrate 202°C, α anhydrous 223°C, β anhydrous 252°C
- PVP K30	softening point~150°C
- Colloidal silica	in aerosols,it minimizes clogging of the spray nozzle(0.5-2%)

Appendix C

DATATEST Program

This program was written using Macro of Lotus 123. The data will be filled in the first column of the table. Then ,press Alt-M that called the menu. Press M for going to the macro area, then move cursor to the cell after **** and edit range of data that required. Called menu again and selected the Datatest Function. The results will be printed automatically from the printer.

Table used for analysis

Mt/Mo	TIME(HRS)	T^n
	0.25	0.25
	0.5	0.5
	0.75	0.75
	1	1
	2	2
	3	3
	4	4
	6	6
	9	9
	12	12

DataTest Program.

```
                        {MENUBRANCH MAIN}
                        {BRANCH FINISH}

MAIN    TABLE   DATATEST EXIT    CLEAR ALLX-CLEAR  Y-CLEAR   MACRO AREA
        MAKE TABLANALYSIS END OF ANCLEAR TABCLEAR T^nCLEAR Mt/ GOTO MACRO AREA FOR EDIT
        {BRANCH T{BRANCH T{BRANCH E{BRANCH C{BRANCH C{BRANCH C {BRANCH EDIT}

END     {QUIT}          END1    {HOME}{RI                   EDIT    {GOTO}W1~

TABLE   {GOTO}A1~
        Mt/Mo{RIGHT}
        TIME(HRS){RIGHT}"T^n{LEFT}{DOWN}
        0.25{RIGHT}+$B$2{DOWN}{LEFT}        CLEARALL {BLANK A1 ..G40}~
        0.50{RIGHT}+$B$3{DOWN}{LEFT}
        0.75{RIGHT}+$B$4{DOWN}{LEFT}        CLEARX   {BLANK C2 ..C12}~
        1{RIGHT}+$B$5{DOWN}{LEFT}
        2{RIGHT}+$B$6{DOWN}{LEFT}           CLEARY   {BLANK A2 ..A12}~
        3{RIGHT}+$B$7{DOWN}{LEFT}
        4{RIGHT}+$B$8{DOWN}{LEFT}
        6{RIGHT}+$B$9{DOWN}{LEFT}
        9{RIGHT}+$B$10{DOWN}{LEFT}
        12{RIGHT}+$B$11~{HOME}{DOWN}{windowson}

TEST    {GOTO}M2~
        {GETNUMBER "n value =",M2}~
        {BRANCH \t}

\t      {GOTO}C2~
        +B2^$M$2~
            /CC2~C2.C
    ****    /DRXC2..C11~YA2..A11~0A16~IZG{PANELON}{WINDOWSON}
    ******** {IF D19<0.998}{BRANCH \a}
            {CONTENTS I1,M2}~
            {CONTENTS J1,C23}~
            {CONTENTS K1,D19}~
            {CONTENTS L1,D17}~
            {PANELOFF}/PPRI1..L1~GQ{PANELON}
            {BRANCH \a}

    ******* \a       {IF M2>1.0}{QUIT}
                    {GOTO}M2~
                    /RY~~
                    {EDIT}+{UP}~
                    {BRANCH \t}
```

Appendix D

Particle Size Distribution of Co-Spray Dried Powdwers

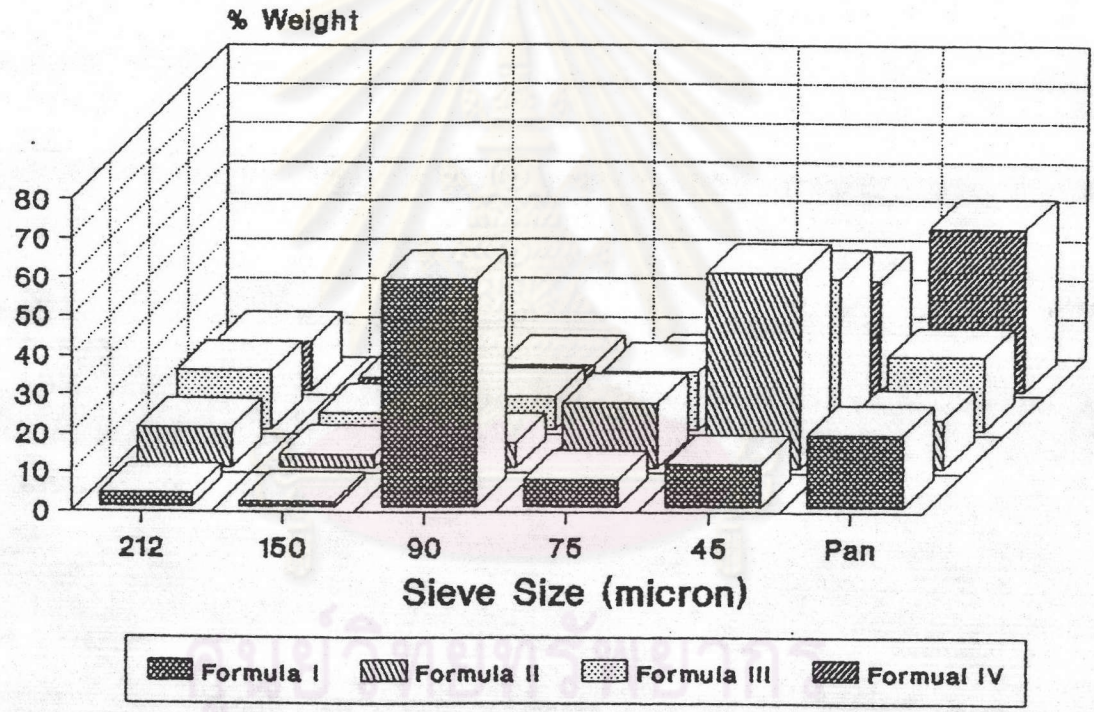

Figure 89. The Particle Size Distribution of Formulation I-IV Co-Spray Dried Powders

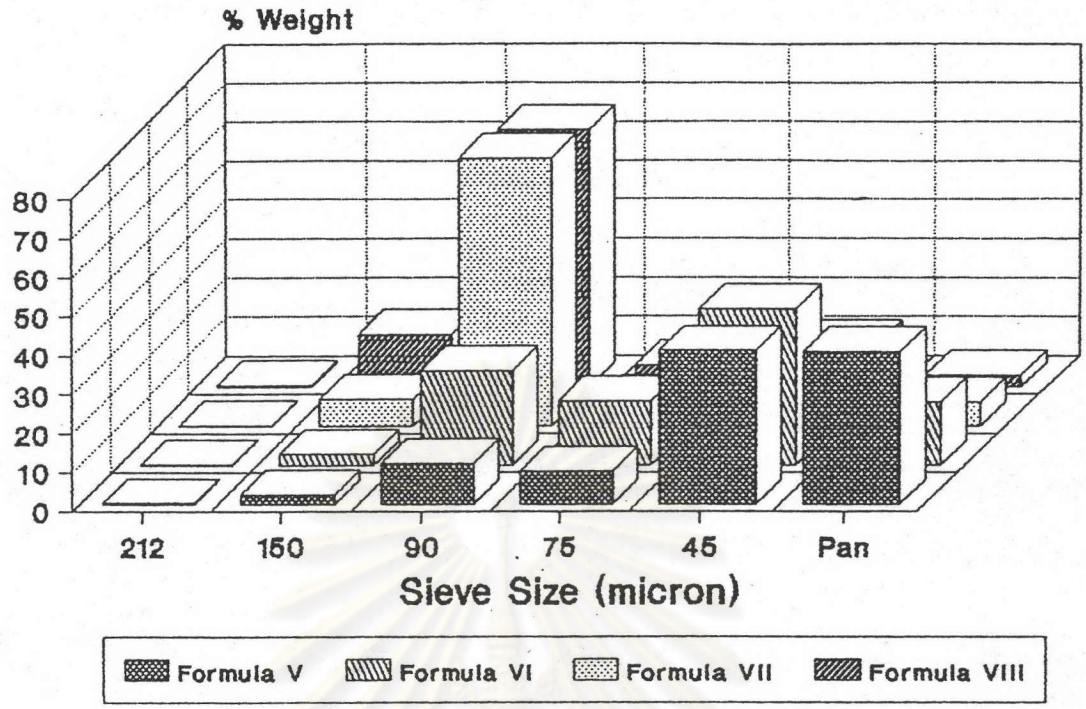

Figure 90. The Particle Size Distribution of Formulation V-VIII Co-spray Dried Powders

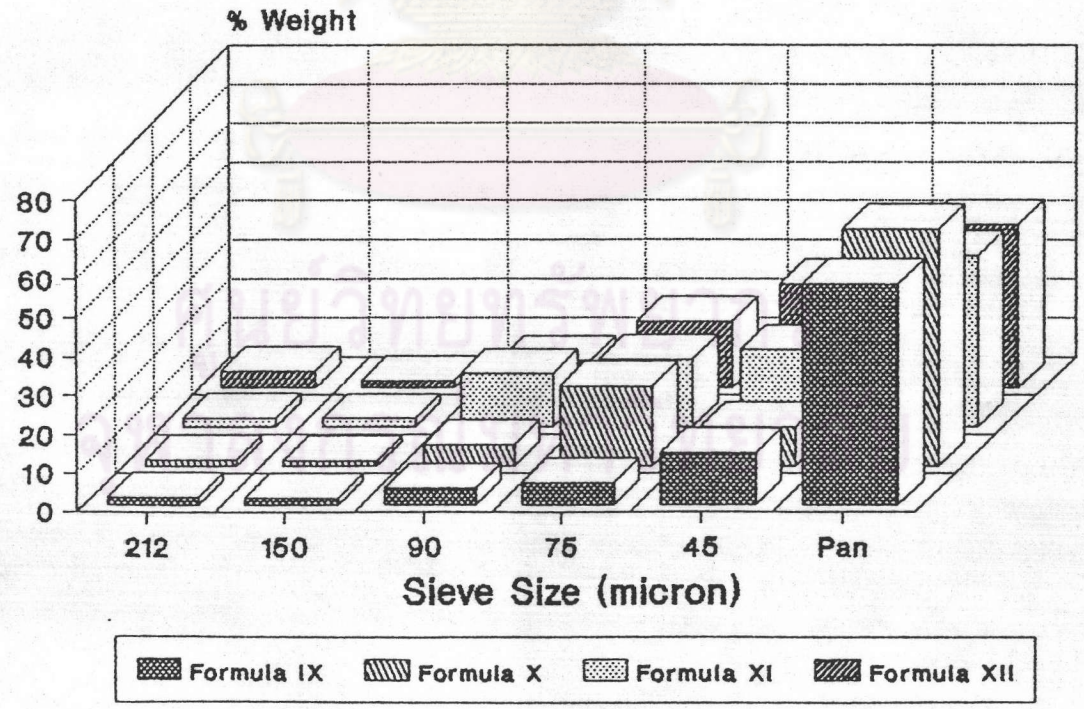

Figure 91. The Particle Size Distribution of Formulation IX-XII Co-Spray Dried Powders

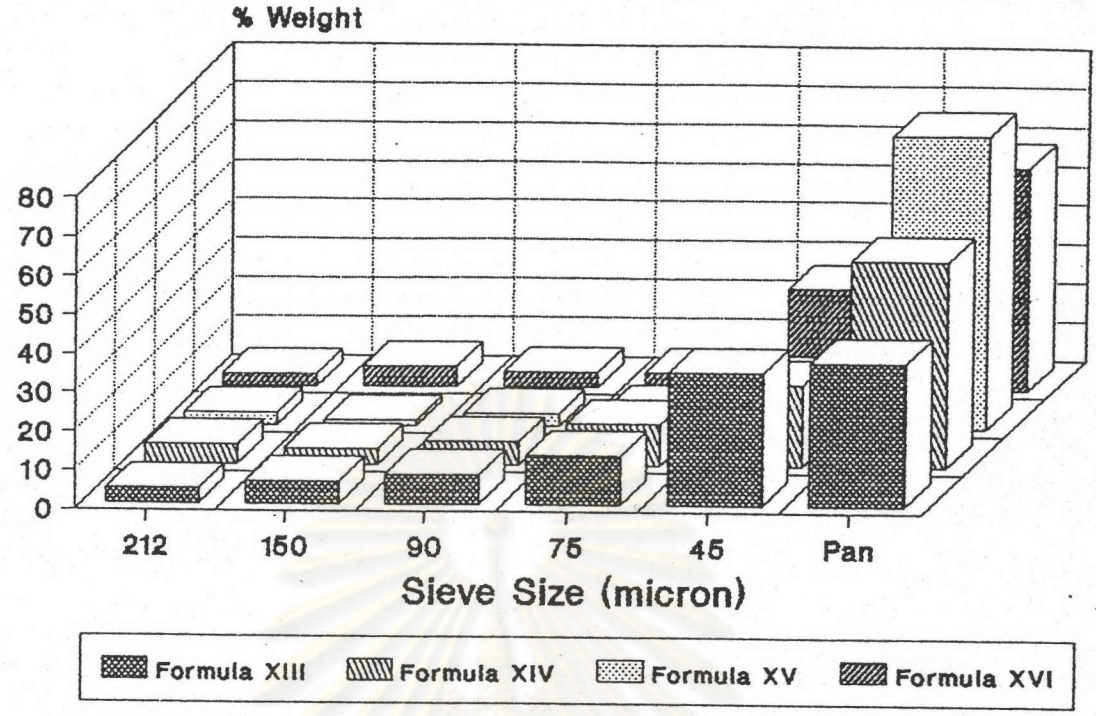

Figure 92. The Particle Size Distribution of Formulation XIII-XVI Co-Spray Dried Powders

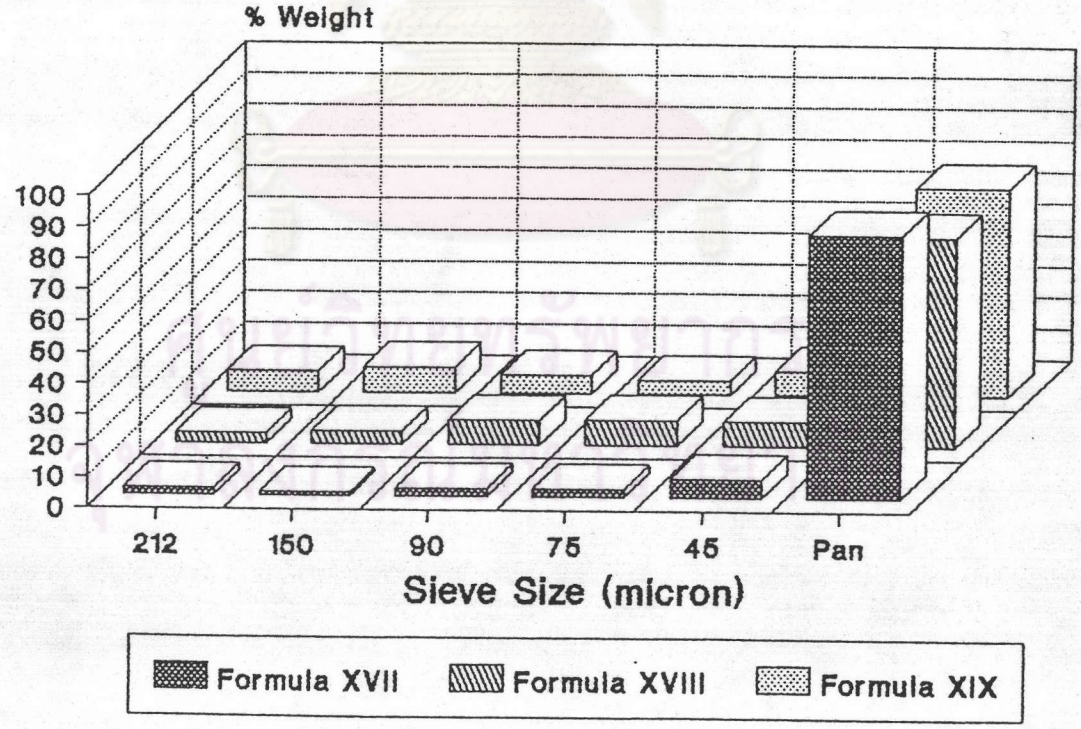

Figure 93. The Particle Size Distribution of Formulation XVII-XIX Co-Spray Dried Powders

Appendix E

Amount Percent of Drug Release, Release Rate

Release Rate Against Amount and Reciprocal of Amount

Table 33. Amount percent of theophylline release from blank matrices

Products	Time	√Time	Dissolution medium						
			0.1 N.HCl			Phosphate buffer pH 6.8			
			Mean*	SD	Log% drug remained	Time	Mean*	SD	Log% drug remained
Blank	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	0.25	0.50	13.34	0.70	1.94	0.25	8.88	0.19	1.96
	0.50	0.71	21.95	0.89	1.89	0.50	16.52	0.23	1.92
	0.75	0.87	30.39	0.95	1.84	0.75	23.90	0.28	1.88
	1	1.00	38.05	1.05	1.79	1	30.36	0.51	1.84
	2	1.41	64.38	2.42	1.55	2	55.43	1.03	1.65
	3	1.73	83.21	4.32	1.22	3	75.95	2.08	1.38
	4	2.00	93.30	3.16	0.82	4	88.67	2.55	1.05
	5	2.45	99.32	0.40	-0.17	6	98.84	2.75	0.80

* = Mean of three determinations (%)

Table 34. Amount Percent of Theophylline Release From Matrices Containing Ethylcellulose.

Formulation	Time	√Time	Dissolution medium					
			0.1 N.HCl			Phosphate buffer pH 6.8		
			Mean*	SD	Log% drug remained	Mean*	SD	Log% drug remained
I	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	7.91	0.34	1.96	6.53	0.74	1.97
	0.50	0.71	12.59	0.74	1.94	9.78	1.02	1.96
	0.75	0.87	16.27	1.41	1.92	12.98	1.19	1.94
	1	1.00	19.14	1.29	1.91	15.66	1.39	1.93
	2	1.41	28.57	1.02	1.85	23.35	0.74	1.88
	3	1.73	36.83	1.52	1.80	29.32	0.63	1.85
	4	2.00	43.33	2.53	1.75	33.44	0.58	1.82
	6	2.45	52.69	1.68	1.67	41.31	0.57	1.77
	9	3.00	63.08	1.56	1.57	50.58	0.46	1.69
	12	3.46	71.90	1.62	1.45	57.94	1.08	1.62
II	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	6.75	0.39	1.97	5.57	0.20	1.97
	0.50	0.71	10.56	0.34	1.95	8.49	0.47	1.96
	0.75	0.87	13.54	0.42	1.94	10.89	0.38	1.95
	1	1.00	15.94	0.09	1.92	13.00	0.66	1.94
	2	1.41	23.97	0.36	1.88	19.14	1.65	1.91
	3	1.73	30.22	0.52	1.84	24.06	1.61	1.88
	4	2.00	34.66	0.22	1.81	28.49	1.36	1.85
	6	2.45	42.46	0.98	1.76	35.75	0.97	1.81
	9	3.00	50.06	0.65	1.70	43.55	0.35	1.75
	12	3.46	59.61	1.40	1.61	51.75	1.34	1.68
III	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	5.63	0.46	1.97	5.55	0.38	1.97
	0.50	0.71	8.42	0.60	1.96	8.24	0.43	1.96
	0.75	0.87	10.58	0.61	1.95	10.46	0.50	1.95
	1	1.00	12.44	1.07	1.94	12.27	0.59	1.94
	2	1.41	19.06	1.24	1.91	18.06	0.49	1.92
	3	1.73	23.05	1.02	1.89	22.36	0.57	1.89
	4	2.00	26.98	0.88	1.86	25.80	0.56	1.87
	6	2.45	33.65	0.91	1.82	31.75	0.44	1.84
	9	3.00	41.10	1.59	1.77	38.22	0.34	1.80
	12	3.46	47.96	1.07	1.72	45.27	1.13	1.74
IV	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	5.36	0.31	1.98	5.59	0.63	1.98
	0.50	0.71	8.07	0.61	1.96	7.99	0.76	1.96
	0.75	0.87	10.23	0.21	1.95	9.93	0.75	1.96
	1	1.00	12.01	0.31	1.94	11.40	0.88	1.95
	2	1.41	17.75	0.16	1.92	16.73	1.16	1.92
	3	1.73	21.51	0.33	1.89	20.62	1.46	1.90
	4	2.00	24.69	0.31	1.88	23.68	1.50	1.88
	6	2.45	30.84	0.59	1.84	29.24	1.46	1.85
	9	3.00	37.17	1.57	1.80	34.64	2.24	1.82
	12	3.46	42.68	2.18	1.76	41.48	1.59	1.77

* = Mean of three determinations (%)

Table 35. Amount Percent of Theophylline Release From Matrices Containing Hydroxypropylmethylcellulose.

Formulation	Time	√Time	Dissolution medium					
			0.1 N.HCl			Phosphate buffer pH 6.8		
			Mean*	SD	Log% drug remained	Mean*	SD	Log% drug remained
V	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	4.13	0.22	1.98	3.78	0.12	1.98
	0.50	0.71	6.45	0.34	1.97	5.42	0.24	1.97
	0.75	0.87	8.58	0.33	1.96	6.85	0.28	1.97
	1	1.00	10.69	0.38	1.95	8.02	0.28	1.96
	2	1.41	19.12	1.24	1.91	12.48	0.44	1.94
	3	1.73	26.71	2.04	1.86	15.53	0.44	1.93
	4	2.00	33.33	2.65	1.82	18.40	0.49	1.91
	6	2.45	43.90	1.89	1.75	23.19	0.54	1.88
	9	3.00	57.10	1.44	1.63	29.13	0.45	1.85
	12	3.46	66.48	0.79	1.52	34.39	0.67	1.82
VI	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	4.29	0.62	1.98	3.70	0.05	1.98
	0.50	0.71	6.46	0.88	1.97	5.41	0.09	1.97
	0.75	0.87	8.44	1.14	1.96	6.53	0.14	1.97
	1	1.00	10.44	1.37	1.95	7.62	0.07	1.96
	2	1.41	17.35	2.34	1.92	11.31	0.16	1.95
	3	1.73	22.78	3.15	1.89	13.51	0.18	1.94
	4	2.00	27.46	3.47	1.86	15.85	0.19	1.92
	6	2.45	35.64	4.30	1.81	19.53	0.26	1.90
	9	3.00	44.43	5.89	1.74	25.12	0.45	1.87
	12	3.46	53.23	6.79	1.70	29.93	0.63	1.84
VII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	4.91	1.52	1.98	4.38	0.03	1.98
	0.50	0.71	6.90	2.99	1.98	6.16	0.14	1.97
	0.75	0.87	9.27	2.68	1.97	7.53	0.15	1.96
	1	1.00	11.03	3.25	1.96	8.85	0.31	1.96
	2	1.41	16.84	4.77	1.94	12.91	0.28	1.94
	3	1.73	20.63	5.11	1.92	16.29	0.21	1.92
	4	2.00	24.24	5.60	1.91	19.22	0.34	1.91
	6	2.45	29.84	5.83	1.88	24.22	0.19	1.88
	9	3.00	37.39	6.65	1.84	29.69	0.15	1.85
	12	3.46	43.68	6.88	1.79	34.60	0.46	1.82
VIII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	3.95	0.23	1.98	4.15	0.07	1.98
	0.50	0.71	5.70	0.17	1.97	5.97	0.19	1.97
	0.75	0.87	6.99	0.24	1.97	7.30	0.26	1.97
	1	1.00	8.40	0.12	1.96	8.46	0.32	1.96
	2	1.41	12.38	0.25	1.94	12.20	0.49	1.94
	3	1.73	15.80	0.42	1.92	15.27	0.65	1.93
	4	2.00	19.13	0.40	1.91	18.05	0.89	1.91
	6	2.45	23.77	0.57	1.88	22.13	1.05	1.89
	9	3.00	30.44	0.93	1.84	27.67	1.01	1.86
	12	3.46	36.46	0.61	1.80	32.88	2.03	1.83

* = Mean of three determinations (%)

Table 36. Amount Percent of Theophylline Release From Matrices Containing Hydroxypropylmethylcellulose Phthalate.

Formulation	Dissolution medium								
	0.1 N.HCl					Phosphate buffer pH 6.8			
	Time	Time	Mean*	SD	Log% drug remained	Time	Mean*	SD	Log% drug remained
IX	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	0.25	0.50	6.84	1.06	1.97	0.25	11.27	1.68	1.95
	0.50	0.71	11.82	1.78	1.94	0.50	20.75	3.06	1.90
	0.75	0.87	17.06	2.49	1.92	0.75	28.00	3.45	1.86
	1	1.00	21.08	2.64	1.90	1	35.89	4.45	1.81
	2	1.41	33.09	3.25	1.82	2	58.34	6.66	1.62
	3	1.73	42.38	1.25	1.76	3	77.22	2.39	1.36
	4	2.00	49.79	0.81	1.70	4	92.47	1.65	0.88
	6	2.45	59.64	1.02	1.60	5	96.51	0.89	0.54
	9	3.00	72.96	1.01	1.43	-	-	-	-
	12	3.46	84.55	1.77	1.19	-	-	-	-
X	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	0.25	0.50	7.10	0.69	1.97	0.25	11.47	2.14	1.95
	0.50	0.71	11.22	0.77	1.95	0.50	21.61	4.34	1.89
	0.75	0.87	15.85	1.11	1.92	0.75	30.75	6.02	1.84
	1	1.00	20.28	1.15	1.90	1	40.84	6.26	1.77
	2	1.41	37.38	4.54	1.80	2	67.49	8.67	1.51
	3	1.73	44.82	7.66	1.74	3	84.27	3.87	1.20
	4	2.00	54.25	9.27	1.66	4	95.28	0.82	0.67
	6	2.45	67.06	10.58	1.52	5	98.96	0.99	0.02
	9	3.00	77.93	10.33	1.34	-	-	-	-
	12	3.46	86.66	8.24	1.12	-	-	-	-
XI	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	0.25	0.50	6.62	0.76	1.97	0.25	10.53	1.20	1.95
	0.50	0.71	10.65	1.36	1.95	0.50	19.35	1.12	1.91
	0.75	0.87	15.01	2.41	1.93	0.75	26.73	1.38	1.86
	1	1.00	19.22	2.99	1.91	1	34.54	1.29	1.82
	2	1.41	32.82	4.26	1.83	2	59.07	3.06	1.61
	3	1.73	41.93	5.17	1.76	3	78.94	2.30	1.32
	4	2.00	48.45	4.27	1.71	4	92.30	2.87	0.88
	6	2.45	58.69	5.27	1.62	5	97.04	0.85	0.47
	9	3.00	69.90	4.30	1.48	-	-	-	-
	12	3.46	78.64	3.47	1.33	-	-	-	-
XII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00
	0.25	0.50	7.07	0.88	1.97	0.25	22.52	12.21	1.89
	0.50	0.71	11.22	1.26	1.95	0.50	29.28	3.01	1.84
	0.75	0.87	14.78	1.41	1.93	0.75	34.73	2.79	1.81
	1	1.00	18.75	2.04	1.91	1	40.86	2.55	1.77
	2	1.41	31.37	4.63	1.84	2	61.94	4.56	1.58
	3	1.73	40.10	4.52	1.78	3	79.89	5.30	1.30
	4	2.00	46.26	5.05	1.73	4	91.31	3.83	0.94
	6	2.45	56.57	6.46	1.64	5	97.32	1.16	0.26
	9	3.00	66.25	5.48	1.53	-	-	-	-
	12	3.46	76.49	4.12	1.37	-	-	-	-

* = Mean of three determinations

Table 37. Amount Percent of Theophylline Release From Matrices Containing Ethylcellulose and PVP K30.

Formulation	Time	√Time	Dissolution medium: 0.1 N.HCl Mean*	SD	Log% drug remained	Phosphate buffer pH 6.8 Mean*	SD	Log% drug remained
XIII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	6.85	0.06	1.97	5.07	0.19	1.98
	0.50	0.71	11.09	0.26	1.95	8.31	0.22	1.96
	0.75	0.87	14.28	0.40	1.93	10.97	0.06	1.95
	1	1.00	18.28	0.39	1.91	13.53	0.22	1.94
	2	1.41	28.38	0.40	1.86	21.40	1.00	1.90
	3	1.73	37.05	0.80	1.80	27.57	1.38	1.86
	4	2.00	41.12	1.87	1.77	33.38	1.97	1.82
	6	2.45	49.43	0.90	1.71	39.96	2.13	1.78
	9	3.00	62.03	1.14	1.58	48.38	1.11	1.71
	12	3.46	68.82	0.90	1.50	56.90	1.32	1.63
XIV	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	5.32	0.15	1.98	5.42	0.75	1.98
	0.50	0.71	11.82	0.32	1.94	8.94	1.22	1.96
	0.75	0.87	15.59	0.36	1.93	11.98	1.45	1.94
	1	1.00	18.79	0.39	1.91	14.46	1.53	1.93
	2	1.41	28.84	0.48	1.85	22.67	1.84	1.89
	3	1.73	36.29	0.65	1.80	28.91	1.67	1.85
	4	2.00	41.22	1.18	1.77	33.93	1.75	1.82
	6	2.45	50.21	0.47	1.70	39.85	1.60	1.78
	9	3.00	60.88	0.68	1.59	50.49	1.65	1.69
	12	3.46	68.55	1.26	1.50	58.14	2.31	1.62
XV	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	6.30	0.83	1.97	7.92	0.36	1.96
	0.50	0.71	11.97	1.30	1.94	16.14	0.62	1.92
	0.75	0.87	17.70	1.82	1.91	23.65	0.29	1.88
	1	1.00	22.92	2.20	1.88	30.79	0.49	1.84
	2	1.41	38.64	2.44	1.79	53.28	1.25	1.67
	3	1.73	49.36	2.30	1.70	71.80	2.29	1.45
	4	2.00	56.41	2.93	1.64	81.68	3.02	1.26
	6	2.45	68.02	3.07	1.50	92.46	1.12	0.88
	9	3.00	78.68	2.53	1.33	97.51	1.12	0.40
	12	3.46	85.27	5.01	1.17	-	-	-
XVI	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	7.60	0.87	1.96	7.82	1.17	1.96
	0.50	0.71	14.77	2.02	1.93	15.29	1.70	1.93
	0.75	0.87	21.10	2.58	1.90	22.32	1.90	1.89
	1	1.00	26.35	3.38	1.87	29.31	2.23	1.85
	2	1.41	41.87	4.76	1.76	52.58	3.43	1.68
	3	1.73	52.65	4.18	1.68	70.20	2.86	1.47
	4	2.00	60.18	3.68	1.60	82.36	2.20	1.25
	6	2.45	69.91	2.20	1.48	95.26	0.84	0.68
	9	3.00	78.09	3.35	1.34	97.70	1.34	0.36
	12	3.46	83.85	0.71	1.21	-	-	-

* = Mean of three determinations (%)

Table 38. Amount Percent of Theophylline Release From Matrices Containing Ethylcellulose and Lactose.

Formulation	Time	√Time	Dissolution medium					
			0.1 N.HCl			Phosphate buffer pH 6.8		
			Mean*	SD	Log% drug remained	Mean*	SD	Log% drug remained
XVII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	6.21	0.45	1.97	5.42	0.37	1.98
	0.50	0.71	10.45	0.72	1.95	8.73	0.49	1.96
	0.75	0.87	13.81	0.92	1.94	11.63	0.45	1.95
	1	1.00	16.92	1.09	1.92	14.33	0.53	1.93
	2	1.41	27.98	1.90	1.86	24.22	0.17	1.88
	3	1.73	38.61	1.85	1.79	33.06	0.07	1.82
	4	2.00	45.62	1.78	1.74	39.46	0.38	1.78
	6	2.45	58.57	1.33	1.62	51.67	0.67	1.68
	9	3.00	72.21	2.01	1.44	63.60	0.79	1.56
	12	3.46	82.92	0.69	1.23	72.79	1.67	1.43
XVIII	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	5.92	0.72	1.97	6.12	0.19	1.97
	0.50	0.71	9.33	0.70	1.96	9.64	0.23	1.96
	0.75	0.87	12.44	0.80	1.94	12.75	0.28	1.94
	1	1.00	15.10	0.85	1.93	15.47	0.51	1.93
	2	1.41	24.57	1.04	1.88	24.88	1.03	1.88
	3	1.73	33.95	1.13	1.82	34.10	2.08	1.82
	4	2.00	42.19	1.24	1.76	42.49	2.55	1.76
	6	2.45	55.91	0.91	1.64	54.59	2.75	1.65
	9	3.00	70.67	0.76	1.47	67.78	5.20	1.51
	12	3.46	82.06	1.02	1.25	77.80	4.05	1.34
XIX	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	6.42	0.66	1.97	4.54	0.26	1.98
	0.50	0.71	10.50	0.74	1.95	7.66	0.34	1.96
	0.75	0.87	13.98	0.82	1.93	10.50	0.45	1.95
	1	1.00	17.77	1.13	1.92	12.96	0.42	1.94
	2	1.41	29.53	1.92	1.85	24.23	0.76	1.88
	3	1.73	41.24	2.43	1.77	34.22	1.09	1.82
	4	2.00	50.14	1.74	1.70	39.26	0.94	1.78
	6	2.45	63.97	2.53	1.56	50.52	1.42	1.69
	9	3.00	79.59	1.56	1.31	64.66	3.09	1.55
	12	3.46	86.40	1.38	1.13	73.19	2.42	1.43

* = Mean of three determinations (%)

Table 39. Amount Percent of Theophylline Release From Commercial Products

Products	Time	√Time	Dissolution medium					
			0.1 N.HCl			Phosphate buffer pH 6.8		
			Mean*	SD	Log% drug remained	Mean*	SD	Log% drug remained
Quibron(R)	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	17.25	2.59	1.92	19.92	2.45	1.90
	0.50	0.71	30.12	3.63	1.84	33.88	4.03	1.82
	0.75	0.87	40.77	5.50	1.77	45.33	4.06	1.74
	1	1.00	51.76	5.17	1.68	58.32	5.30	1.62
	2	1.41	78.92	5.26	1.32	87.58	3.37	1.09
	3	1.73	95.18	2.76	0.68	95.53	0.07	0.65
	4	2.00	98.03	1.14	0.29	95.53	0.39	0.63
	5	2.45	97.31	1.10	0.43	-	-	-
Nuelin(R)	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	8.38	0.28	1.96	8.57	0.23	1.96
	0.50	0.71	12.57	0.30	1.94	13.88	0.31	1.93
	0.75	0.87	15.93	0.33	1.92	18.27	0.54	1.91
	1	1.00	18.51	0.33	1.91	22.52	0.92	1.89
	2	1.41	25.40	0.54	1.87	42.37	4.31	1.76
	3	1.73	30.45	0.70	1.84	60.07	4.25	1.60
	4	2.00	34.80	0.42	1.81	73.68	3.55	1.42
	6	2.45	41.62	0.87	1.77	92.89	3.86	0.85
	9	3.00	48.40	1.84	1.71	97.36	0.40	0.42
	12	3.46	56.08	2.63	1.64	-	-	-
Theodur(R)	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00
	0.25	0.50	4.83	0.22	1.98	4.36	0.11	1.98
	0.50	0.71	7.33	0.39	1.97	6.67	0.34	1.97
	0.75	0.87	9.32	0.59	1.96	8.57	0.52	1.96
	1	1.00	11.05	0.89	1.95	10.38	0.41	1.95
	2	1.41	16.35	1.76	1.92	15.20	0.26	1.93
	3	1.73	22.82	4.34	1.89	20.16	1.48	1.90
	4	2.00	29.90	6.97	1.84	27.53	4.86	1.86
	6	2.45	44.02	4.96	1.75	49.71	8.11	1.70
	9	3.00	56.20	3.77	1.64	77.75	7.97	1.35
	12	3.46	66.65	3.92	1.52	89.71	3.93	1.01

* = Mean of three determinations (%)

Table 40. Amount Percent of Theophylline Release From Formulation XIX, Nuelin T/SR and Theodur in pH Change Method.

Formulation	Time	√Time	Mean*	SD	Log% drug remained
Formulation XIX	0.00	0.00	0.00	0.00	2.00
	0.25	0.50	5.44	0.03	1.98
	0.50	0.71	9.05	0.03	1.96
	0.75	0.87	12.29	0.14	1.94
	1	1.00	15.06	0.28	1.93
	2	1.41	27.02	1.03	1.86
	3	1.73	37.32	2.99	1.80
	4	2.00	46.80	1.23	1.72
	5	2.24	51.99	0.25	1.68
	6	2.45	58.52	2.08	1.61
	7	2.64	61.84	2.35	1.57
	8	2.83	67.47	1.75	1.51
	10	3.16	73.09	0.95	1.43
	12	3.46	81.46	0.68	1.27
Theodur(R)	0.00	0.00	0.00	0.00	2.00
	0.25	0.50	4.50	0.22	1.98
	0.50	0.71	6.92	0.37	1.97
	0.75	0.87	8.71	0.49	1.96
	1	1.00	10.21	0.54	1.95
	2	1.41	14.88	1.32	1.93
	3	1.73	25.88	4.44	1.87
	4	2.00	35.83	7.45	1.81
	5	2.24	42.66	8.73	1.76
	6	2.45	51.74	10.80	1.68
	7	2.64	58.37	11.44	1.62
	8	2.83	68.72	14.42	1.50
	10	3.16	83.81	9.95	1.21
	12	3.46	92.80	8.93	0.86
Nuelin(R)	0.00	0.00	0.00	0.00	2.00
	0.25	0.50	8.00	0.34	1.96
	0.50	0.71	12.32	0.55	1.94
	0.75	0.87	15.53	0.47	1.93
	1	1.00	18.67	0.99	1.91
	2	1.41	26.30	0.46	1.87
	3	1.73	30.86	0.60	1.84
	4	2.00	39.37	2.55	1.78
	5	2.24	45.13	2.68	1.74
	6	2.45	52.83	2.82	1.67
	7	2.64	57.55	3.74	1.63
	8	2.83	61.38	3.31	1.59
	10	3.16	69.66	4.37	1.48
	12	3.46	77.94	5.83	1.34

* = Mean of three determinations (%)

Table 41. The release rate of blank theophylline in 0.1 N.HCl and in buffer pH 6.8.

Release Rate (%/hour)			
Mean Time	in 0.1N.HCl	Mean Time	in pH6.8
0.125	53.35	0.125	35.51
0.375	34.46	0.375	30.58
0.625	33.73	0.625	29.52
0.875	30.66	0.875	25.81
1.5	26.33	1.5	25.07
2.5	18.83	2.5	20.52
3.5	10.09	3.5	12.72
4.5	6.02	5.0	5.09

Table 42. The release rate of theophylline from Formulations I-IV in 0.1 N.HCl

	Release Rate (%/hour)			
Mean Time	Formulation I	Formulation II	Formulation III	Formulation IV
0.125	31.65	27.00	22.52	21.46
0.375	18.70	15.25	11.15	10.83
0.625	14.74	11.90	8.63	8.65
0.875	11.47	9.63	7.44	7.09
1.5	9.43	8.02	6.62	5.75
2.5	8.26	6.25	3.99	3.75
3.5	6.50	4.44	3.93	3.19
5.0	4.68	3.90	3.34	3.07
7.5	3.46	2.53	2.48	2.11
10.5	2.94	3.18	2.29	1.84

Table 43. The release rate of theophylline from Formulations I-IV in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	Formulation I	Formulation II	Formulation III	Formulation IV
0.125	26.04	22.27	21.88	22.06
0.375	13.00	11.58	10.57	9.47
0.625	12.63	9.57	8.74	7.66
0.875	10.84	8.42	7.11	5.81
1.5	7.66	6.12	5.70	5.27
2.5	5.96	4.90	4.24	3.84
3.5	4.11	4.42	3.39	3.03
5.0	3.92	3.62	2.92	2.75
7.5	3.08	2.59	2.12	1.77
10.5	2.44	2.72	2.31	2.26

Table 44. The release rate of theophylline from Formulations V-VIII in 0.1 N.HCl

Mean Time	Release Rate (%/hour)			
	Formulation V	Formulation VI	Formulation VII	Formulation VIII
0.125	16.51	17.16	14.16	15.81
0.375	9.28	8.68	6.76	6.98
0.625	8.52	7.94	5.68	5.16
0.875	8.45	8.01	5.17	5.65
1.5	8.43	6.90	4.36	3.98
2.5	7.59	5.43	3.54	3.41
3.5	6.62	4.69	3.18	3.33
5.0	5.28	4.08	2.80	2.32
7.5	4.40	2.93	2.30	2.22
10.5	3.12	2.93	2.10	2.01

Table 45. The release rate of theophylline from Formulations V-VIII in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	Formulation V	Formulation VI	Formulation VII	Formulation VIII
0.125	15.14	14.80	17.51	16.59
0.375	6.57	6.83	7.12	7.29
0.625	5.70	4.51	5.49	5.31
0.875	4.65	4.35	5.29	4.63
1.5	4.46	3.69	4.05	3.74
2.5	3.06	2.19	3.38	3.07
3.5	2.87	2.34	2.93	2.77
5.0	2.39	1.84	2.50	2.04
7.5	1.98	1.86	1.82	1.85
10.5	1.75	1.60	1.63	1.74

Table 46. The release rate of theophylline from Formulations IX-XII in 0.1 N.HCl

Mean Time	Release Rate (%/hour)			
	Formulation IX	Formulation X	Formulation XI	Formulation XII
0.125	27.34	28.40	26.47	28.29
0.375	19.94	16.48	16.12	16.59
0.625	20.97	18.53	17.45	14.25
0.875	16.08	17.70	16.84	15.86
1.5	12.01	17.10	13.60	12.62
2.5	9.29	7.44	9.12	8.73
3.5	7.41	9.43	6.51	6.16
5.0	4.93	6.41	5.12	5.16
7.5	4.44	3.62	3.74	3.23
10.5	3.86	2.91	2.92	3.41

Table 47. The release rate of theophylline from Formulation IX-XII in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	Formulation IX	Formulation X	Formulation XI	Formulation XII
0.125	45.08	45.88	42.13	90.09
0.375	37.90	40.56	35.27	27.01
0.625	29.03	36.57	29.51	21.81
0.875	31.54	40.35	31.25	24.54
1.5	22.45	26.66	24.52	21.07
2.5	18.87	16.78	19.87	17.96
3.5	15.25	11.00	13.37	11.42
4.5	4.04	3.68	4.73	6.88

Table 48. The release rate of theophylline from Formulatios XIII-XIV in 0.1 N.HCl and in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	in 0.1 N.HCl		in buffer pH 6.8	
	Formulation XIII	Formulation XIV	Formulation XIII	Formulation XIV
0.125	27.21	21.29	20.26	21.70
0.375	16.80	25.99	12.99	14.08
0.625	14.51	15.11	10.61	12.13
0.875	14.05	12.79	10.24	9.95
1.5	10.02	10.05	7.87	8.20
2.5	8.60	7.44	6.17	6.24
3.5	4.04	4.94	5.80	5.02
5.0	4.12	4.49	3.29	2.96
7.5	4.17	3.56	2.81	3.55
10.5	2.25	2.56	2.83	2.55

Table 49. The release rate of theophylline from Formulatios XV-XVI in 0.1 N.HCl and in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	in 0.1 N.HCl		in buffer pH 6.8	
	Formulation XV	Formulation XVI	Formulation XV	Formulation XVI
0.125	25.21	30.40	31.70	31.28
0.375	22.66	28.69	32.86	29.88
0.625	22.93	25.31	30.03	28.14
0.875	20.87	20.99	28.55	27.95
1.5	15.72	15.53	22.50	23.27
2.5	10.72	10.77	18.52	17.62
3.5	7.04	7.54	9.88	12.16
5.0	5.81	4.86	5.39	6.45
7.5	3.55	2.73	1.68	0.81
10.5	2.20	1.92	-	-

Table 50. The release rate of theophylline from Formulations XVII-XVIII in 0.1 N.HCl and in buffer pH 6.8

Mean Time	Release Rate (%/hour)			
	in 0.1 N.HCl		in buffer pH 6.8	
	Formulation XVII	Formulation XVIII	Formulation XVII	Formulation XVIII
0.125	24.85	23.68	21.69	24.53
0.375	16.96	13.63	13.21	14.08
0.625	13.43	12.46	11.62	12.45
0.875	12.42	10.61	10.80	10.89
1.5	11.06	9.47	9.89	9.42
2.5	10.63	9.39	8.83	9.23
3.5	7.01	8.24	6.40	8.41
5.0	6.47	6.86	6.11	6.06
7.5	4.54	4.92	3.98	4.40
10.5	3.57	3.80	3.06	3.34

Table 51. The release rate of theophylline from Formulations XIX and Theodur(R) in 0.1 N.HCl and in buffer pH 6.8

	Release Rate (%/hour)			
	in 0.1 N.HCl		in buffer pH 6.8	
Mean Time	Formulation XIX	Theodur	Formulation XIX	Theodur
0.125	25.69	19.31	18.15	17.43
0.375	16.32	10.02	12.48	9.23
0.625	13.92	7.98	11.37	7.60
0.875	15.17	6.89	9.82	7.26
1.5	11.75	5.30	11.27	4.82
2.5	11.71	6.47	9.99	4.96
3.5	8.90	7.08	5.04	7.37
5.0	6.92	7.06	5.63	11.09
7.5	5.20	4.06	4.71	9.34
10.5	2.27	3.48	2.84	3.99

Table 52. The release rate of theophylline from Quibron(R) in 0.1 N.HCl and in buffer pH 6.8

	Release Rate (%/hour)	
Mean Time	0.1 N. HCl	pH6.8
0.125	69.02	79.67
0.375	51.45	55.84
0.625	42.61	45.79
0.875	43.97	51.99
1.5	27.15	29.26
2.5	16.26	7.94
3.5	2.85	0.18

Table 53. The release rate of theophylline from Nuelin(R) in 0.1 N.HCl and buffer pH 6.8

Release Rate (%/hour)			
Mean Time	in 0.1 N.HCl	Mean Time	in buffer pH 6.8
0.125	33.51	0.125	34.28
0.375	16.77	0.375	21.26
0.625	13.46	0.625	17.55
0.875	10.31	0.875	16.98
1.5	6.88	1.5	19.86
2.5	5.06	2.5	17.70
3.5	4.35	3.5	13.61
5.0	3.41	5.0	9.60
7.5	2.26	7.5	1.49
10.5	2.56	-	-

Table 54. The release rate of theophylline from Theodur(R), Nuelin(R) and Formulation XIX in pH change method.

Mean Time	Release Rate(%/hour)		
	Theodur(R)	Nuelin(R)	Formulation XIX
0.125	18.01	32.02	21.78
0.375	9.66	17.25	14.43
0.625	7.17	12.84	12.94
0.875	6.01	12.59	11.09
1.5	4.67	7.62	11.96
2.5	11.00	4.56	10.30
3.5	9.95	8.51	9.48
4.5	6.83	5.76	5.19
5.5	9.08	7.70	6.54
6.5	6.64	4.72	4.19
7.5	10.34	3.83	4.71
9.0	7.55	4.14	2.84
11.0	4.49	4.14	4.18

Table 55. Values for rate, amount released, and the corresponding reciprocal for the release of blank theophyline matrix.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
Blank	53.35	13.34	0.075	35.51	8.88	0.113
	34.46	21.95	0.046	30.58	16.52	0.060
	33.73	30.39	0.033	29.52	23.90	0.042
	30.66	38.05	0.026	25.81	30.36	0.033
	26.33	64.38	0.016	25.07	55.43	0.018
	18.83	83.21	0.012	20.52	75.95	0.013
	10.09	93.30	0.011	12.72	88.67	0.011
	6.02	99.32	0.010	5.09	98.84	0.010

Table 56. Values for rate, amount released, and the corresponding reciprocal for the release of Formulations I-IV matrices.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
I	31.65	7.91	0.126	26.04	6.51	0.154
	18.70	12.59	0.080	13.00	9.76	0.102
	14.74	16.27	0.061	12.63	12.92	0.077
	11.47	19.14	0.052	10.83	15.63	0.064
	9.43	28.58	0.035	7.66	23.29	0.043
	8.26	36.83	0.027	5.96	29.24	0.034
	6.50	43.33	0.023	4.11	33.36	0.030
	4.68	52.70	0.019	3.92	41.21	0.024
	3.46	63.08	0.016	3.08	50.46	0.020
	2.94	71.90	0.014	2.44	57.79	0.017
II	27.00	6.75	0.148	22.27	5.57	0.180
	15.25	10.56	0.095	11.58	8.46	0.118
	11.90	13.54	0.074	9.57	10.86	0.092
	9.63	15.94	0.063	8.42	12.96	0.077
	8.02	23.97	0.042	6.12	19.08	0.052
	6.25	30.22	0.033	4.90	23.98	0.042
	4.44	34.66	0.029	4.42	28.40	0.035
	3.90	42.46	0.024	3.62	35.63	0.028
	2.53	50.06	0.020	2.59	43.42	0.023
	3.18	59.61	0.017	2.72	51.58	0.019
III	22.52	5.63	0.177	21.88	5.47	0.183
	11.15	8.42	0.119	10.57	8.11	0.123
	8.63	10.58	0.094	8.74	10.30	0.097
	7.44	12.44	0.080	7.11	12.08	0.083
	6.62	19.06	0.052	5.70	17.77	0.056
	3.99	23.04	0.043	4.24	22.01	0.045
	3.93	26.98	0.037	3.39	25.40	0.039
	3.34	33.65	0.030	2.92	31.25	0.032
	2.48	41.10	0.024	2.12	37.61	0.026
	2.29	47.96	0.021	2.31	44.54	0.022
IV	21.46	5.36	0.186	22.06	5.52	0.181
	10.83	8.07	0.124	9.47	7.88	0.127
	8.65	10.23	0.098	7.66	9.80	0.102
	7.09	12.01	0.083	5.81	11.25	0.089
	5.75	17.75	0.056	5.27	16.52	0.060
	3.75	21.51	0.046	3.84	20.36	0.049
	3.19	24.69	0.040	3.03	23.38	0.043
	3.07	30.84	0.032	2.75	28.88	0.035
	2.11	37.17	0.027	1.77	34.20	0.029
	1.84	42.68	0.023	2.26	40.98	0.024

Table 57. Values for rate, amount released, and the corresponding reciprocal for the release of Formulations V-VIII matrices.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
V	16.51	4.13	0.242	15.14	3.78	0.264
	9.28	6.45	0.155	6.57	5.43	0.184
	8.52	8.58	0.116	5.70	6.85	0.146
	8.45	10.69	0.094	4.65	8.02	0.125
	8.43	19.12	0.052	4.46	12.48	0.080
	7.59	26.71	0.037	3.06	15.53	0.064
	6.62	33.33	0.030	2.87	18.40	0.054
	5.28	43.90	0.023	2.39	23.19	0.043
	4.40	57.10	0.018	1.98	29.43	0.034
	3.12	66.48	0.015	1.75	34.39	0.029
VI	17.16	4.29	0.233	14.80	3.70	0.270
	8.68	6.46	0.155	6.83	5.41	0.185
	7.94	8.44	0.118	4.51	6.53	0.153
	8.01	10.44	0.096	4.35	7.62	0.131
	6.90	17.35	0.058	3.69	11.31	0.088
	5.43	22.78	0.044	2.19	13.51	0.074
	4.69	27.46	0.036	2.34	15.85	0.063
	4.08	35.64	0.028	1.84	19.53	0.051
	2.93	44.43	0.022	1.86	25.12	0.040
	2.93	53.23	0.019	1.60	29.93	0.033
VII	14.06	3.51	0.284	17.51	4.38	0.228
	6.76	5.20	0.192	7.12	6.16	0.162
	5.68	6.62	0.151	5.49	7.53	0.133
	5.17	7.92	0.126	5.30	8.86	0.113
	4.36	12.28	0.081	4.06	12.91	0.077
	3.54	15.82	0.063	3.38	16.29	0.061
	3.18	19.00	0.053	2.93	19.22	0.052
	2.80	24.61	0.041	2.50	24.22	0.041
	2.30	31.50	0.032	1.82	29.69	0.034
	2.10	37.81	0.026	1.63	34.60	0.029
VIII	15.81	3.95	0.253	16.59	4.15	0.241
	6.98	5.70	0.176	7.29	5.97	0.167
	5.16	6.99	0.143	5.31	7.30	0.137
	5.65	8.40	0.119	4.64	8.46	0.118
	3.98	12.38	0.081	3.74	12.20	0.082
	3.41	15.80	0.063	3.07	15.27	0.065
	3.33	19.13	0.052	2.77	18.05	0.055
	2.32	23.77	0.042	2.04	22.13	0.045
	2.22	30.44	0.033	1.85	27.67	0.036
	2.01	36.46	0.027	1.74	32.89	0.030

Table 58. Values for rate, amount released, and the corresponding reciprocal for the release of Formulations IX-XII matrices.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
IX	27.34	6.84	0.146	45.08	11.27	0.089
	19.94	11.82	0.084	37.90	20.75	0.048
	20.97	17.06	0.059	29.03	28.00	0.036
	16.08	21.08	0.047	31.54	35.89	0.028
	12.01	33.09	0.030	22.45	58.34	0.017
	9.29	42.38	0.024	18.87	77.22	0.013
	7.41	49.79	0.020	15.25	92.47	0.011
	4.92	59.64	0.017	4.04	96.51	0.010
	4.44	72.96	0.014	-	-	-
	3.86	84.55	0.012	-	-	-
X	28.40	7.10	0.141	45.88	11.47	0.087
	16.48	11.22	0.089	40.56	21.61	0.046
	18.53	15.85	0.063	36.57	30.75	0.032
	17.70	20.28	0.049	40.35	40.84	0.024
	17.10	37.38	0.027	26.66	67.50	0.015
	7.44	44.82	0.022	16.78	84.27	0.012
	9.43	54.25	0.018	11.00	95.28	0.010
	6.41	67.06	0.015	3.68	98.96	0.010
	3.62	77.93	0.013	-	-	-
	2.91	86.66	0.012	-	-	-
XI	26.47	6.62	0.151	42.13	10.53	0.095
	16.12	10.65	0.094	35.27	19.35	0.052
	17.45	15.01	0.067	29.51	26.73	0.037
	16.84	19.22	0.052	31.25	34.54	0.029
	13.60	32.82	0.030	24.52	59.07	0.017
	9.12	41.94	0.024	19.87	78.94	0.013
	6.51	48.45	0.021	13.37	92.30	0.011
	5.12	58.69	0.017	4.73	97.04	0.010
	3.74	69.90	0.014	-	-	-
	2.92	78.65	0.013	-	-	-
XII	28.29	7.07	0.141	90.09	22.52	0.044
	16.59	11.22	0.089	27.01	29.28	0.034
	14.25	14.78	0.068	21.81	34.73	0.029
	15.86	18.75	0.053	24.54	40.86	0.024
	12.62	31.37	0.032	21.07	61.94	0.016
	8.73	40.10	0.025	17.96	79.89	0.012
	6.16	46.26	0.022	11.42	91.31	0.011
	5.16	56.57	0.018	6.88	98.20	0.010
	3.23	66.25	0.015	-	-	-
	3.41	76.49	0.013	-	-	-

Table 59. Values for rate, amount released, and the corresponding reciprocalfor the release of Formulation XIII-XVI.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
XIII	27.21	6.80	0.147	20.26	5.06	0.197
	16.80	11.00	0.091	12.99	8.31	0.120
	14.51	14.63	0.068	10.61	10.97	0.091
	14.05	18.14	0.055	10.24	13.52	0.074
	10.02	28.16	0.036	7.88	21.40	0.047
	8.60	36.76	0.027	6.17	27.57	0.036
	4.04	40.81	0.024	5.80	33.38	0.030
	4.12	49.05	0.020	3.29	39.96	0.025
	4.17	61.55	0.016	2.81	48.38	0.021
	2.25	68.29	0.015	2.84	56.90	0.018
XIV	21.29	5.32	0.188	21.70	5.42	0.184
	25.99	11.82	0.085	14.08	8.94	0.112
	15.11	15.59	0.064	12.13	11.98	0.084
	12.79	18.79	0.053	9.95	14.46	0.069
	10.05	28.84	0.035	8.20	22.67	0.044
	7.44	36.29	0.028	6.24	28.91	0.034
	4.94	41.22	0.024	5.02	33.93	0.029
	4.49	50.21	0.020	2.96	39.84	0.025
	3.56	60.88	0.016	3.55	50.49	0.020
	2.56	68.55	0.014	2.55	58.14	0.017
XV	25.21	6.30	0.159	31.70	7.92	0.126
	22.66	11.97	0.084	32.86	16.14	0.062
	22.93	17.70	0.056	30.03	23.65	0.042
	20.87	22.92	0.044	28.55	30.78	0.032
	15.72	38.64	0.026	22.50	53.28	0.019
	10.72	49.36	0.020	18.52	71.80	0.014
	7.04	56.41	0.018	9.88	81.68	0.012
	5.81	68.02	0.015	5.39	92.46	0.011
	3.55	78.68	0.013	1.68	97.51	0.010
	2.20	85.26	0.012	-	-	-
XVI	30.40	7.60	0.132	31.28	7.82	0.128
	28.68	14.77	0.068	29.88	15.29	0.065
	25.31	21.10	0.047	28.14	22.32	0.048
	20.99	26.34	0.038	27.95	29.31	0.034
	15.53	41.87	0.024	23.27	52.58	0.019
	10.77	52.64	0.019	17.62	70.20	0.014
	7.54	60.18	0.017	12.16	82.36	0.012
	4.86	69.91	0.014	6.45	95.26	0.010
	2.73	78.09	0.013	0.81	97.70	0.010
	1.92	83.85	0.012	-	-	-

Table 60. Values for rate, amount released, and the corresponding reciprocal for the release of Formulation XVII-XIX.

Formulation	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
XVII	24.85	6.21	0.161	21.69	5.42	0.184
	16.96	10.45	0.096	13.21	8.72	0.115
	13.43	13.81	0.072	11.62	11.63	0.086
	12.42	16.92	0.059	10.80	14.33	0.070
	11.06	27.98	0.036	9.89	24.22	0.041
	10.63	38.61	0.026	8.83	33.06	0.030
	7.01	45.62	0.022	6.40	39.46	0.025
	6.47	58.57	0.017	6.11	51.67	0.019
	4.55	72.20	0.014	3.98	63.60	0.016
	3.57	82.92	0.012	3.06	72.79	0.014
XVIII	23.68	5.92	0.169	24.53	6.13	0.163
	13.63	9.33	0.107	14.08	9.65	0.104
	12.46	12.44	0.080	12.45	12.76	0.078
	10.61	15.10	0.066	10.89	15.49	0.064
	9.47	24.57	0.041	9.42	24.91	0.040
	9.38	33.95	0.029	9.23	34.14	0.029
	8.24	42.19	0.024	8.41	42.55	0.024
	6.86	55.90	0.018	6.06	54.67	0.018
	4.92	70.67	0.014	4.40	67.88	0.015
	3.80	82.06	0.012	3.34	77.91	0.013
XIX	25.69	6.42	0.156	18.15	4.54	0.220
	16.32	10.50	0.095	12.48	7.66	0.130
	13.91	13.98	0.072	11.37	10.50	0.095
	15.17	17.77	0.056	9.82	12.96	0.077
	11.75	29.53	0.034	11.27	24.23	0.041
	11.71	41.24	0.024	9.99	34.22	0.029
	8.90	50.14	0.020	5.04	39.26	0.025
	6.92	63.97	0.016	5.63	50.52	0.020
	5.20	79.59	0.012	4.71	64.66	0.015
	2.27	86.40	0.012	2.84	73.19	0.014

Table 61. Values for rate, amount released, and the corresponding reciprocal for the release of commercial products.

Products	Dissolution Medium					
	0.1 N. HCl			Buffer pH 6.8		
	dQ/dt	Q	1/Q	dQ/dt	Q	1/Q
Theodur	19.31	4.83	0.207	17.43	4.36	0.229
	10.02	7.33	0.136	9.23	6.67	0.150
	7.98	9.32	0.107	7.60	8.57	0.117
	6.89	11.05	0.090	7.26	10.38	0.096
	5.30	16.35	0.061	4.82	15.20	0.066
	6.47	22.82	0.044	4.96	20.16	0.050
	7.08	29.90	0.033	7.37	27.53	0.036
	7.06	44.02	0.023	11.09	49.71	0.020
	4.06	56.20	0.018	9.34	77.75	0.013
	3.48	66.65	0.015	3.99	89.71	0.011
Nuelin	33.51	8.38	0.119	34.28	8.57	0.117
	16.77	12.57	0.080	21.26	13.88	0.072
	13.46	15.93	0.063	17.55	18.27	0.055
	10.31	18.51	0.054	16.98	22.52	0.044
	6.88	25.40	0.039	19.86	42.37	0.024
	5.06	30.45	0.033	17.70	60.07	0.017
	4.35	34.80	0.029	13.61	73.68	0.014
	3.41	41.62	0.024	9.60	92.89	0.011
	2.26	48.40	0.021	1.49	97.36	0.010
	2.56	56.08	0.018	-	-	-
Quibron	69.02	17.25	0.056	79.67	19.92	0.050
	51.45	30.12	0.033	55.84	33.88	0.030
	42.61	40.77	0.024	45.79	45.32	0.022
	43.97	51.76	0.019	51.99	58.32	0.017
	27.15	78.92	0.013	29.26	87.58	0.011
	16.26	95.18	0.010	7.94	95.52	0.010
	2.85	98.03	0.010	0.18	95.71	0.010
	-0.72	97.31	0.010	-	-	-

Table 62. Values for rate, amount released, and the corresponding reciprocal for the release of commercial products and Formulation XIX from pH change method.

Products	dQ/dt	Q	1/Q
Formulation XIX	21.78	5.44	0.184
	14.43	9.05	0.110
	12.94	12.29	0.081
	11.09	15.06	0.066
	11.96	27.02	0.037
	10.30	37.32	0.027
	9.48	46.80	0.021
	5.19	51.99	0.019
	6.54	58.52	0.017
	4.19	62.71	0.016
	4.71	67.42	0.015
	2.84	73.09	0.014
	4.18	81.46	0.012
Theodur	18.01	4.50	0.222
	9.66	6.92	0.144
	7.17	8.71	0.115
	6.01	10.21	0.098
	4.67	14.88	0.067
	11.00	25.88	0.039
	9.95	35.83	0.028
	6.83	42.66	0.023
	9.08	51.74	0.019
	6.64	58.37	0.017
	10.34	68.72	0.014
	7.55	83.81	0.012
	4.49	92.80	0.011
Nuelin	32.02	8.00	0.125
	17.25	12.32	0.081
	12.84	15.53	0.064
	12.59	18.67	0.054
	7.62	26.30	0.038
	4.56	30.86	0.032
	8.51	39.37	0.025
	5.76	45.13	0.022
	7.70	52.83	0.019
	4.72	57.55	0.017
	3.83	61.38	0.016
	4.14	69.66	0.014
	4.14	77.94	0.013

Appendix F

Data In Statistical Processes

Table 63. Comparison of linearity between plots of rate of release against reciprocal amount and amount of theophyllnie released from the matrices in 0.1 N. HCl.

Formulation	Matrices	Correlation coeficient of rate	
		versus Q	versus 1/Q
Blank	1	0.8764	0.8540
	2	0.8896	0.8347
	3	0.8991	0.8636
IX	1	0.8586	0.8626
	2	0.8881	0.8533
	3	0.8673	0.8655
X	1	0.8096	0.7699
	2	0.8487	0.7853
	3	0.8400	0.7828
XI	1	0.8753	0.8544
	2	0.8645	0.8526
	3	0.8933	0.8174
XII	1	0.7956	0.9165
	2	0.7861	0.9205
	3	0.8169	0.9114
XIX	1	0.8145	0.8825
	2	0.8234	0.8718
	3	0.8227	0.8787

Table 64. Comparison of linearity between plots of rate of release against reciprocal amount and amount of theophyllnie released from the matrices in buffer pH 6.8.

Formulation	Matrices	Correlation coeficient of rate	
		versus Q	versus 1/Q
XII	1	0.4831	0.7760
	2	0.2892	0.2141
	3	0.5503	0.9702
XIX	1	0.7958	0.7994
	2	0.7853	0.8017
	3	0.7875	0.8020
Quibron(R)	1	0.8900	0.7463
	2	0.9173	0.7680
	3	0.8814	0.7618
Nuelin(R)	1	0.w44	0.7066
	2	0.6823	0.7154
	3	0.7110	0.7365

Table 65. Comparison of linearity between plots of rate of release against reciprocal amount and amount of theophyllnie released from the matrices in pH change method.

Formulation	Matrices	Correlation coeficient of rate	
		versus Q	versus 1/Q
XIX	1	0.8220	0.8542
	2	0.8238	0.8413
	3	0.8244	0.8492

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 $H_0 : \mu_1-\mu_2 = 0$

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

if α = 0.05, *degree of freedom* = 4

then critical values of t are ±2.1318

Table 66. The t-values of linearity between rate of release against reciprocal amount and amount(degree of freedom=4, data from Tables 63-65).

Products	t-value	Significance test
Blank in 0.1 N. HCl	3.499046	S
Formulation IX in 0.1 N.HCl	1.144824	NS
Formulation X in 0.1 N.HCl	4.181596	S
Formulation XI in 0.1 N.HCl	2.467986	S
Formulation XII in 0.1 N.HCl Formulation XII in pH 6.8	-12.30473 -0.88628	S NS
Formulation XIX in 0.1 N.HCl Formulation XIX in pH 6.8 Formulation XIX in pH change	-13.536558 -3.482356 -6.504746	S S S
Quibron(R) in pH 6.8	10.91486	S
Nuelin(R) in pH 6.8	-2.072113	NS

S = Significance
NS = Non-significecance

Biography

Mr. Phuriwat Leesawat was born on march 25, 1964. He got his Bachelor Degree in Pharmacy with honour in 1987 from the Faculty of Pharmacy, Chiangmai University, Chiangmai, Thailand.