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APPENDICES

APPENDIX A

TABLES

weak acids	Ka	pKa
Benzoic acid	7.871×10^{-5}	4.104
Potassium biphthalate	9.156×10^{-6}	5.038
p – Nitrophenol	1.004×10^{-7}	6.998
Pralidoxime chloride	1.240×10^{-8}	7.907
Boric acid	8.017×10^{-10}	9.096
Ephedrine hydrochloride	2.153×10^{-10}	9.667

TABLE 1 : The dissociation constants (Ka) and pKa of weak acidic compounds

WEAK ACIDIC MIXTURES	Δ pKa	pKa
1. Neutral weak acid + Neutral weak acid		
Benzoic acid + Boric acid	4.992	4.104, 9.096
Benzoic acid + p-Nitrophenol	2.894	4.104, 6.998
p-Nitrophenol + Boric acid	2.098	6.998, 9.096
2. Neutral weak acid + Ionized weak acid		
Benzoic acid + Ephedrine HCl	5.563	4.104, 9.667
p-Nitrophenol + Ephedrine HCl	2.669	6.998, 9.096
Boric acid + Ephedrine HCl	0.571	9.096, 9.667
Potassium biphthalate + Boric acid	4.058	5.038, 9.667
Benzoic acid + Pralidoxime Cl	3.803	4.104, 7.907
Potassium biphthalate + p-Nitrophenol	1.960	5.038, 6.998
p-Nitrophenol + Pralidoxime Cl	0.909	6.998, 7.907
Pralidoxime Cl + Boric acid	1.189	7.907, 9.096
Benzoic acid + Potassium biphthalate	0.934	4.104, 5.038
3. Ionized weak acid + Ionized weak acid		
Potassium biphthalate + Ephedrine HCl	4.629	5.038, 9.667
Pralidoxime Cl + Ephedrine HCl	1.760	7.907, 9.667
Potassium biphthalate + Pralidoxime Cl	2.869	5.038, 7.907

TABLE 2 : The mixtures of weak acids and their ΔpKa

Δ pKa	pKa		Theoretical equivalent V		Calculated equivalent V	
	pKa1	pKa2	Vea	Veb	Vea	Veb
5	4.000	9.000	2.50	2.50	2.50	2.50
4	4.000	8.000	2.50	2.50	2.50	2.50
	5.000	9.000	2.50	2.50	2.50	2.50
3	4.000	7.000	2.50	2.50	2.50	2.50
	5.000	8.000	2.50	2.50	2.50	2.50
	6.000	9.000	2.50	2.50	2.50	2.50
2.5	4.000	6.500	2.50	2.50	2.50	2.50
	5.000	7.500	2.50	2.50	2.50	2.50
	6.000	8.500	2.50	2.50	2.50	2.50
	7.000	9.500	2.50	2.50	2.50	2.50
2	4.000	6.000	2.50	2.50	2.50	2.50
	5.000	7.000	2.50	2.50	2.50	2.50
	6.000	8.000	2.50	2.50	2.50	2.50
	7.000	9.000	2.50	2.50	2.50	2.50
1.5	4.000	5.500	2.50	2.50	2.50	2.50
	5.000	6.500	2.50	2.50	2.50	2.50
	6.000	7.500	2.50	2.50	2.50	2.50
	7.000	8.500	2.50	2.50	2.50	2.50
	8.000	9.500	2.50	2.50	2.50	2.50
1	4.000	5.000	2.50	2.50	2.50	2.50
	5.000	6.000	2.50	2.50	2.50	2.50
	6.000	7.000	2.50	2.50	2.50	2.50
	7.000	8.000	2.50	2.50	2.50	2.50
	8.000	9.000	2.50	2.50	2.50	2.50
0.5	4.000	4.500	2.50	2.50	2.50	2.50
	5.000	5.500	2.50	2.50	2.50	2.50
	6.000	6.500	2.50	2.50	2.50	2.50
	7.000	7.500	2.50	2.50	2.50	2.50
	8.000	8.500	2.50	2.50	2.50	2.50
	9.000	9.500	2.50	2.50	2.50	2.50
0.2	4.000	4.200	2.50	2.50	2.50	2.50
	5.000	5.200	2.50	2.50	2.50	2.50
	6.000	6.200	2.50	2.50	2.50	2.50
	7.000	7.200	2.50	2.50	2.50	2.50
	8.000	8.200	2.50	2.50	2.50	2.50
	9.000	9.200	2.50	2.50	2.50	2.50

TABLE 3 : The comparison between the calculated equivalent volume obtained from solving the modified equation and the theoretical equivalent volume taken into the polynomial equation in the step of data simulation at the difference of pKa and ΔpKa

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
BA					
1	2.67	2.68	2.69	2.69	2.67
2	2.67	2.68	2.68	2.67	2.69
3	2.68	2.69	2.69	2.69	2.68
4	2.68	2.68	2.68	2.69	2.68
5	2.69	2.69	2.69	2.69	2.69
mean	2.68	2.68	2.69	2.69	2.68
s. d.	0.008	0.005	0.005	0.005	0.008

TABLE 4 : The equivalent volume of benzoic acid from the titration of single solution and the titration of benzoic acid - boric acid mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
BO					
1	–	2.73	2.60	2.73	2.75
2	–	2.75	2.62	2.75	2.75
3	–	2.76	2.62	2.75	2.76
4	–	2.74	2.61	2.74	2.73
5	–	2.75	2.62	2.76	2.75
mean	–	2.75	2.61	2.75	2.75
s. d.	–	0.009	0.009	0.011	0.009

TABLE 5 : The equivalent volume of boric acid from the titration of single solution and the titration of benzoic acid - boric acid mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
BA					
1	2.53	2.54	2.54	2.52	2.53
2	2.54	2.53	2.53	2.53	2.53
3	2.54	2.53	2.54	2.54	2.53
4	2.53	2.53	2.54	2.53	2.54
5	2.54	2.54	2.54	2.54	2.53
mean	2.54	2.53	2.54	2.53	2.53
s. d.	0.005	0.005	0.005	0.008	0.004

TABLE 6 : The equivalent volume of benzoic acid from the titration of single solution and the titration of benzoic acid - p-nitrophenol mixture

sample	equivalentvolume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
NP					
1	2.55	2.56	2.57	2.55	2.54
2	2.55	2.55	2.56	2.55	2.54
3	2.55	2.55	2.56	2.55	2.55
4	2.55	2.54	2.55	2.54	2.55
5	2.56	2.55	2.56	2.55	2.55
mean	2.55	2.55	2.56	2.55	2.55
s. d.	0.005	0.007	0.007	0.004	0.005

TABLE 7 : The equivalent volume of p-nitrophenol from the titration of single solution and the titration of benzoic acid - p-nitrophenol mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
NP					
1	2.60	2.61	2.61	2.60	2.61
2	2.60	2.60	2.60	2.60	2.61
3	2.62	2.61	2.61	2.61	2.61
4	2.61	2.61	2.61	2.61	2.61
5	2.61	2.62	2.62	2.61	2.61
mean	2.61	2.61	2.61	2.61	2.61
s. d.	0.008	0.007	0.007	0.005	0.004

TABLE 8 : The equivalent volume of p-nitrophenol from the titration of single solution and the titration of p-nitrophenol - boric acid mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
BO					
1	–	2.64	2.58	2.64	2.64
2	–	2.65	2.56	2.66	2.64
3	–	2.65	2.55	2.65	2.64
4	–	2.64	2.58	2.64	2.65
5	–	2.64	2.57	2.64	2.65
mean	–	2.64	2.57	2.65	2.64
s. d.	–	0.005	0.013	0.009	0.005

TABLE 9 : The equivalent volume of boric acid from the titration of single solution and the titration of p-nitrophenol - boric acid mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
BA					
1	2.41	2.41	2.42	2.40	2.45
2	2.42	2.42	2.43	2.41	2.44
3	2.41	2.41	2.42	2.40	2.45
4	2.41	2.41	2.42	2.40	2.45
5	2.42	2.42	2.43	2.42	2.44
mean	2.41	2.41	2.42	2.41	2.45
s. d.	0.005	0.005	0.005	0.009	0.005

TABLE 10 : The equivalent volume of benzoic acid from the titration of single solution and the titration of benzoic acid - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
EH					
1	–	2.49	2.28	2.49	2.52
2	–	2.51	2.29	2.51	2.52
3	–	2.50	2.30	2.50	2.51
4	–	2.50	2.29	2.50	2.53
5	–	2.49	2.30	2.49	2.52
mean	–	2.50	2.29	2.50	2.52
s. d.	–	0.008	0.008	0.008	0.007

TABLE 11 : The equivalent volume of ephedrine hydrochloride from the titration of single solution and the titration of benzoic acid - ephedrine hydrochloride mixture

sample	equivalentvolume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
NP					
1	2.91	2.91	2.91	2.91	2.94
2	2.91	2.90	2.91	2.89	2.96
3	2.91	2.91	2.91	2.91	2.94
4	2.90	2.91	2.91	2.91	2.95
5	2.91	2.90	2.91	2.90	2.94
mean	2.91	2.91	2.91	2.90	2.95
s. d.	0.004	0.005	0.006	0.009	0.009

TABLE 12 : The equivalent volume of p-nitrophenol from the titration of single solution and the titration of p-nitrophenol - ephedrine hydrochloride mixture

sample	equivalentvolume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
EH					
1	–	3.02	2.70	3.05	3.23
2	–	3.01	2.71	3.04	3.23
3	–	3.01	2.71	3.03	3.23
4	–	3.01	2.71	3.04	3.24
5	–	3.02	2.70	3.03	3.23
mean	–	3.01	2.71	3.04	3.23
s. d.	–	0.005	0.005	0.008	0.004

TABLE 13 : The equivalent volume of ephedrine hydrochloride from the titration of single solution and the titration of p-nitrophenol - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
BO					
1	–	2.47	2.39	2.49	2.36
2	–	2.49	2.39	2.49	2.35
3	–	2.47	2.39	2.47	2.31
4	–	2.48	2.39	2.47	2.32
5	–	2.46	2.40	2.49	2.33
mean	–	2.48	2.39	2.48	2.33
s. d.	–	0.008	0.004	0.011	0.013

TABLE 14 : The equivalent volume of boric acid from the titration of single solution and the titration of boric acid - ephedrine hydrochloride mixture

sample	equivale volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
EH					
1	–	2.49	2.28	2.49	2.59
2	–	2.51	2.29	2.51	2.60
3	–	2.50	2.30	2.50	2.63
4	–	2.50	2.29	2.50	2.62
5	–	2.49	2.30	2.49	2.61
mean	–	2.50	2.29	2.50	2.61
s. d.	–	0.008	0.008	0.008	0.014

TABLE 15 : The equivalent volume of ephedrine hydrochloride from the titration of single solution and the titration of boric acid - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PB					
1	2.64	2.64	2.64	2.64	2.65
2	2.65	2.65	2.65	2.65	2.64
3	2.65	2.65	2.65	2.65	2.65
4	2.65	2.65	2.65	2.65	2.65
5	2.65	2.65	2.65	2.65	2.65
mean	2.65	2.65	2.65	2.65	2.65
s. d.	0.004	0.004	0.004	0.004	0.003

TABLE 16 : The equivalent volume of potassium biphthalate from the titration of single solution and the titration of potassium biphthalate - boric acid mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
BO					
1	–	2.76	2.63	2.75	2.76
2	–	2.75	2.64	2.75	2.75
3	–	2.76	2.65	2.76	2.75
4	–	2.75	2.63	2.75	2.75
5	–	2.76	2.64	2.75	2.76
mean	–	2.76	2.64	2.75	2.75
s. d.	–	0.006	0.008	0.004	0.005

TABLE 17 : The equivalent volume of boric acid from the titration of single solution and the titration of potassium biphthalate - boric acid mixture

sample	Equivalentvolume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
BA					
1	2.37	2.38	2.39	2.38	2.38
2	2.37	2.38	2.38	2.38	2.38
3	2.36	2.38	2.39	2.38	2.38
4	2.38	2.38	2.39	2.38	2.38
5	2.37	2.38	2.38	2.38	2.38
mean	2.37	2.38	2.39	2.38	2.38
s. d.	0.007	0.004	0.005	0.004	0.005

TABLE 18 : The equivalent volume of benzoic acid from the titration of single solution and the titration of benzoic acid - pralidoxime chloride mixture

sample	Equivalentvolume (ml)				
				Mofidied eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
PC					
1	2.40	2.40	2.40	2.40	2.40
2	2.40	2.40	2.40	2.40	2.40
3	2.40	2.40	2.40	2.41	2.40
4	2.40	2.40	2.41	2.40	2.40
5	2.40	2.40	2.40	2.40	2.40
mean	2.40	2.40	2.40	2.40	2.40
s. d.	0.004	0.004	0.004	0.004	0.003

TABLE 19 : The equivalent volume of pralidoxime chloride from the titration of single solution and the titration of benzoic acid - pralidoxime chloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PB					
1	2.52	2.52	2.52	2.51	2.51
2	2.53	2.53	2.53	2.53	2.51
3	2.53	2.52	2.52	2.52	2.52
4	2.53	2.52	2.52	2.52	2.52
5	2.52	2.51	2.52	2.52	2.52
mean	2.53	2.52	2.52	2.52	2.52
s. d.	0.005	0.007	0.004	0.007	0.008

TABLE 20 : The equivalent volume of potassium biphthalate from the titration of single solution and the titration of potassium biphthalate - p-nitrophenol mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
NP					
1	2.55	2.56	2.57	2.55	2.54
2	2.55	2.55	2.56	2.55	2.54
3	2.55	2.55	2.56	2.55	2.55
4	2.55	2.54	2.55	2.54	2.55
5	2.56	2.55	2.56	2.55	2.56
mean	2.55	2.55	2.56	2.55	2.55
s. d.	0.005	0.007	0.007	0.004	0.008

TABLE 21 : The equivalent volume of p-nitrophenol from the titration of single solution and the titration of potassium biphthalate - p-nitrophenol mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
NP					
1	2.25	2.24	2.25	2.23	2.20
2	2.24	2.23	2.25	2.23	2.21
3	2.24	2.23	2.24	2.23	2.22
4	2.24	2.24	2.25	2.24	2.20
5	2.25	2.24	2.25	2.24	2.21
mean	2.24	2.24	2.25	2.23	2.21
s. d.	0.008	0.006	0.004	0.005	0.008

TABLE 22 : The equivalent volume of p-nitrophenol from the titration of single solution and the titration of p-nitrophenol - pralidoxime chloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PC					
1	2.23	2.23	2.24	2.23	2.27
2	2.25	2.23	2.24	2.24	2.26
3	2.24	2.24	2.25	2.24	2.26
4	2.24	2.24	2.25	2.24	2.27
5	2.25	2.24	2.25	2.25	2.26
mean	2.24	2.24	2.25	2.24	2.27
s. d.	0.010	0.005	0.006	0.007	0.007

TABLE 23 : The equivalent volume of pralidoxime chloride from the titration of single solution and the titration of p-nitrophenol - pralidoxime chloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PC					
1	2.61	2.60	2.61	2.61	2.54
2	2.60	2.61	2.61	2.61	2.54
3	2.60	2.61	2.61	2.61	2.52
4	2.60	2.61	2.61	2.61	2.53
5	2.61	2.60	2.60	2.61	2.53
mean	2.60	2.61	2.61	2.61	2.53
s. d.	0.007	0.008	0.004	0.005	0.008

TABLE 24 : The equivalent volume of pralidoxime chloride from the titration of single solution and the titration of pralidoxime chloride - boric acid mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
BO					
1	–	2.64	2.58	2.64	2.67
2	–	2.65	2.56	2.66	2.68
3	–	2.65	2.55	2.65	2.67
4	–	2.64	2.58	2.64	2.67
5	–	2.64	2.57	2.64	2.67
mean	–	2.64	2.57	2.65	2.67
s. d.	–	0.006	0.013	0.009	0.007

TABLE 25 : The equivalent volume of boric acid from the titration of single solution and the titration of pralidoxime chloride - boric acid mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
BA					
1	2.57	2.58	2.58	2.57	3.14
2	2.57	2.58	2.58	2.57	3.12
3	2.57	2.58	2.58	2.57	3.13
4	2.58	2.57	2.58	2.58	3.13
5	2.57	2.58	2.58	2.57	3.12
mean	2.57	2.58	2.58	2.57	3.13
s. d.	0.006	0.006	0.006	0.005	0.008

TABLE 26 : The equivalent volume of benzoic acid from the titration of single solution and the titration of benzoic acid - potassium biphthalate mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
PB					
1	2.63	2.64	2.64	2.64	2.50
2	2.63	2.63	2.63	2.63	2.49
3	2.63	2.63	2.63	2.63	2.48
4	2.63	2.64	2.64	2.63	2.49
5	2.64	2.64	2.64	2.64	2.49
mean	2.63	2.64	2.64	2.63	2.49
s. d.	0.007	0.005	0.006	0.006	0.007

TABLE 27 : The equivalent volume of potassium biphthalate from the titration of single solution and the titration of benzoic acid - potassium biphthalate mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
PB					
1	2.63	2.64	2.64	2.64	2.81
2	2.63	2.63	2.63	2.63	2.80
3	2.63	2.63	2.63	2.63	2.78
4	2.63	2.64	2.64	2.63	2.79
5	2.64	2.64	2.64	2.64	2.79
mean	2.63	2.64	2.64	2.63	2.79
s. d.	0.007	0.006	0.006	0.006	0.011

TABLE 28 : The equivalent volume of potassium biphthalate from the titration of single solution and the titration of potassium biphthalate - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
				Modified eq. for	
	Titration c	G plot	V plot	single W.	mixed W.
EH					
1	–	2.73	2.45	2.73	2.85
2	–	2.72	2.44	2.73	2.85
3	–	2.71	2.44	2.72	2.84
4	–	2.72	2.45	2.73	2.83
5	–	2.72	2.44	2.71	2.84
mean	–	2.72	2.44	2.72	2.84
s. d.	–	0.007	0.006	0.009	0.008

TABLE 29 : The equivalent volume of ephedrine hydrochloride from the titration of single solution and the titration of potassium biphthalate - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	mixed W.
PC					
1	2.42	2.42	2.43	2.43	2.43
2	2.42	2.42	2.43	2.42	2.44
3	2.42	2.42	2.43	2.43	2.44
4	2.41	2.42	2.43	2.42	2.44
5	2.41	2.41	2.42	2.42	2.44
mean	2.42	2.42	2.43	2.42	2.44
s. d.	0.007	0.007	0.005	0.006	0.008

TABLE 30 : The equivalent volume of pralidoxime chloride from the titration of single solution and the titration of pralidoxime chloride - ephedrine hydrochloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	mixed W.
EH					
1	–	2.49	2.28	2.49	2.54
2	–	2.51	2.29	2.51	2.55
3	–	2.50	2.30	2.50	2.54
4	–	2.50	2.29	2.50	2.54
5	–	2.49	2.30	2.49	2.55
mean	–	2.50	2.29	2.50	2.54
s. d.	–	0.008	0.008	0.008	0.007

TABLE 31 : The equivalent volume of ephedrine hydrochloride from the titration of single solution and the titration of pralidoxime chloride - ephedrine hydrochloride mixture

sample	equivalentvolume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PB					
1	2.34	2.34	2.34	2.34	2.33
2	2.34	2.35	2.35	2.35	2.34
3	2.34	2.35	2.35	2.36	2.34
4	2.34	2.34	2.35	2.34	2.35
5	2.35	2.34	2.34	2.34	2.34
mean	2.34	2.34	2.35	2.35	2.34
s. d.	0.006	0.005	0.006	0.009	0.007

TABLE 32 : The equivalent volume of potassium biphthalate from the titration of single solution and the titration of potassium biphthalate - pralidoxime chloride mixture

sample	equivalent volume (ml)				
	Titration c	G plot	V plot	Modified eq. for single W.	Modified eq. for mixed W.
PC					
1	2.38	2.37	2.37	2.37	2.38
2	2.39	2.39	2.39	2.39	2.38
3	2.39	2.39	2.39	2.39	2.37
4	2.38	2.38	2.38	2.38	2.39
5	2.38	2.38	2.38	2.38	2.38
mean	2.38	2.38	2.38	2.38	2.38
s. d.	0.007	0.008	0.009	0.008	0.007

TABLE 33 : The equivalent volume of pralidoxime chloride from the titration of single solution and the titration of potassium biphthalate - pralidoxime chloride mixture

WEAK ACIDIC MIXTURES	Δ pKa	RESULT
1.Neutral weak acid + Neutral weak acid		
Benzoic acid + Boric acid	4.992	/
Benzoic acid + p-Nitrophenol	3.394	/
p-Nitrophenol + Boric acid	2.098	/
2.Neutral weak acid + Ionized weak acid		
Benzoic acid + Ephedrine HCl	5.563	X
p-Nitrophenol + Ephedrine HCl	2.669	X
Boric acid + Ephedrine HCl	0.571	X
Potassium biphthalate + Boric acid	4.058	/
Benzoic acid + Pralidoxime Cl	3.803	/
Potassium biphthalate + p-Nitrophenol	1.960	/
p-Nitrophenol + Pralidoxime Cl	0.909	X
Pralidoxime Cl + Boric acid	1.189	X
Benzoic acid + Potassium biphthalate	0.934	X
3.Ionized weak acid + Ionized weak acid		
Potassium biphthalate + Ephedrine HCl	4.629	X
Pralidoxime Cl + Ephedrine HCl	1.760	X
Potassium biphthalate + Pralidoxime Cl	2.869	/

TABLE 34 : The results from the titration of weak acid mixtures

/ = no statistical difference at 95% confidence interval between the equivalent volume obtained from solving the modified equation and G plot

X = statistical difference at 95% confidence interval between the equivalent volume obtained from solving the modified equation and G plot

SAMPLE	Δ pKa	SLOPE
Single weak acid		
Boric acid	–	0.764
p–Nitrophenol	–	0.793
Benzoic acid	–	0.831
Pralidoxime chloride	–	0.844
Potassium biphthalate	–	0.965
Mixed weak acids		
Benzoic acid + Potassium biphthalate	0.934	0.405
p–Nitrophenol + Pralidoxime chloride	0.909	0.533
Pralidoxime chloride + Boric acid	1.169	0.541
Benzoic acid + p–Nitrophenol	2.894	0.674
Potassium biphthalate + Boric acid	4.058	0.685
p–Nitrophenol + Boric acid	2.098	0.693
Potassium biphthalate + p–Nitrophenol	1.960	0.725
Benzoic acid + Boric acid	4.992	0.775
Benzoic acid + Pralidoxime chloride	3.803	0.812
Potassium biphthalate + Pralidoxime Cl	2.869	0.828

TABLE 35 : The slope of buffer region from the titration curve of each weak acid solution and mixed weak acid solution (minimum slope).

APPENDIX B

FIGURES

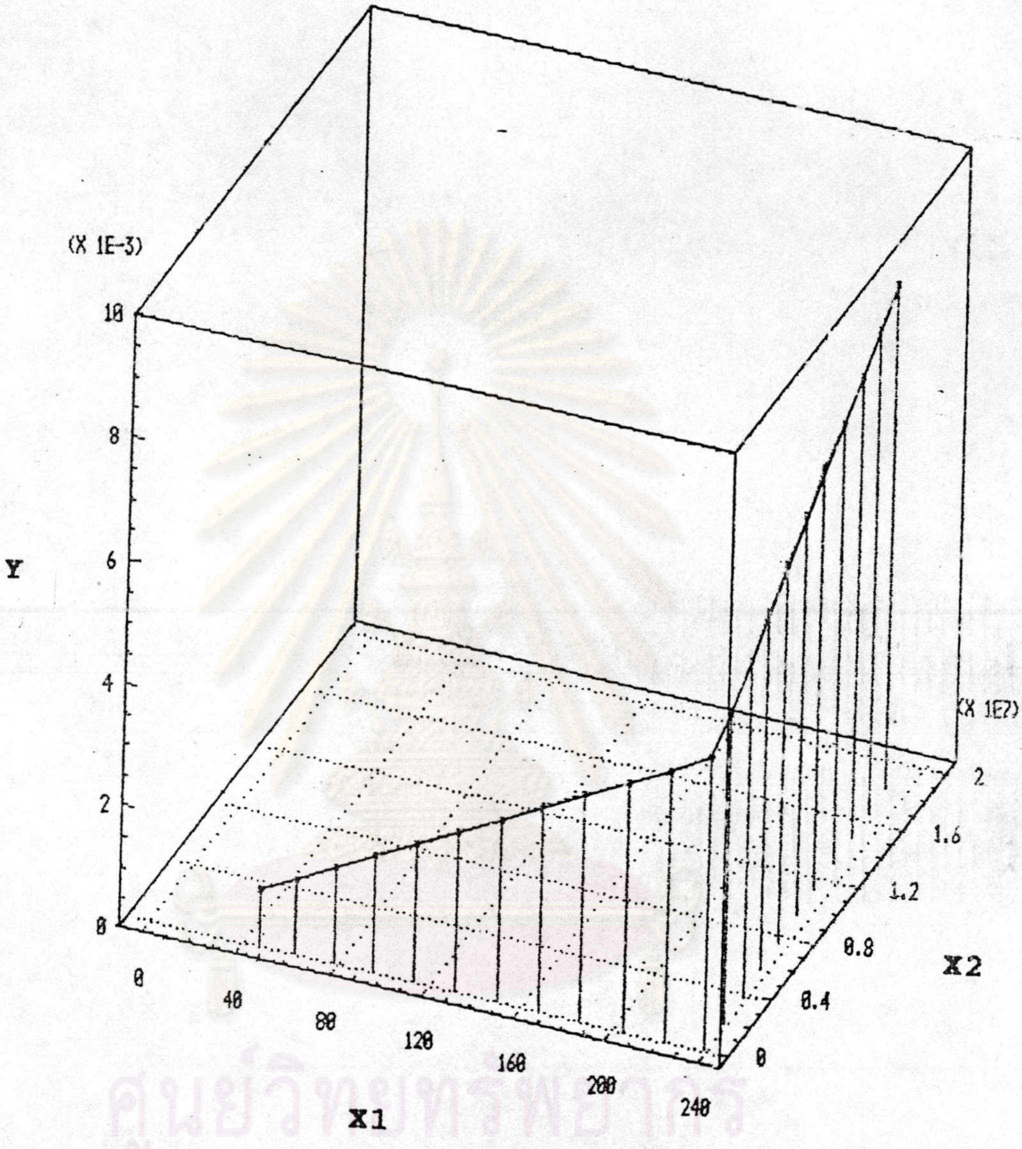

FIGURE 8 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 9

ΔpKa = 5

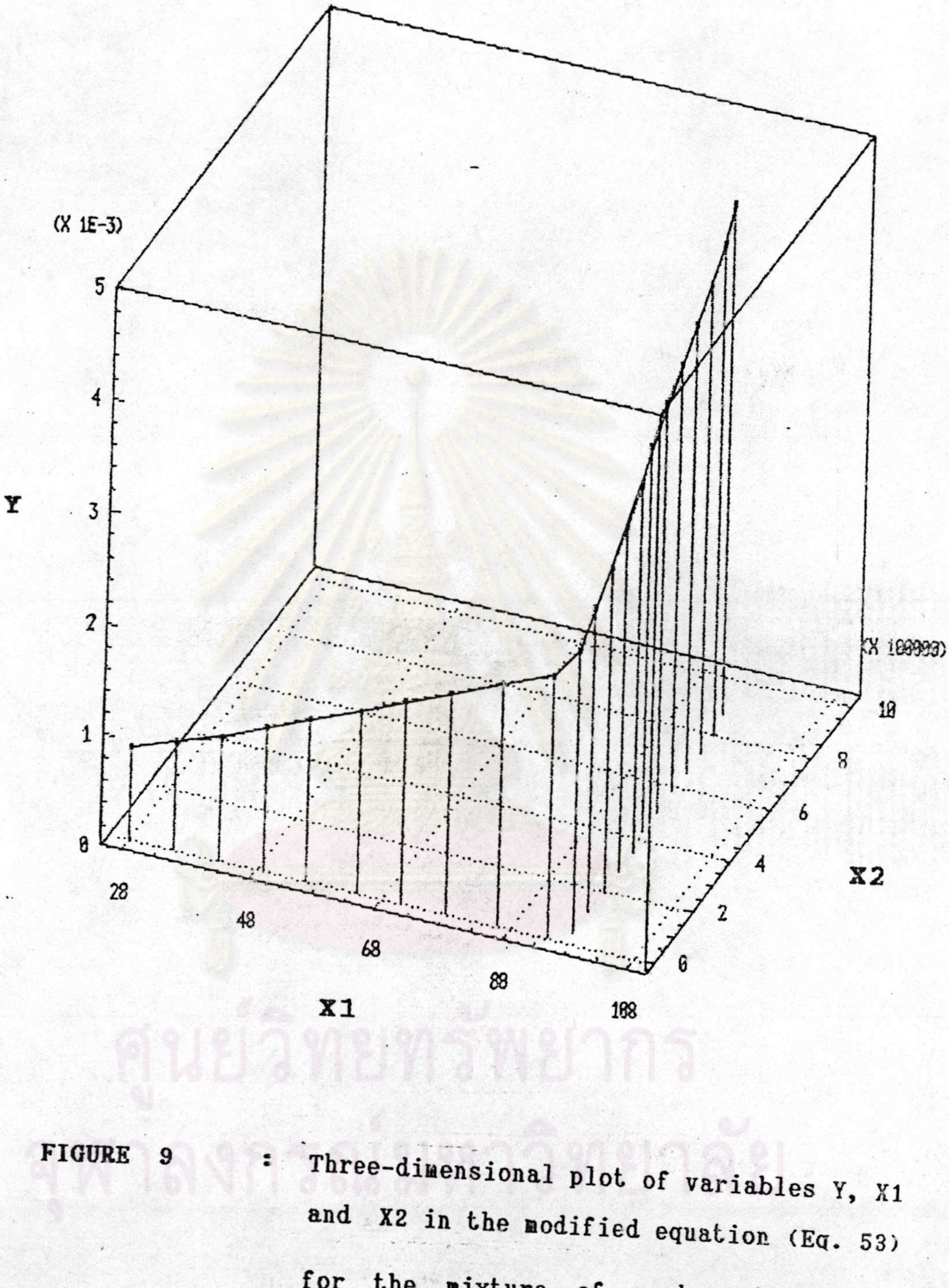

FIGURE 9 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 8

ΔpKa = 4

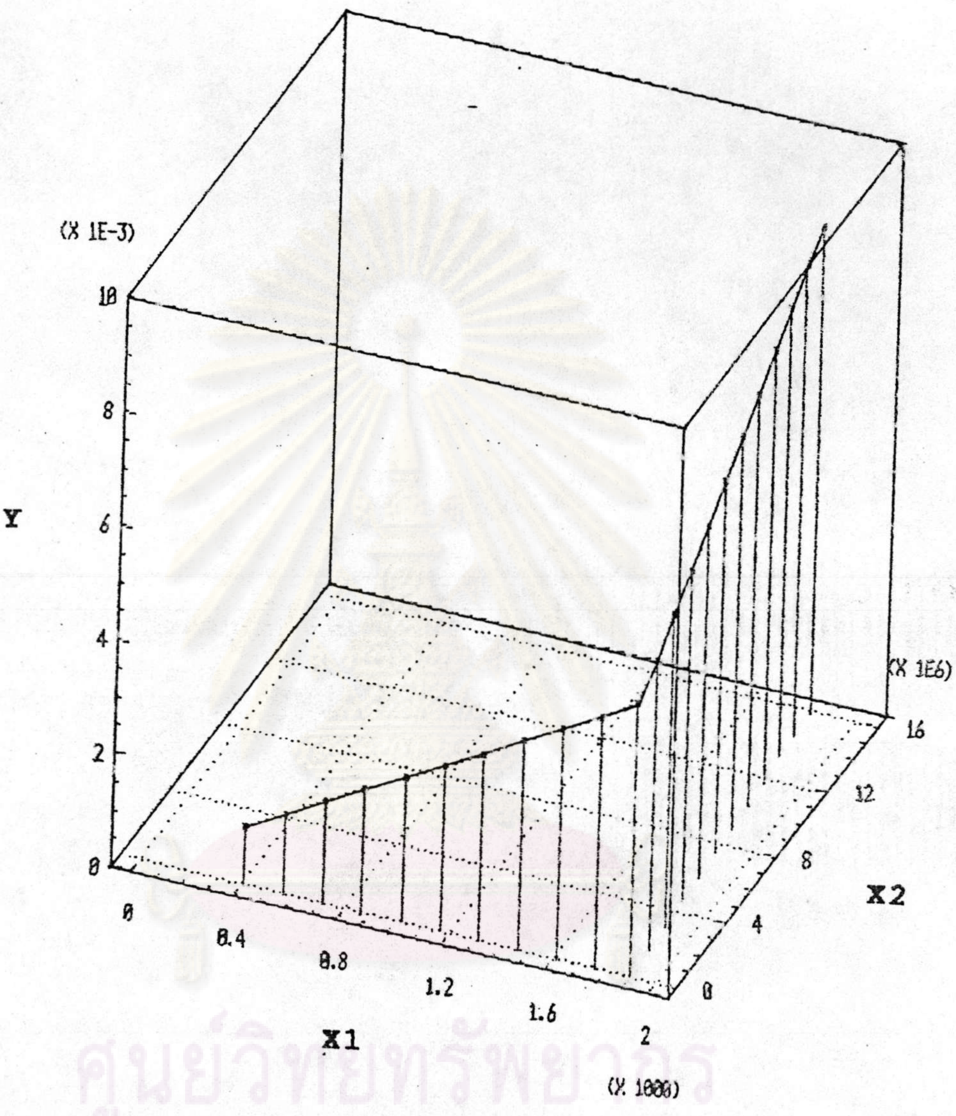

FIGURE 10 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 9

ΔpKa = 4

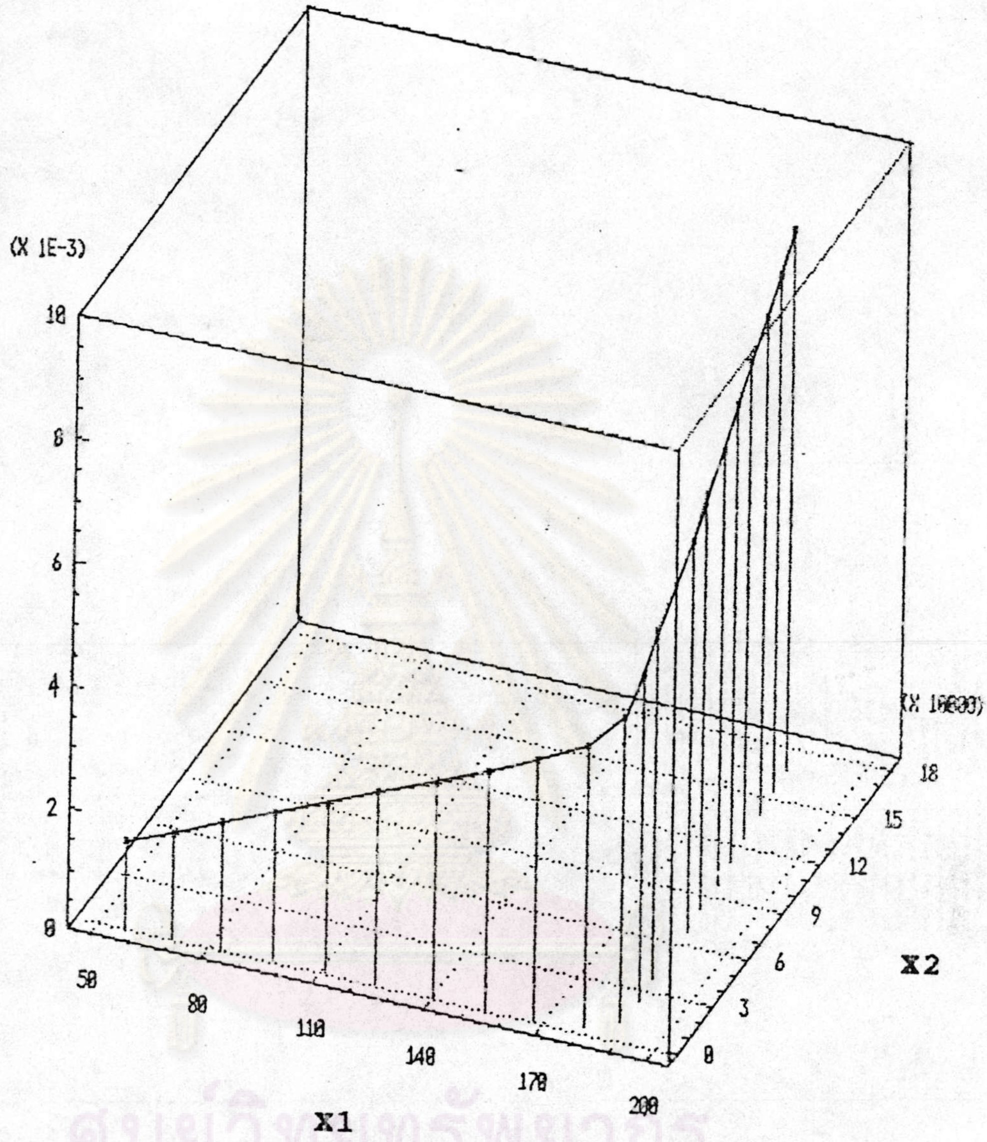

FIGURE 11 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 7

ΔpKa = 3

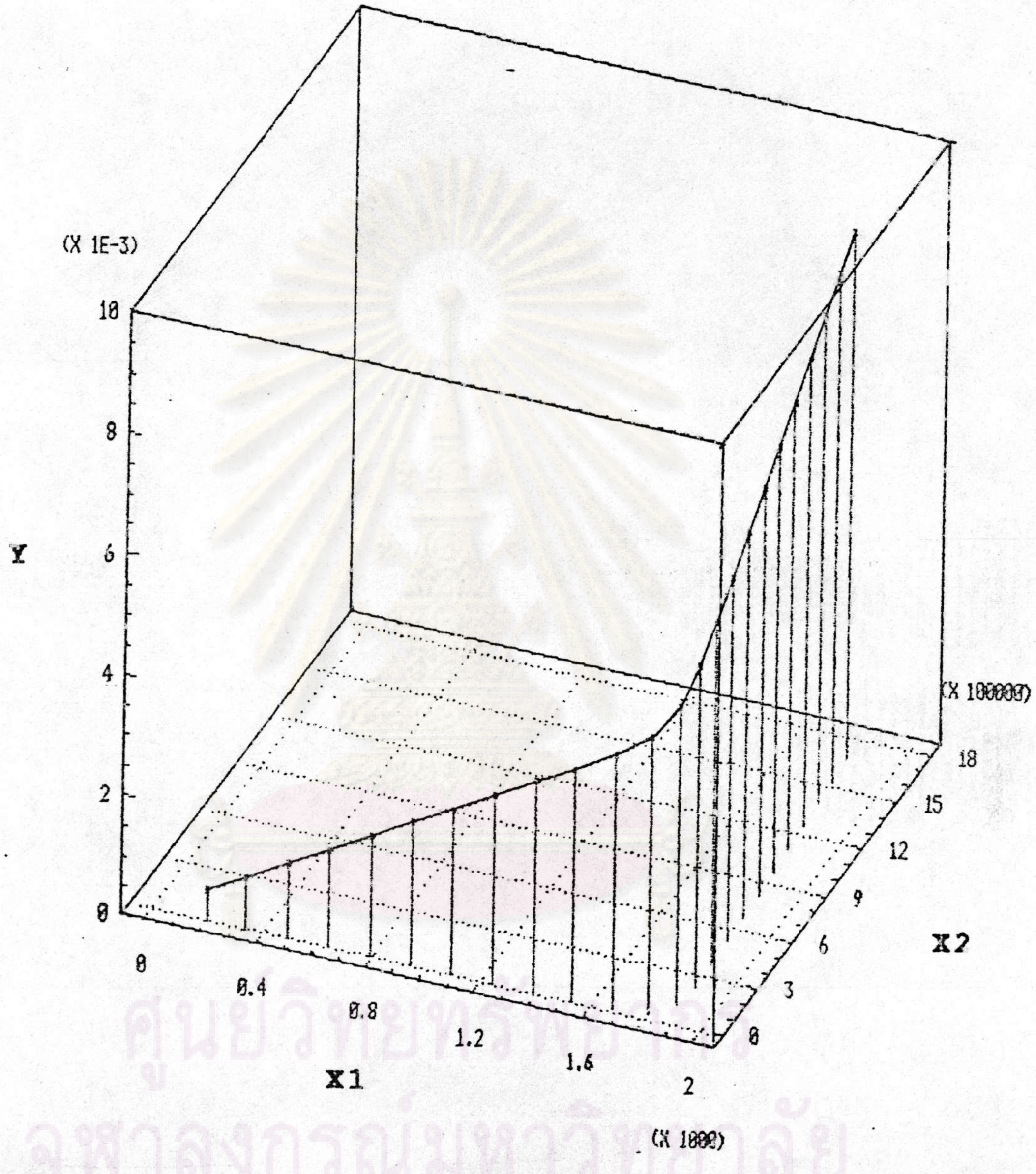

FIGURE 12 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 8

ΔpKa = 3

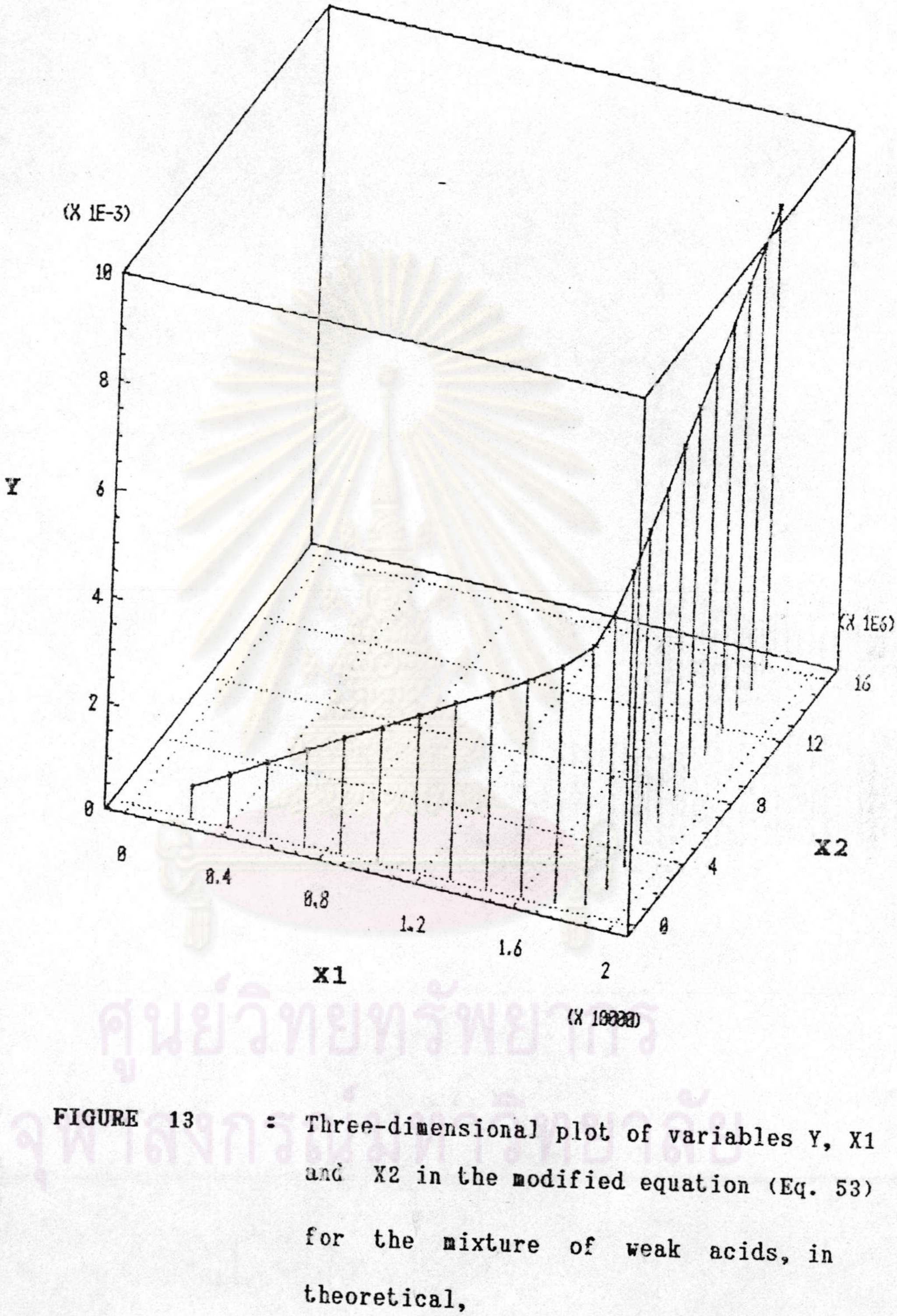

FIGURE 13 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 6$

$pKa2 = 9$

$\Delta pKa = 3$

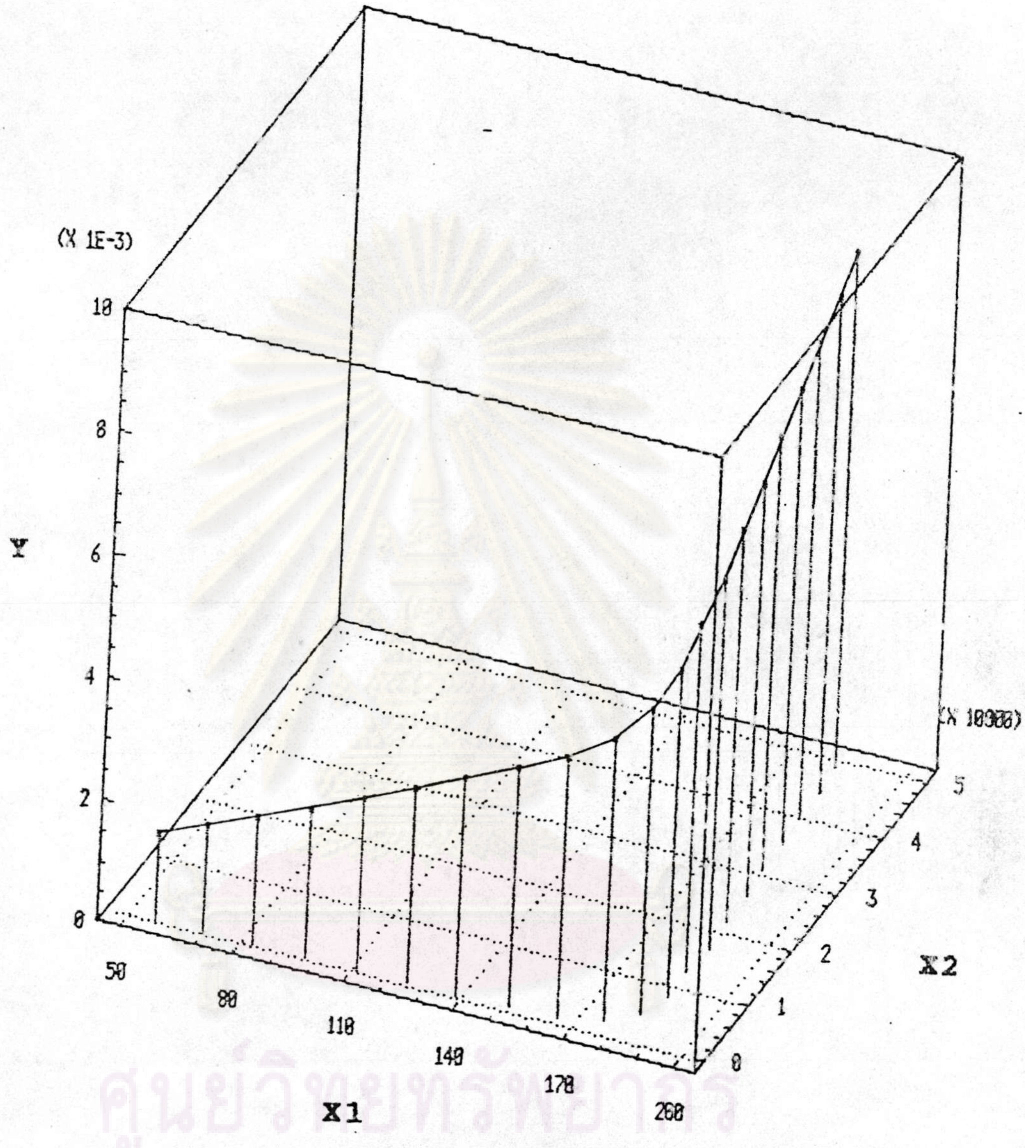

FIGURE 14 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 6.5

ΔpKa = 2.5

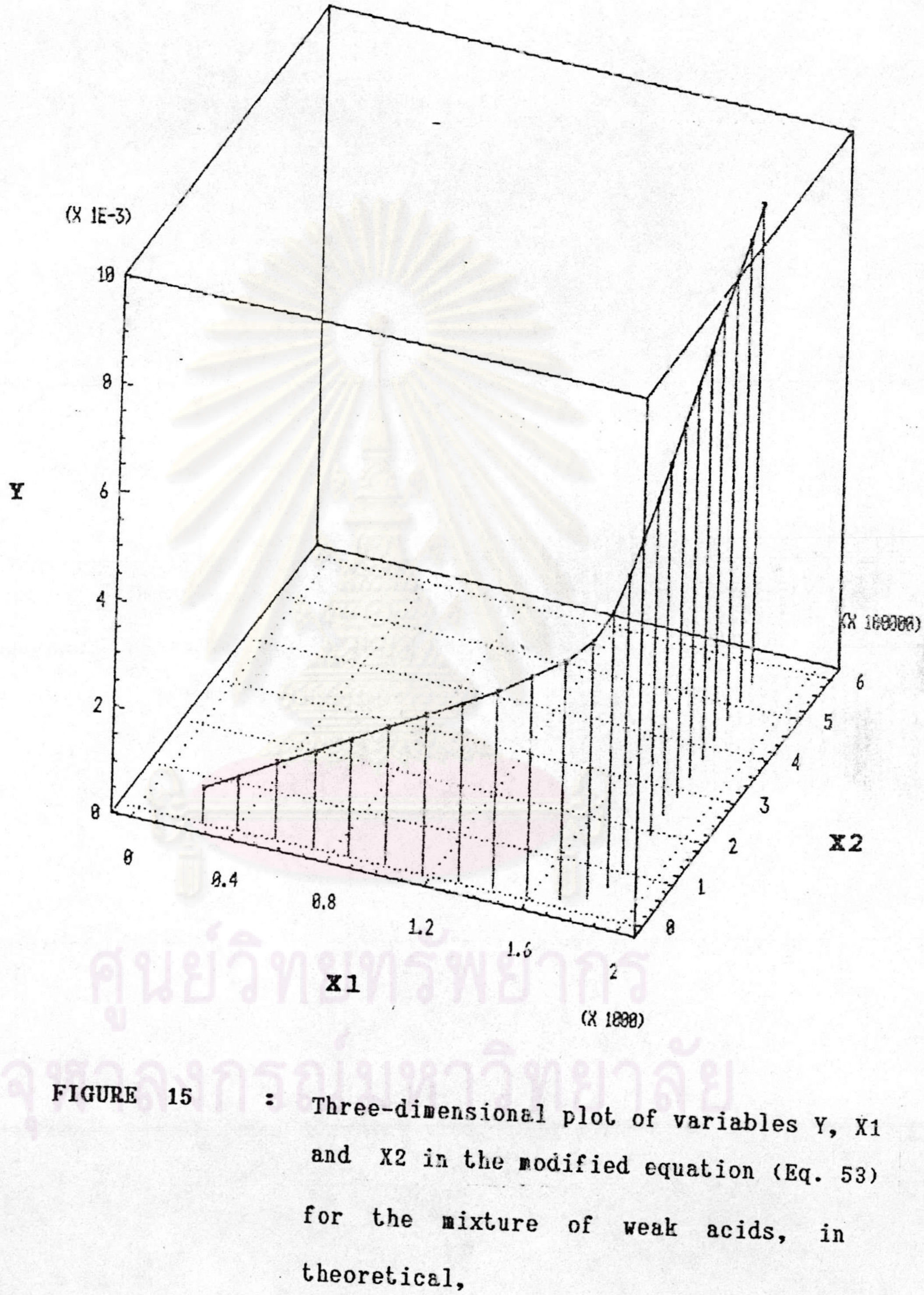

FIGURE 15 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 7.5

ΔpKa = 2.5

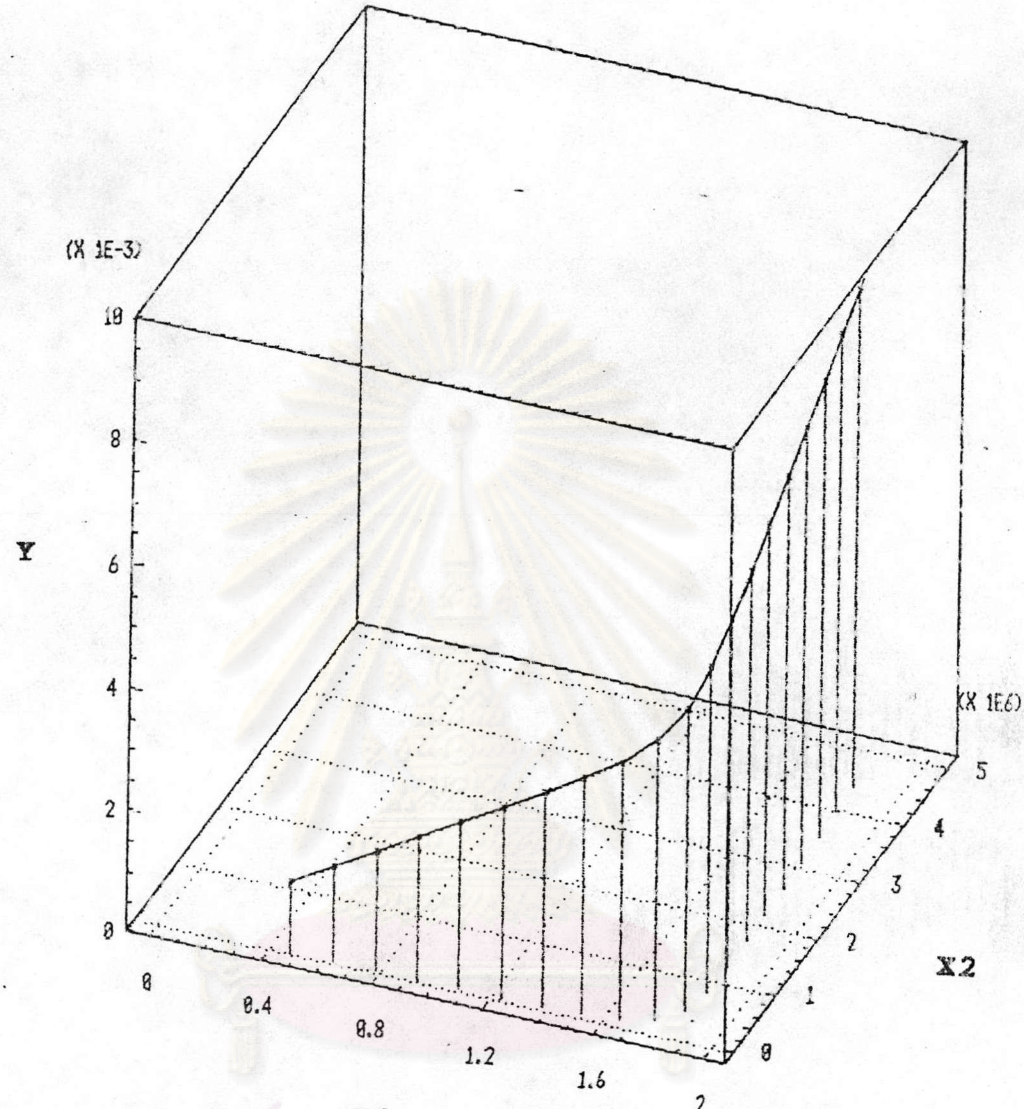

FIGURE 16 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 6

pKa2 = 8.5

ΔpKa = 2.5

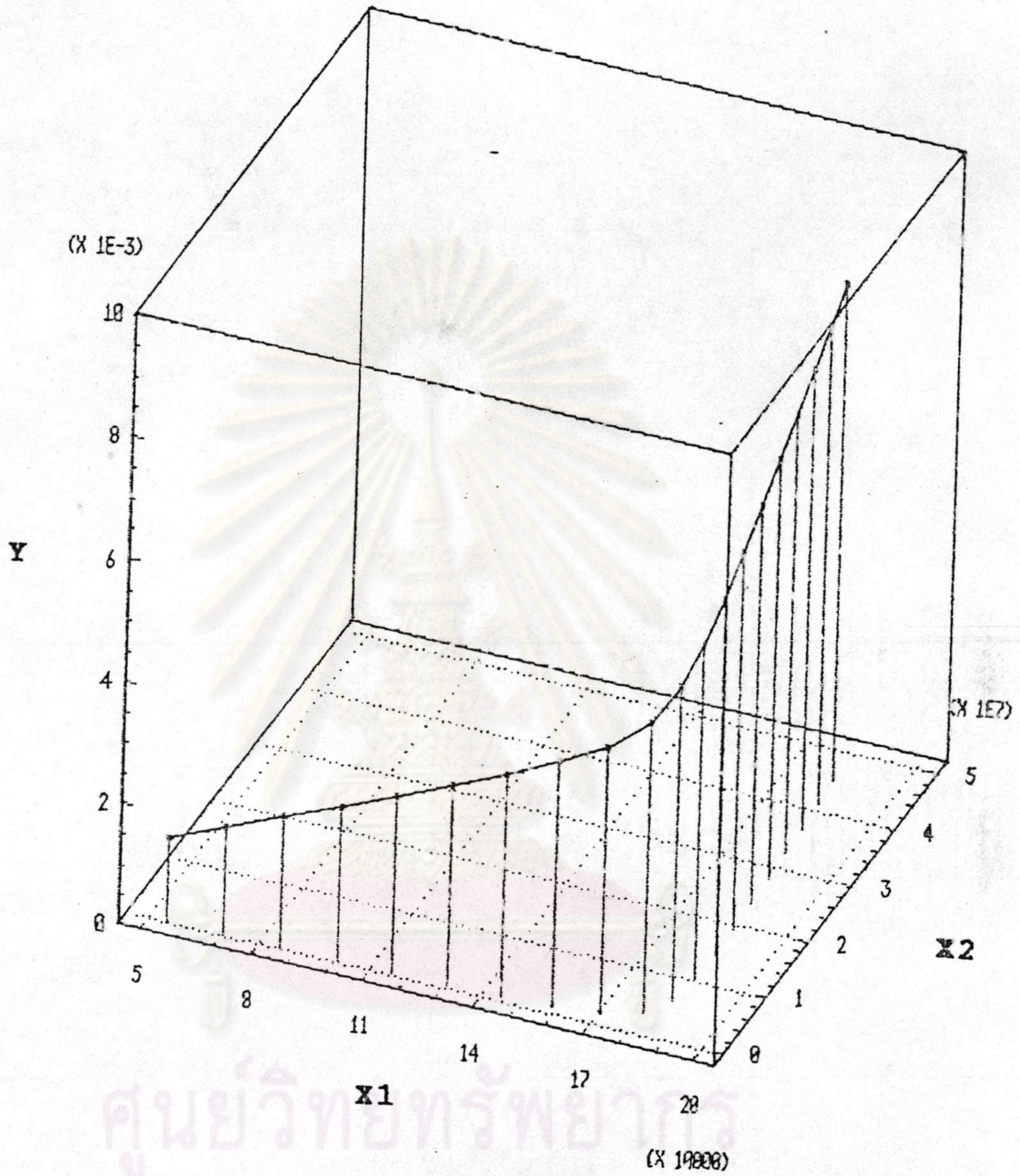

FIGURE 17 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 7

pKa2 = 9.5

ΔpKa = 2.5

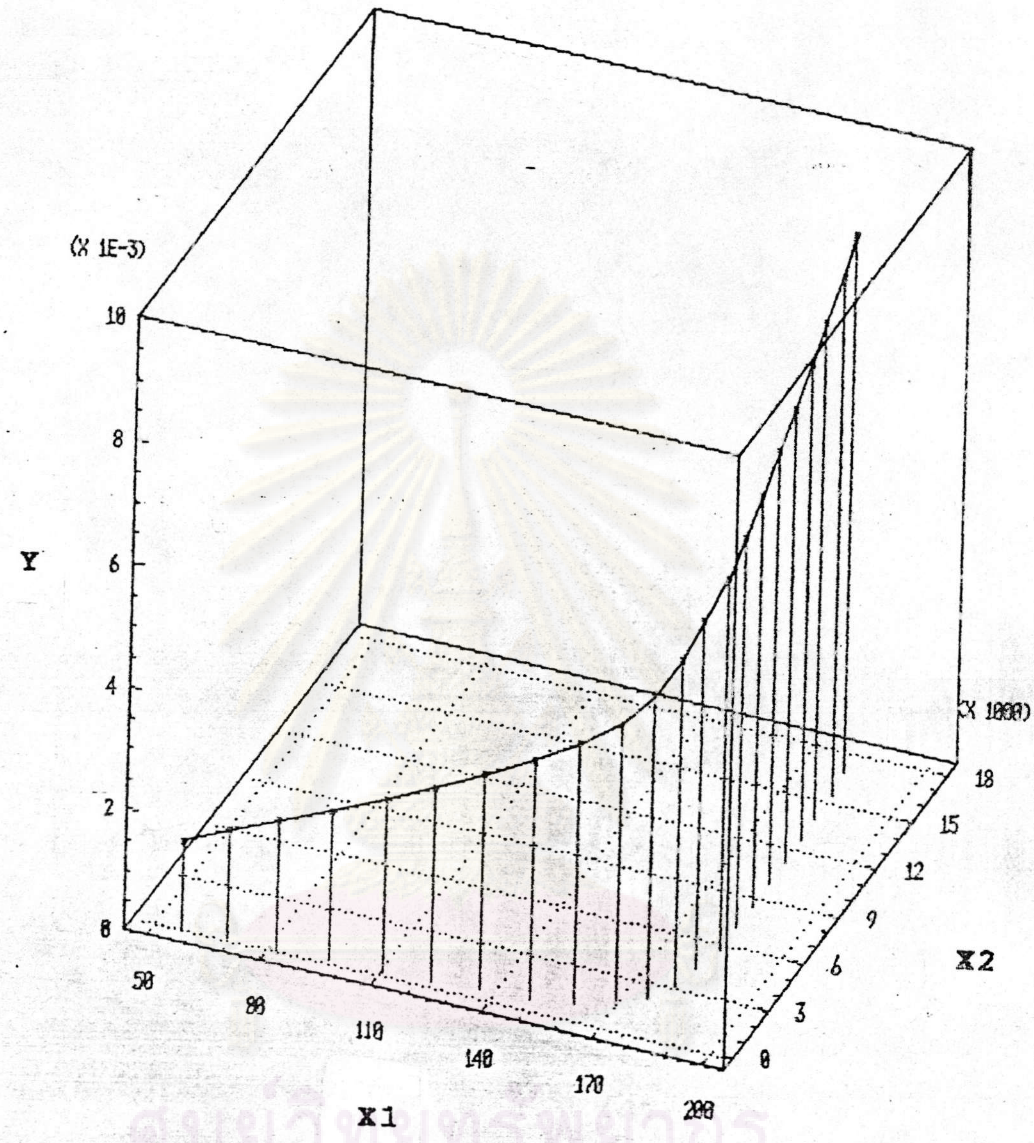

FIGURE 18 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 6

ΔpKa = 2

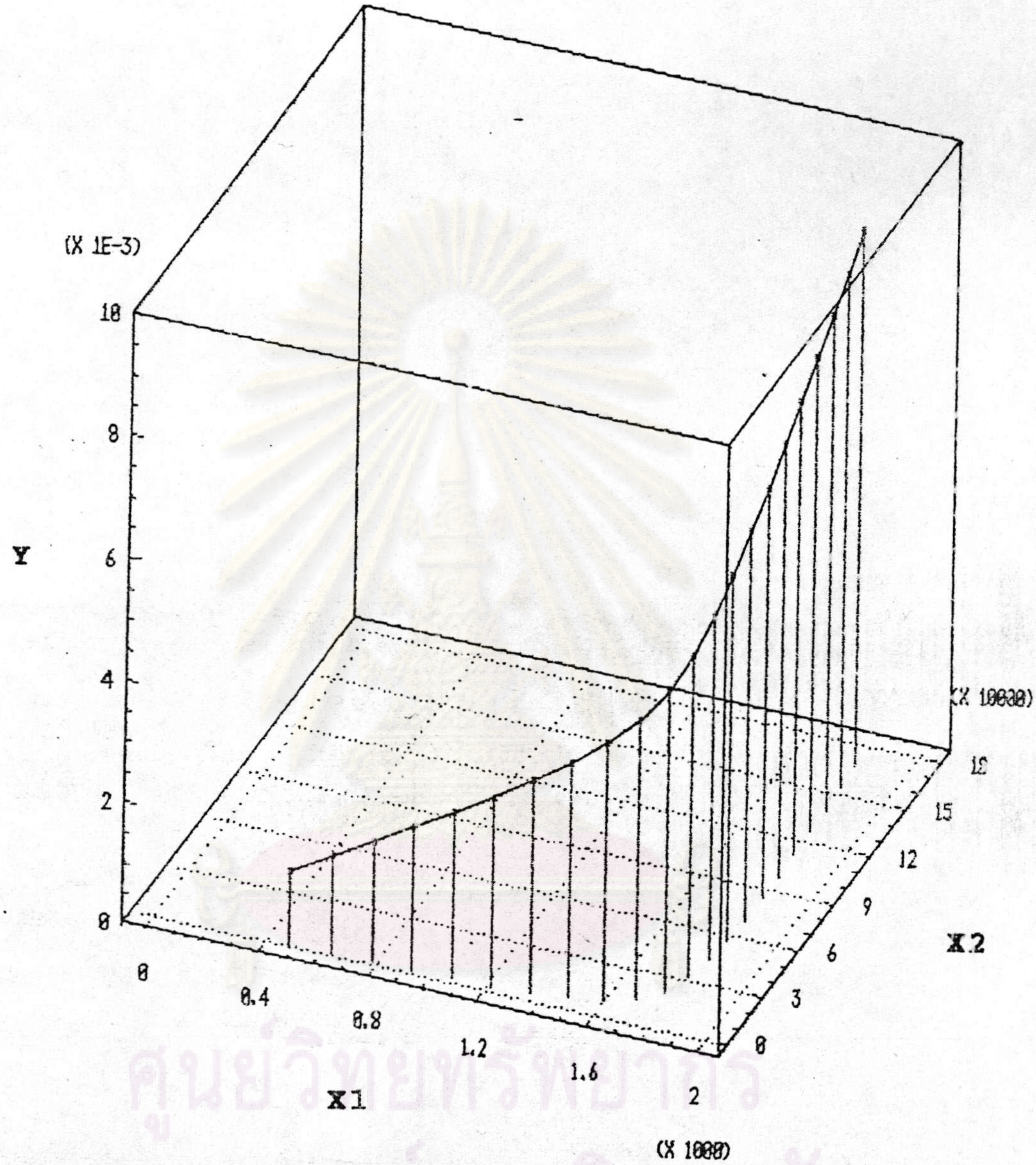

FIGURE 19 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 5$

$pKa2 = 7$

$\Delta pKa = 2$

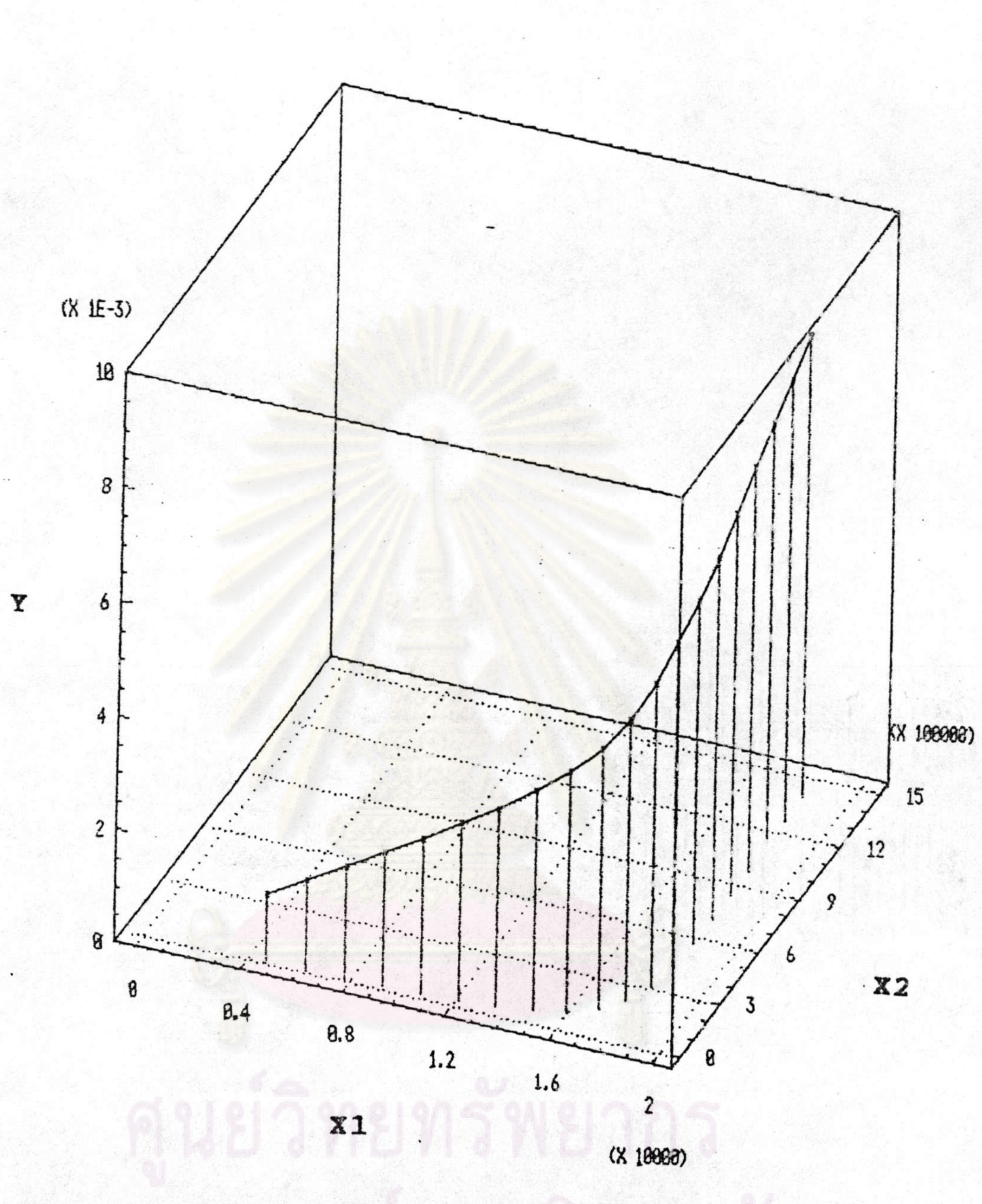

FIGURE 20 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 6

pKa2 = 8

ΔpKa = 2

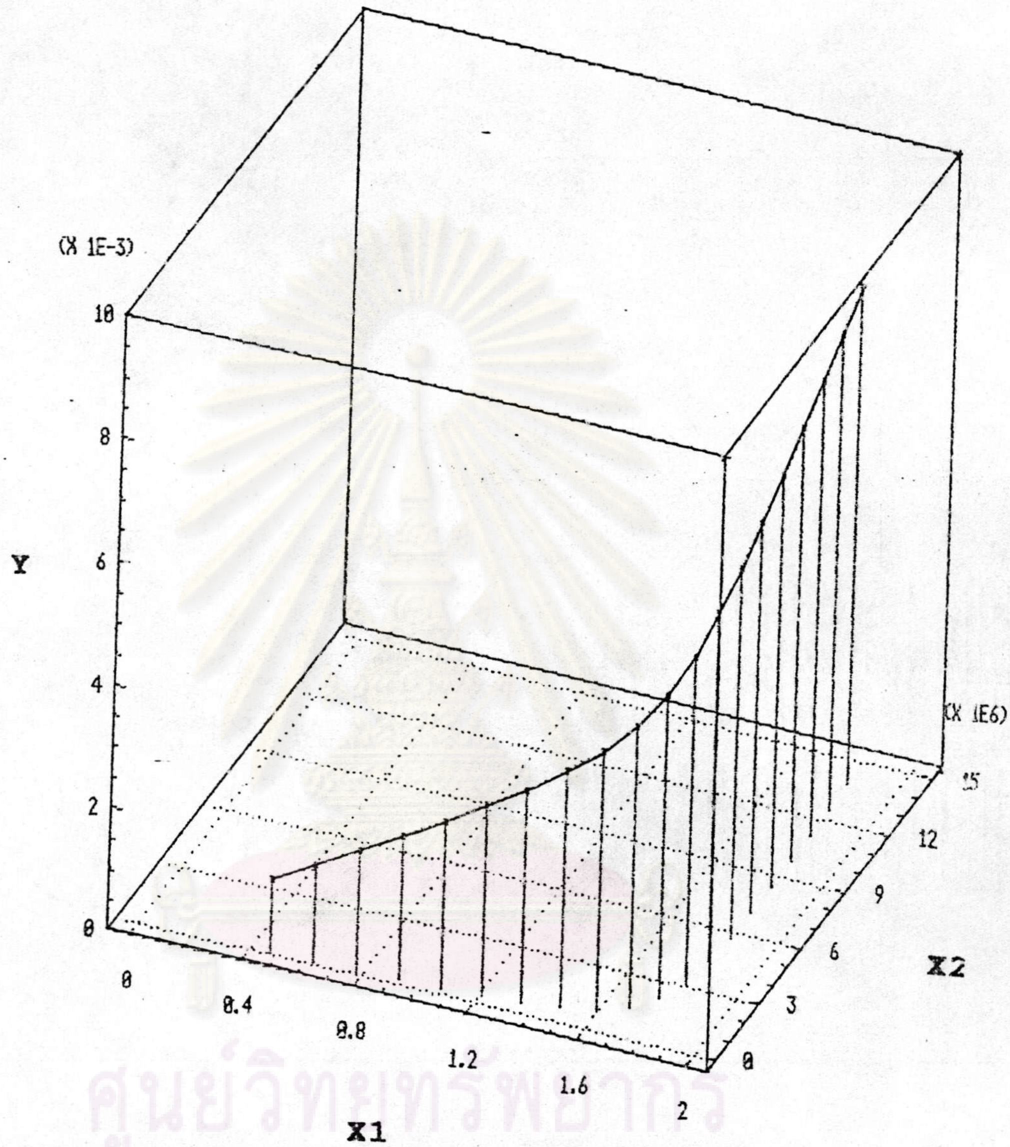

FIGURE 21 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 7

pKa2 = 9

ΔpKa = 2

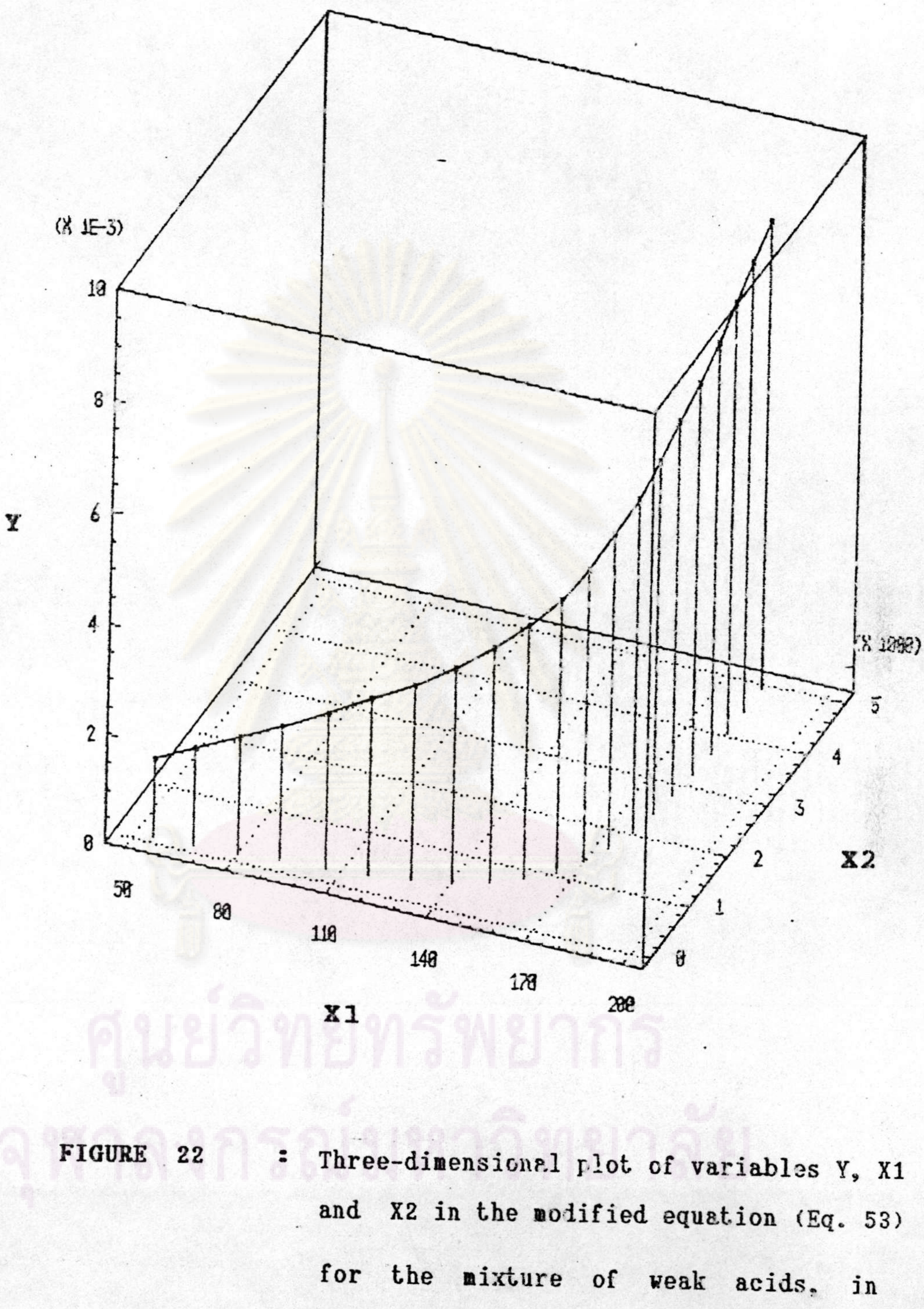

FIGURE 22 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 5.5

ΔpKa = 1.5

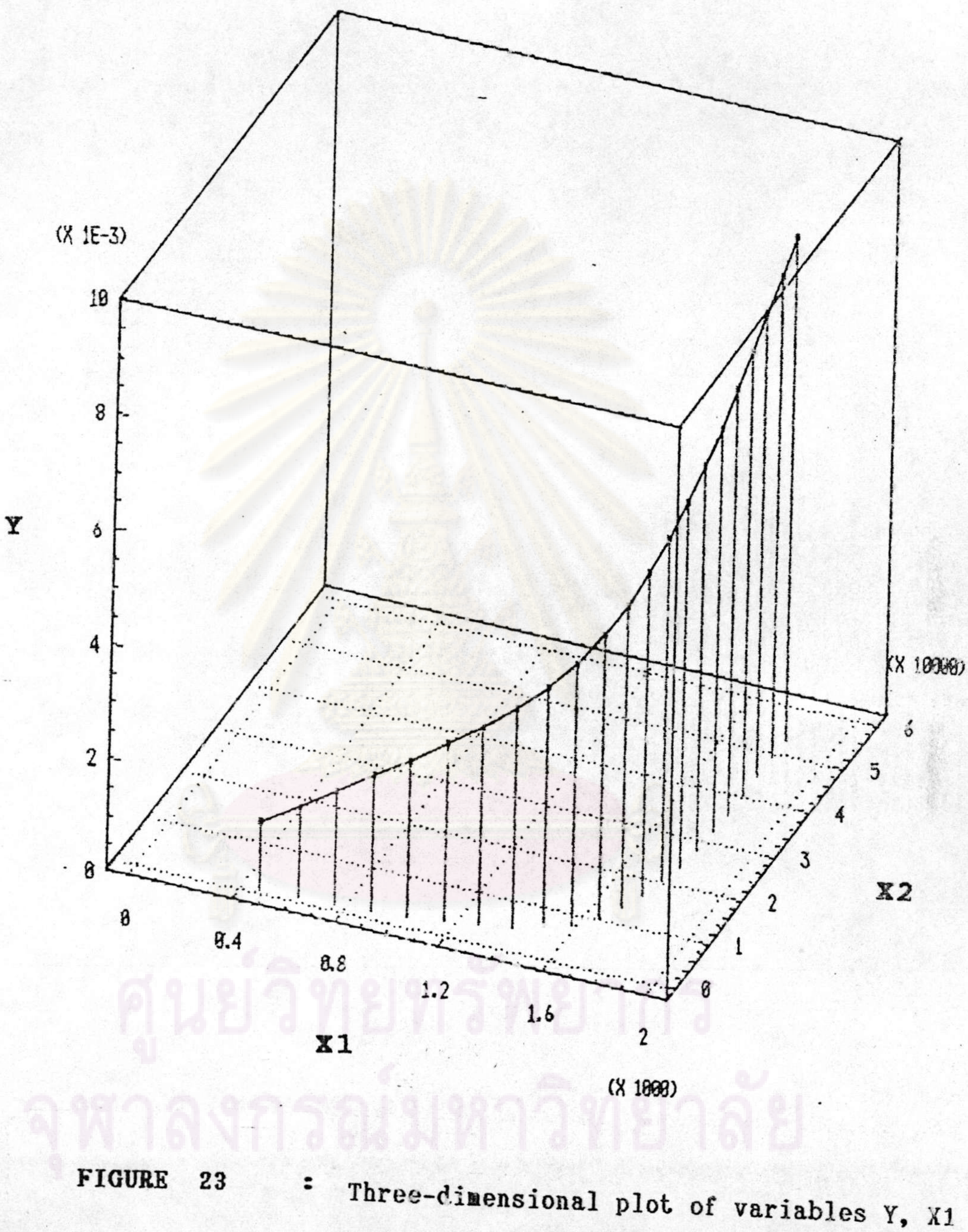

FIGURE 23 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 6.5

ΔpKa = 1.5

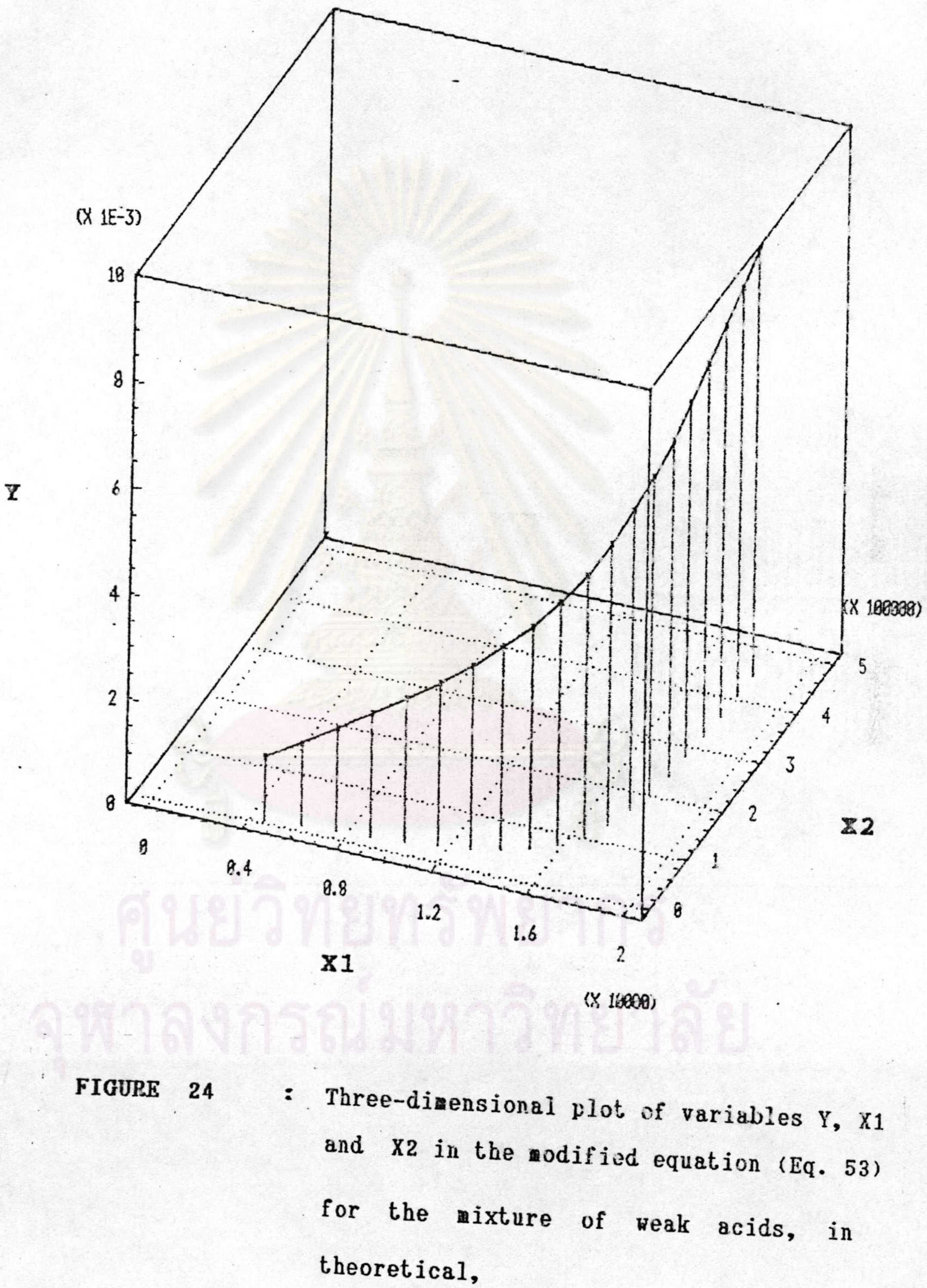

FIGURE 24 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 6

pKa2 = 7.5

ΔpKa = 1.5

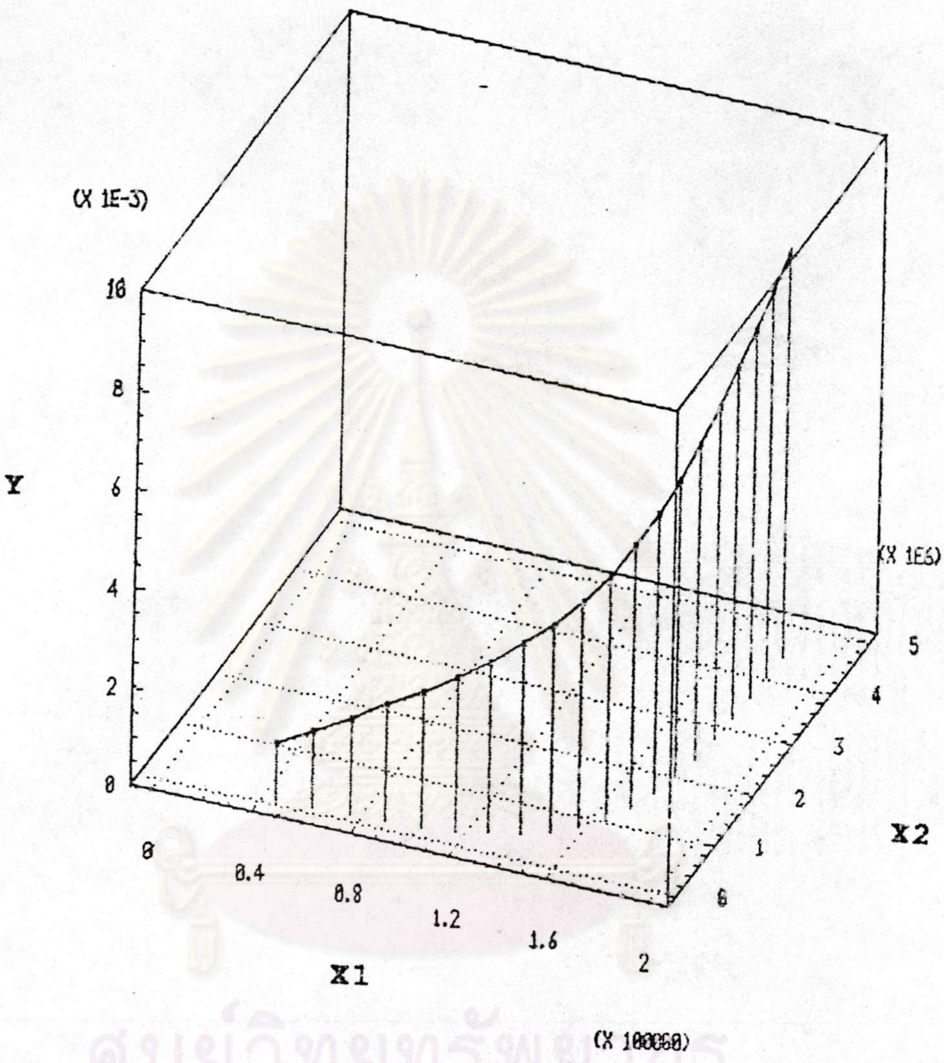

FIGURE 25 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 7

pKa2 = 8.5

ΔpKa = 1.5

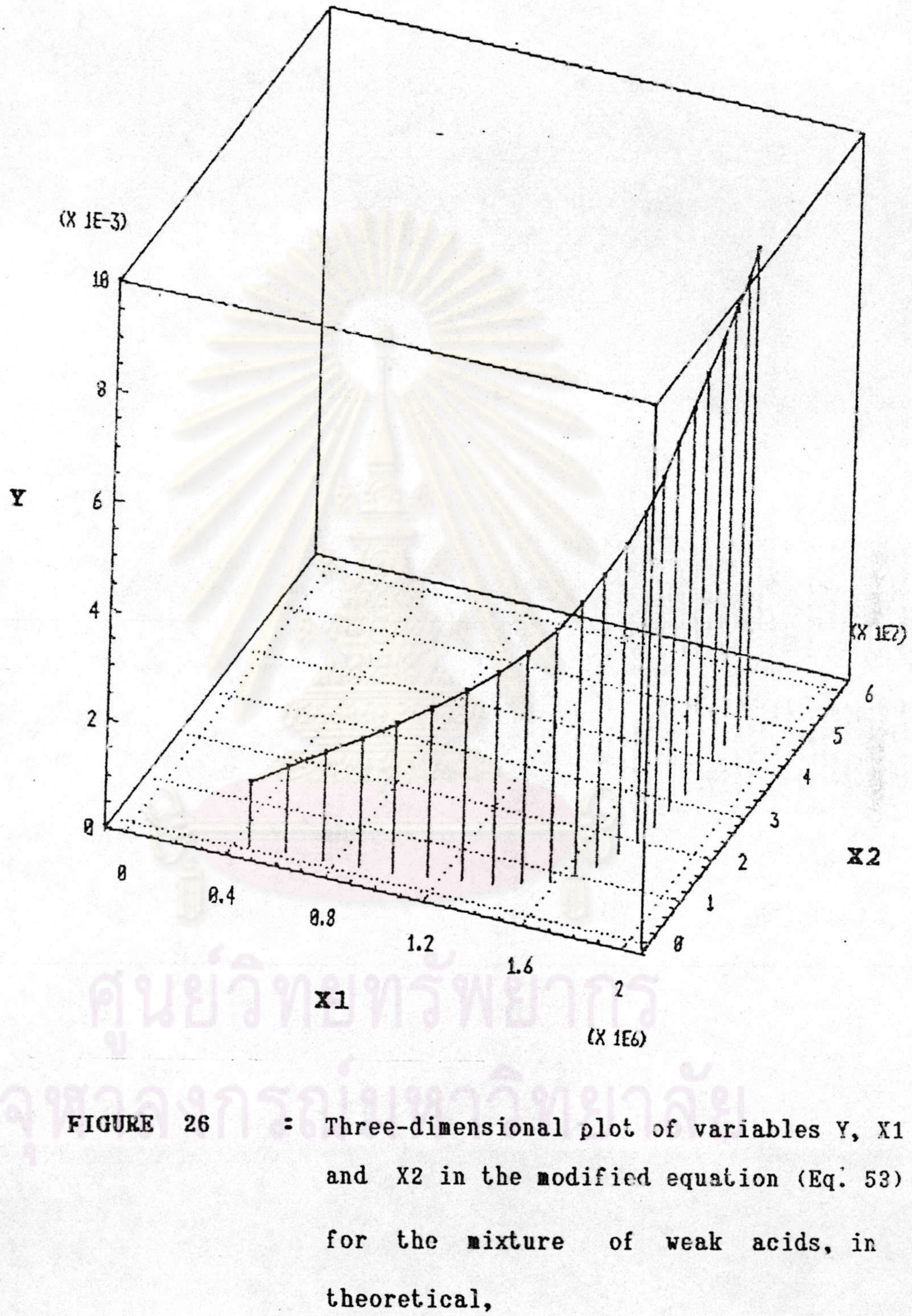

FIGURE 26 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 8$

$pKa2 = 9.5$

$\Delta pKa = 1.5$

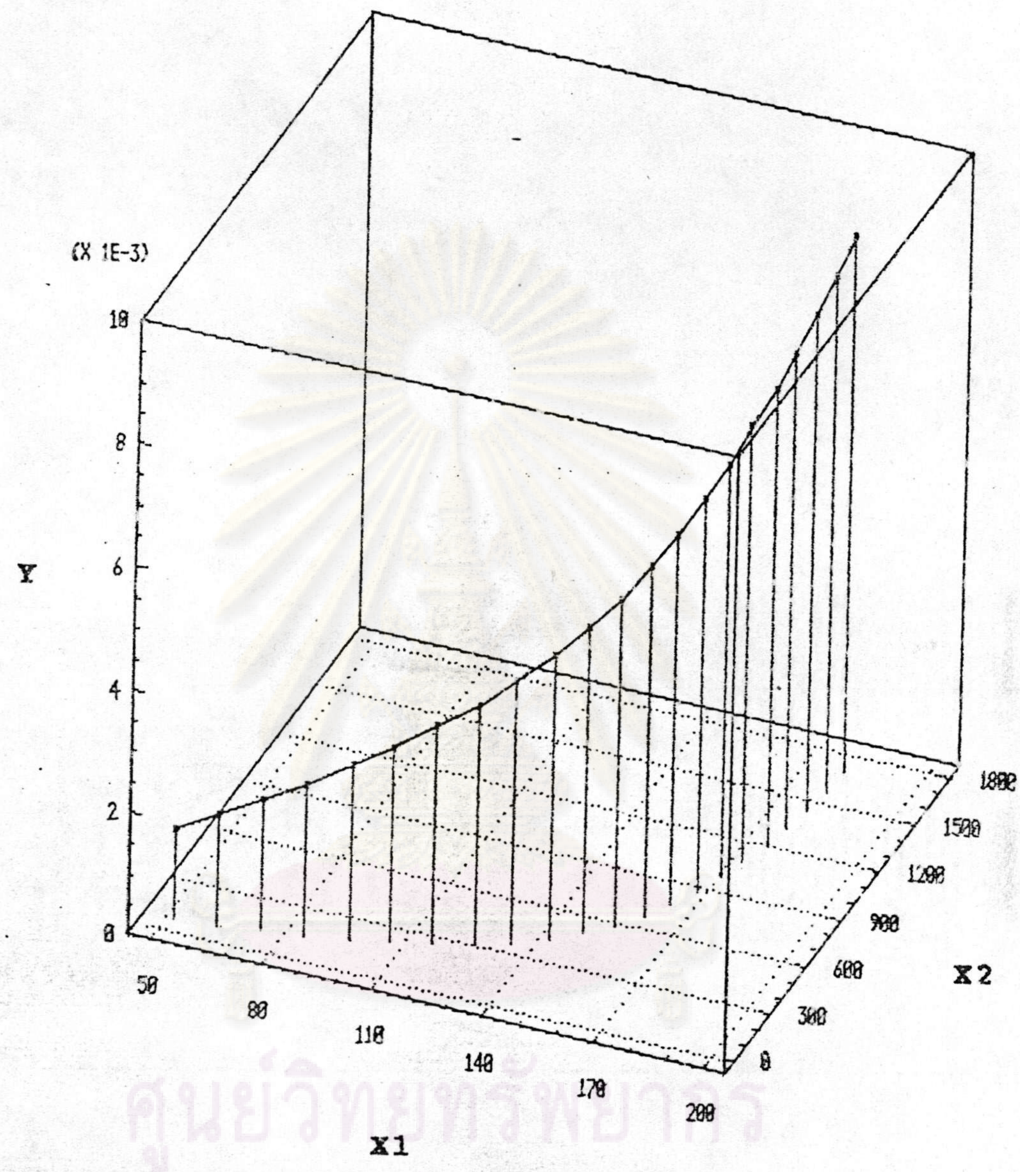

FIGURE 27 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 4$

$pKa2 = 5$

$\Delta pKa = 1$

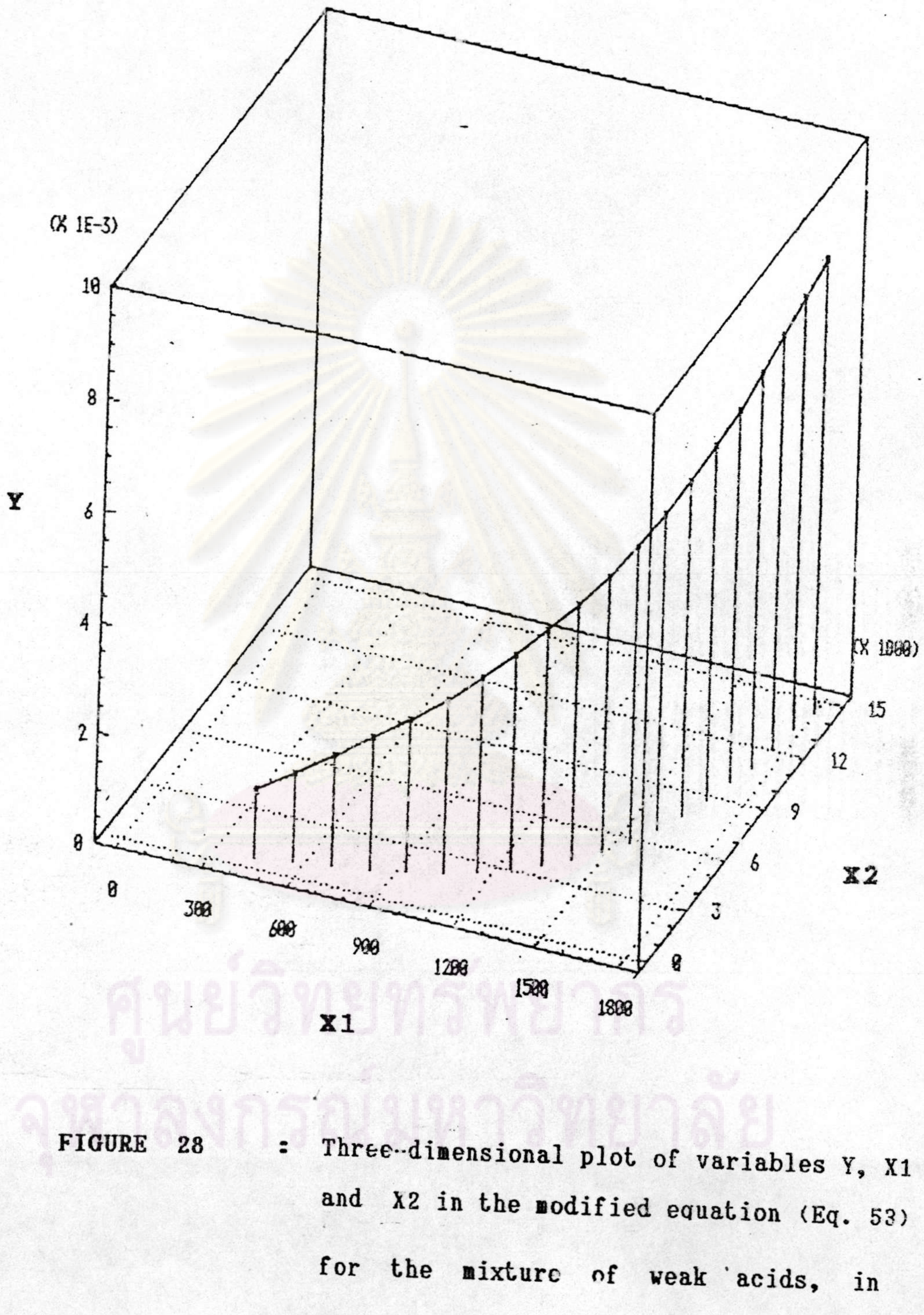

FIGURE 28 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 6

ΔpKa = 1

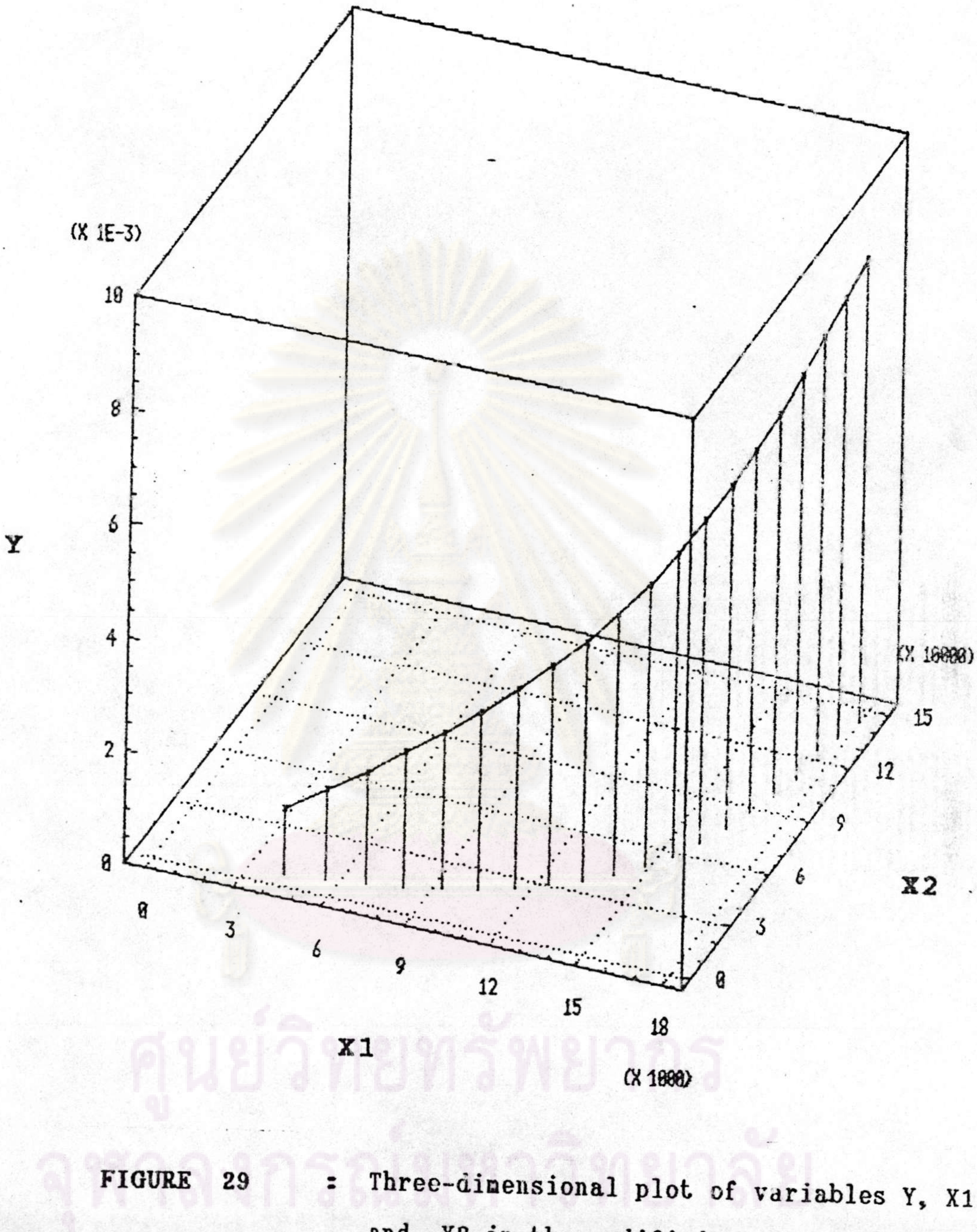

FIGURE 29 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 6

pKa2 = 7

ΔpKa = 1

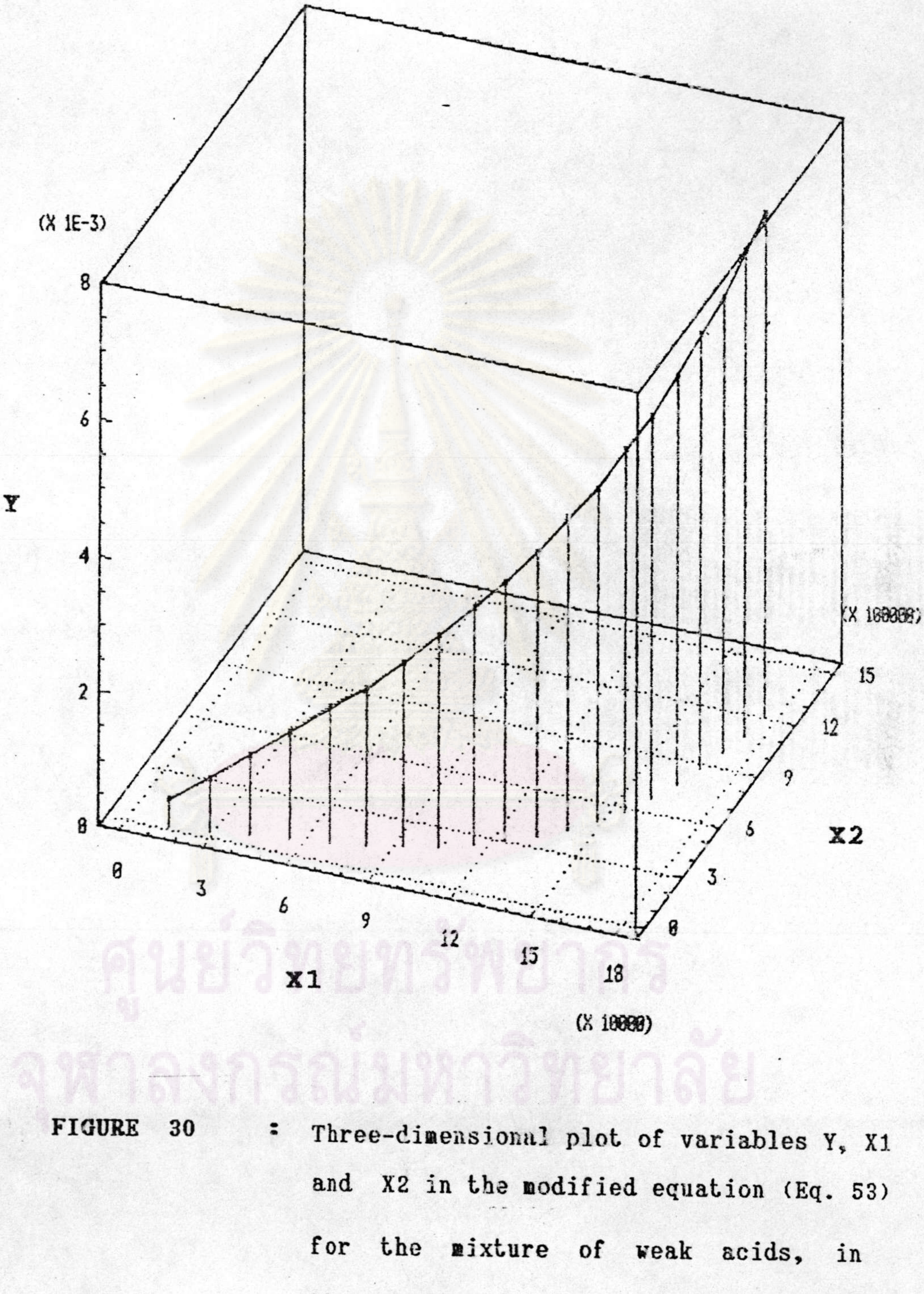

FIGURE 30 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 7$

$pKa2 = 8$

$\Delta pKa = 1$

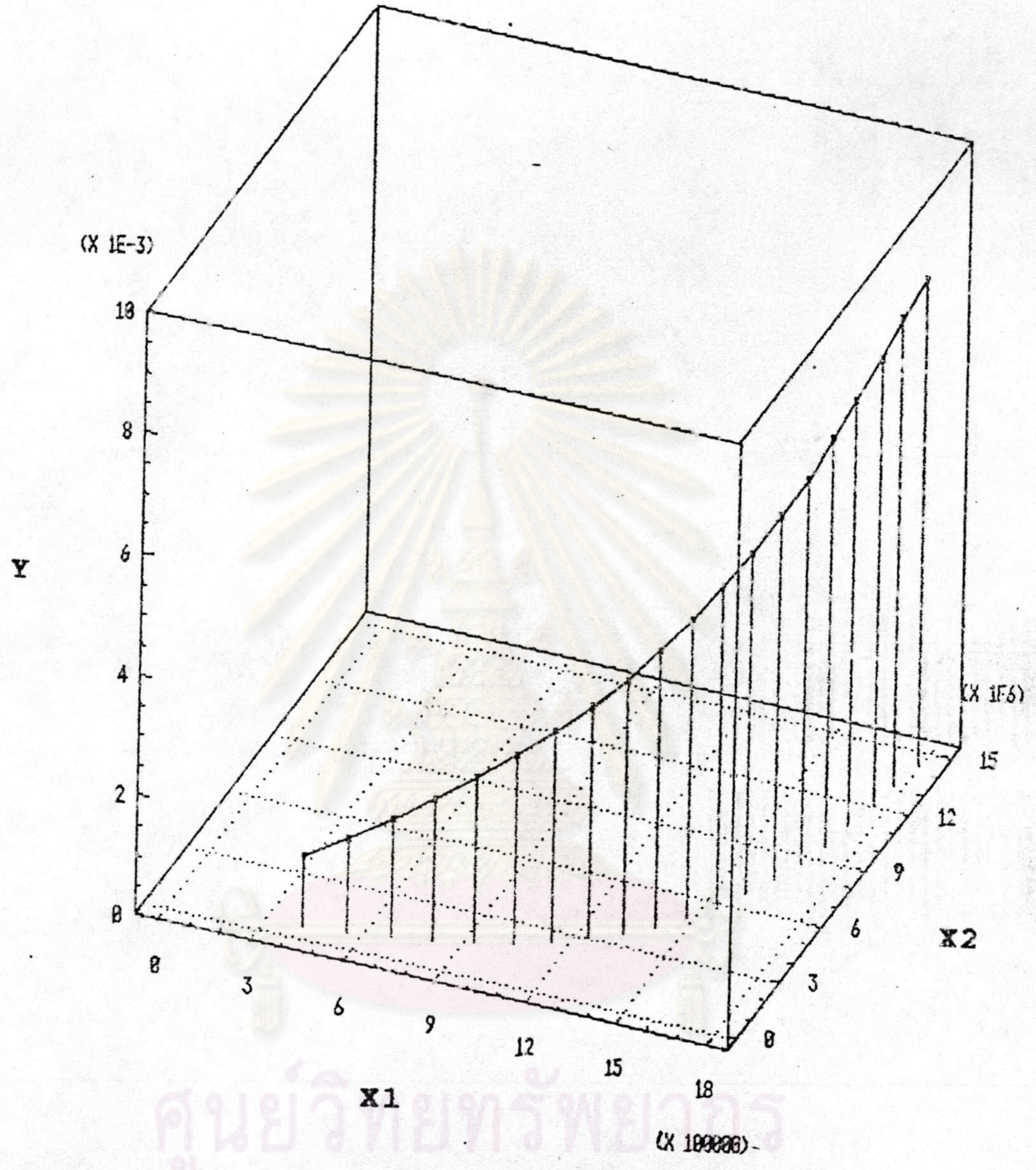

FIGURE 31 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 8

pKa2 = 9

ΔpKa = 1

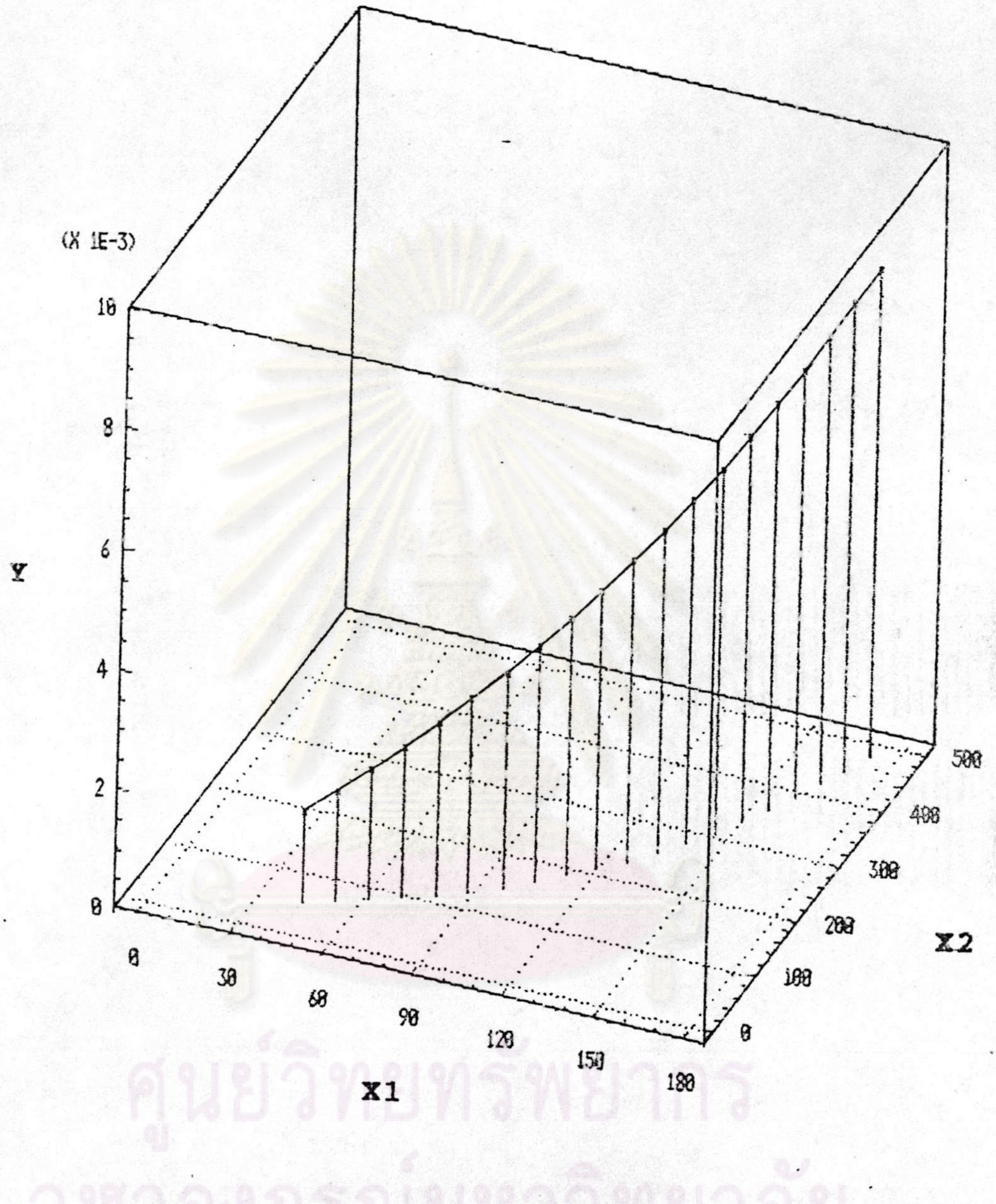

FIGURE 32 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 4$

$pKa2 = 4.5$

$\Delta pKa = 0.5$

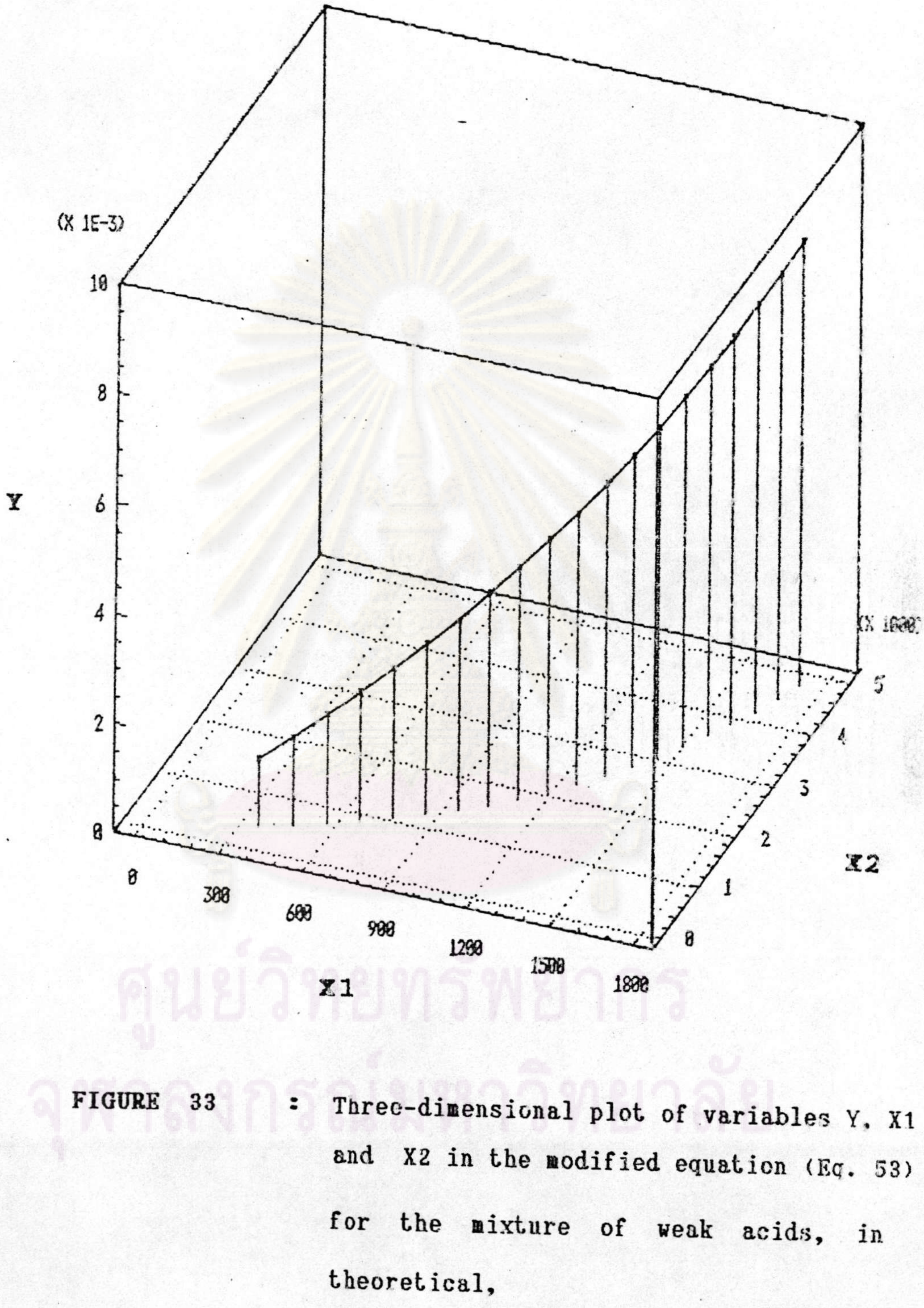

FIGURE 33 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 5.5

ΔpKa = 0.5

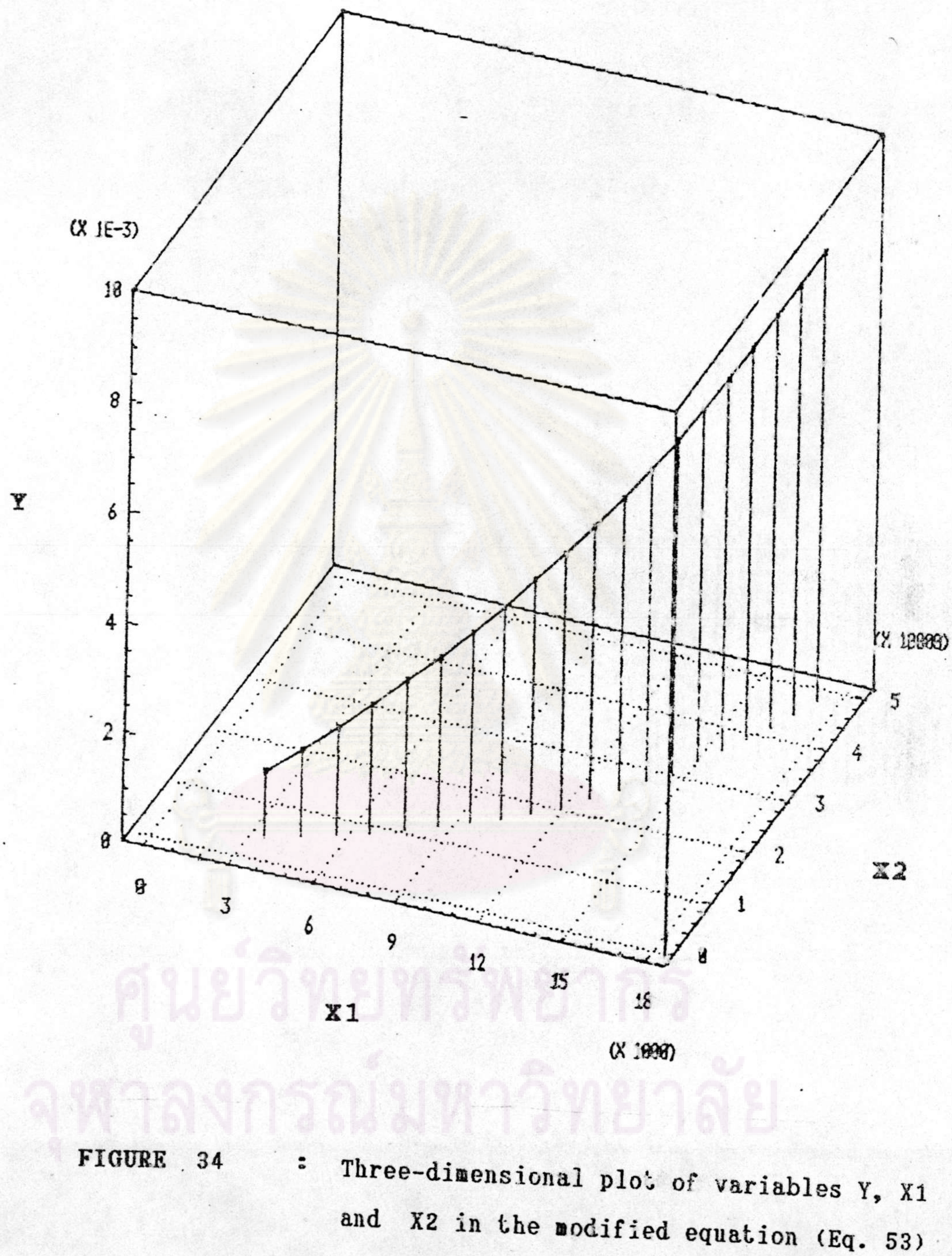

FIGURE 34 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 6$

$pKa2 = 6.5$

$\Delta pKa = 0.5$

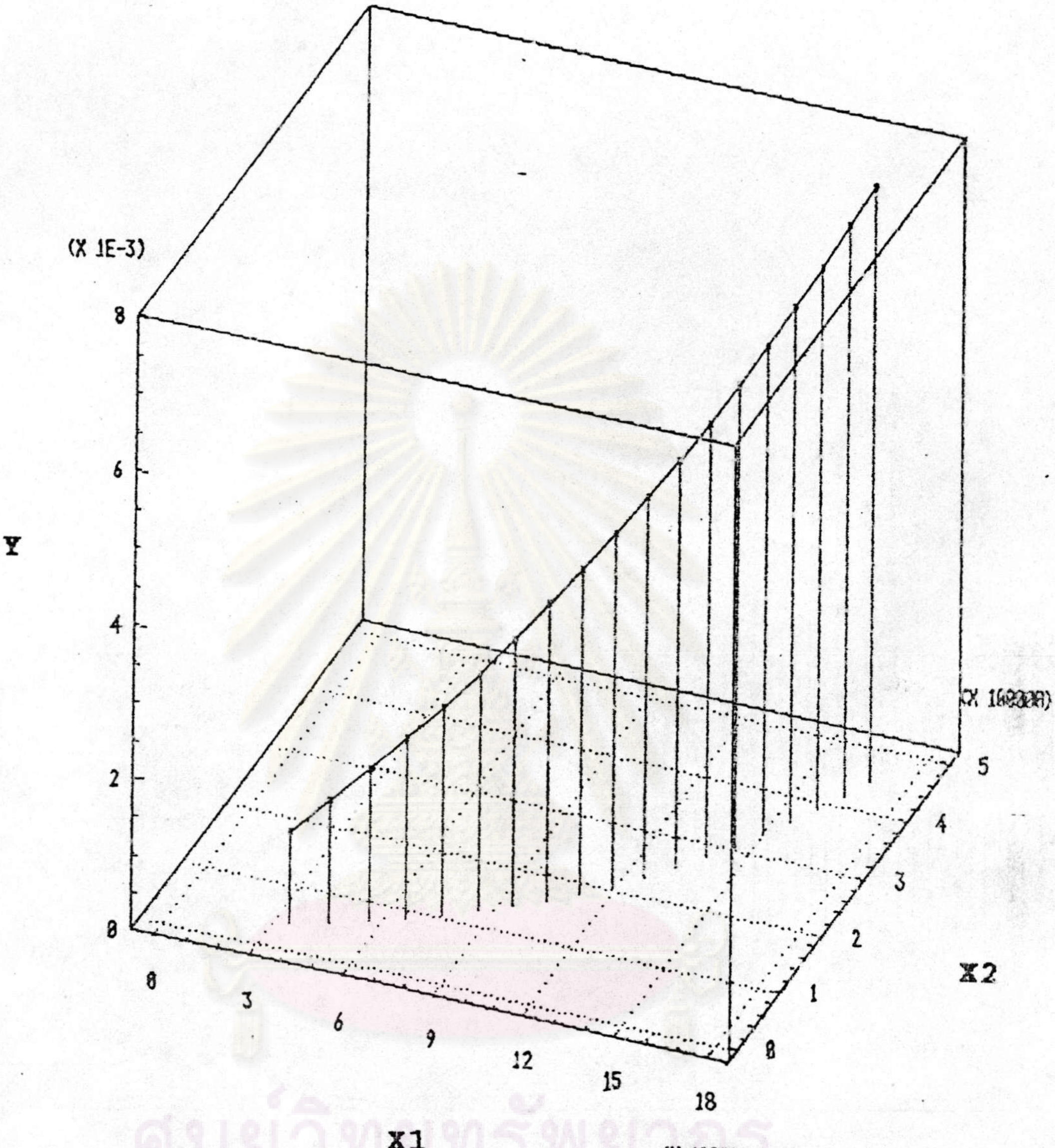

FIGURE 35 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 7

pKa2 = 7.5

ΔpKa = 0.5

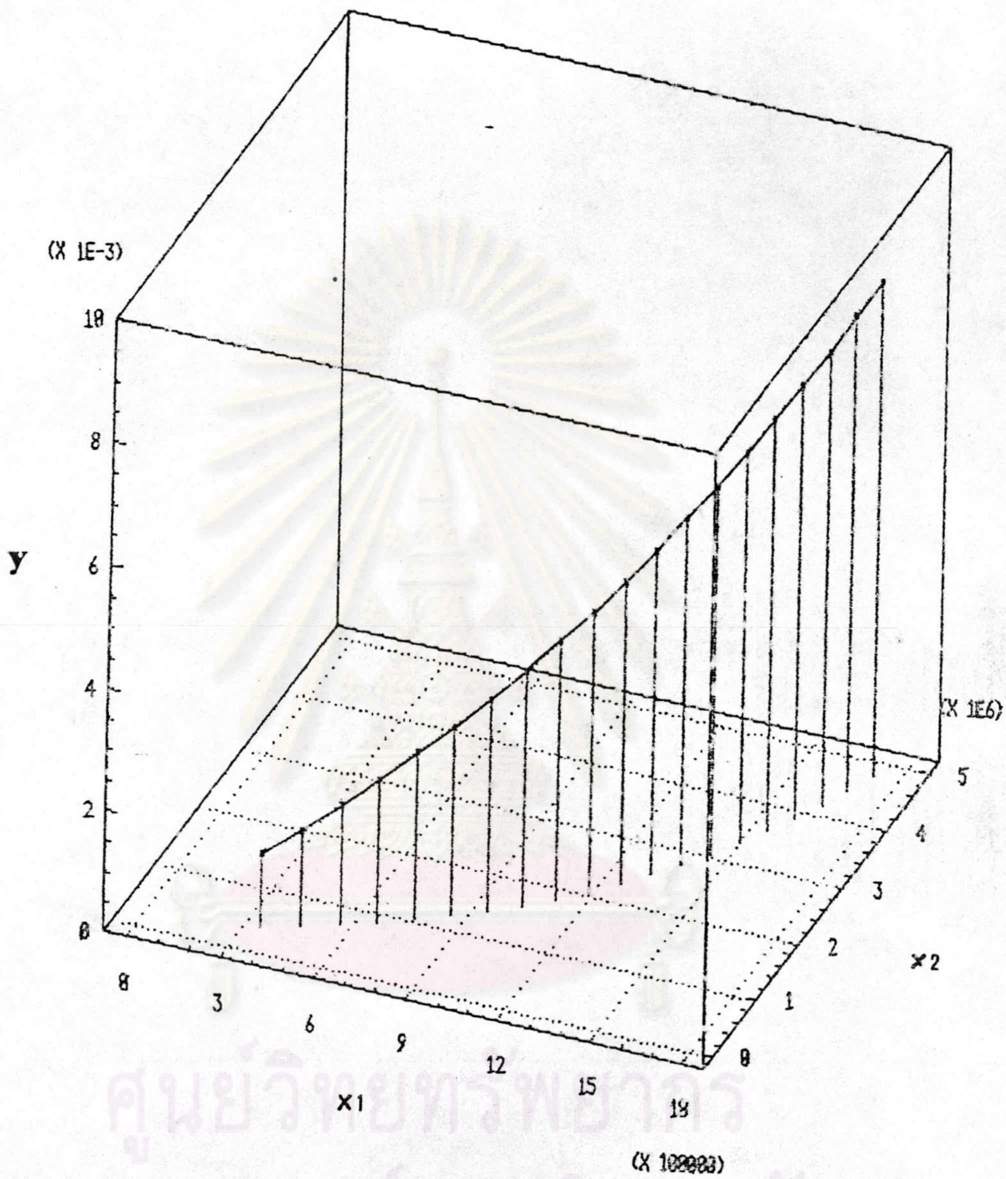

FIGURE 36 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 8

pKa2 = 8.5

ΔpKa = 0.5

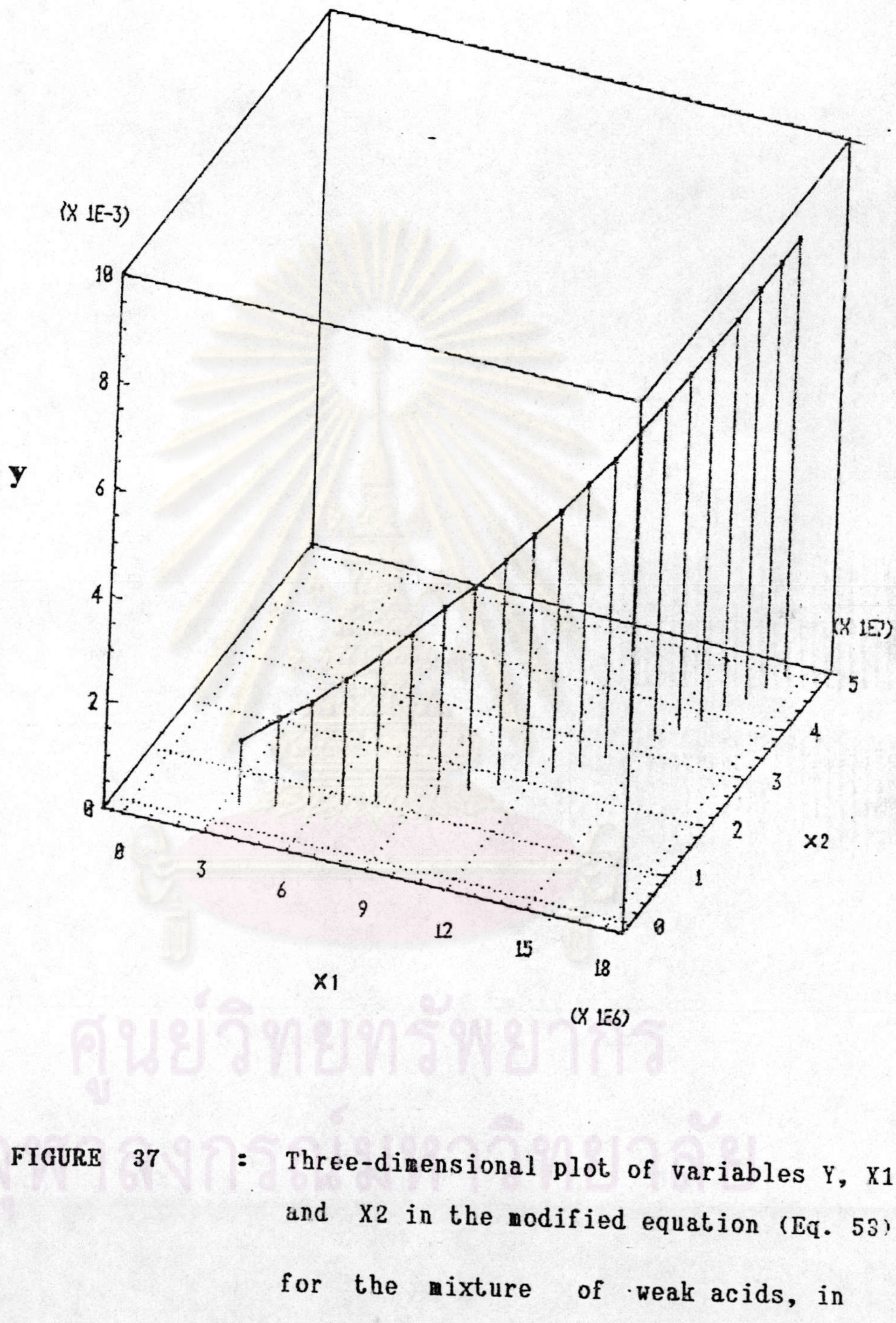

FIGURE 37 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which $pKa1 = 9$

$pKa2 = 9.5$

$\Delta pKa = 0.5$

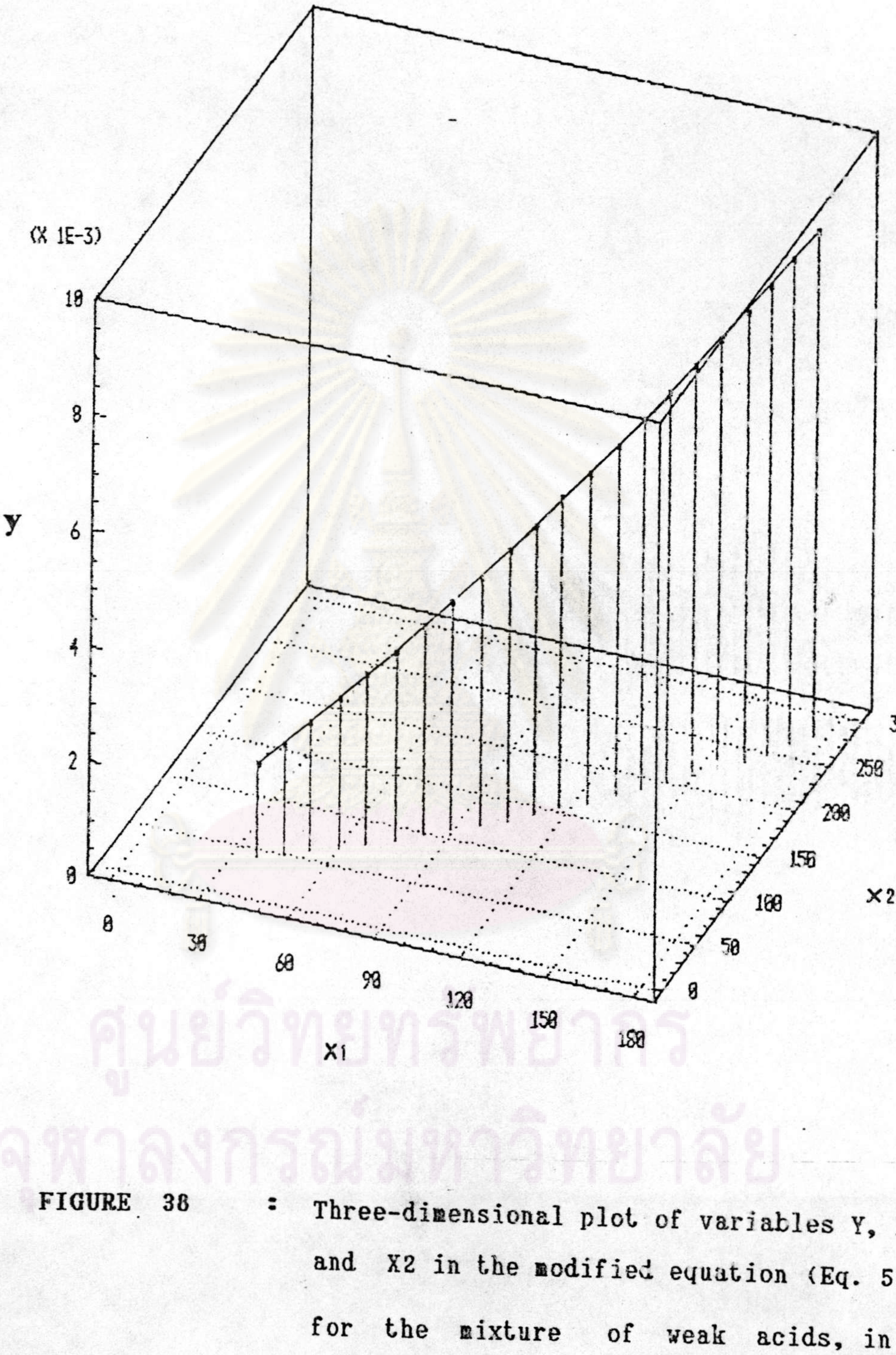

FIGURE 38 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 4

pKa2 = 4.2

ΔpKa = 0.2

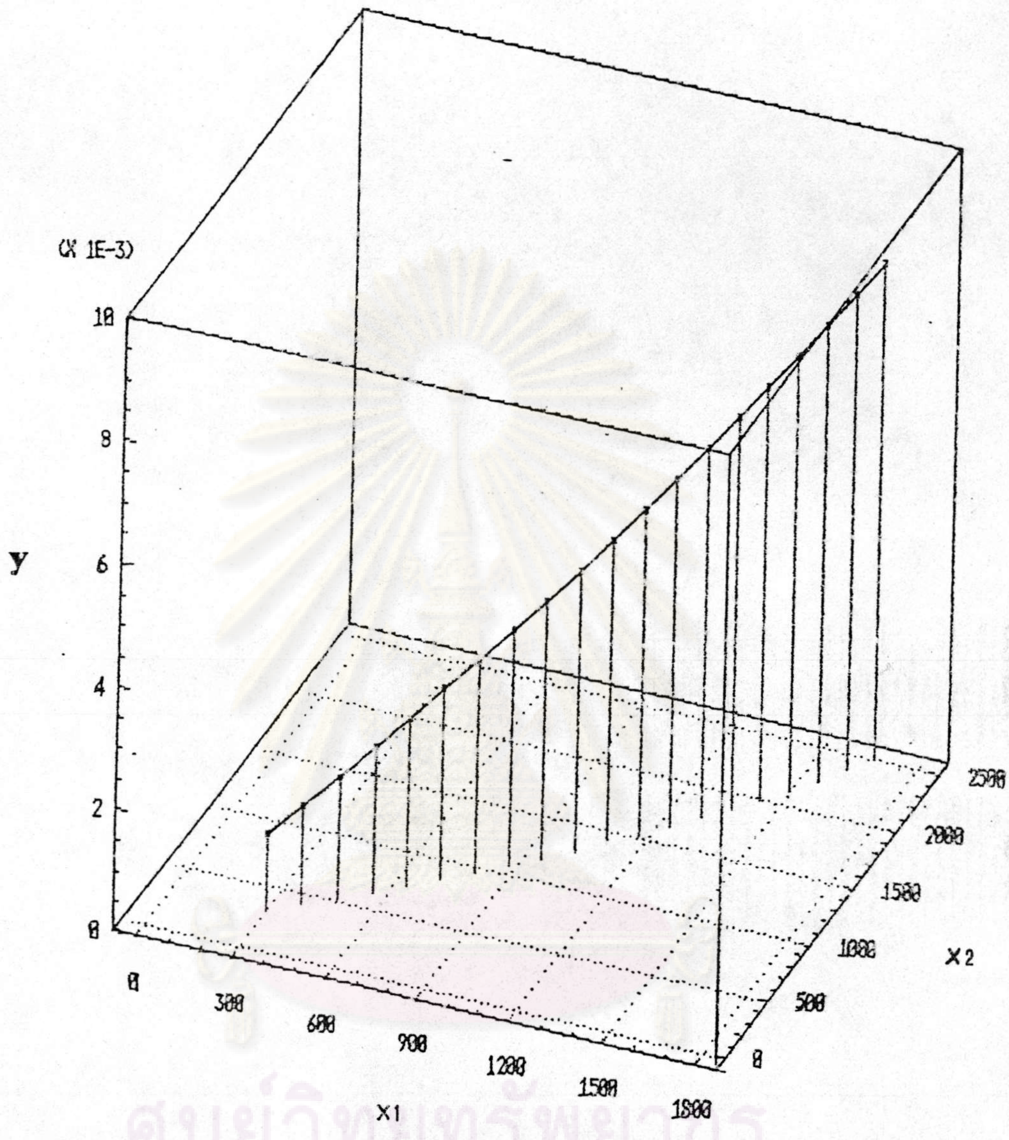

FIGURE 39 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 5

pKa2 = 5.2

ΔpKa = 0.2

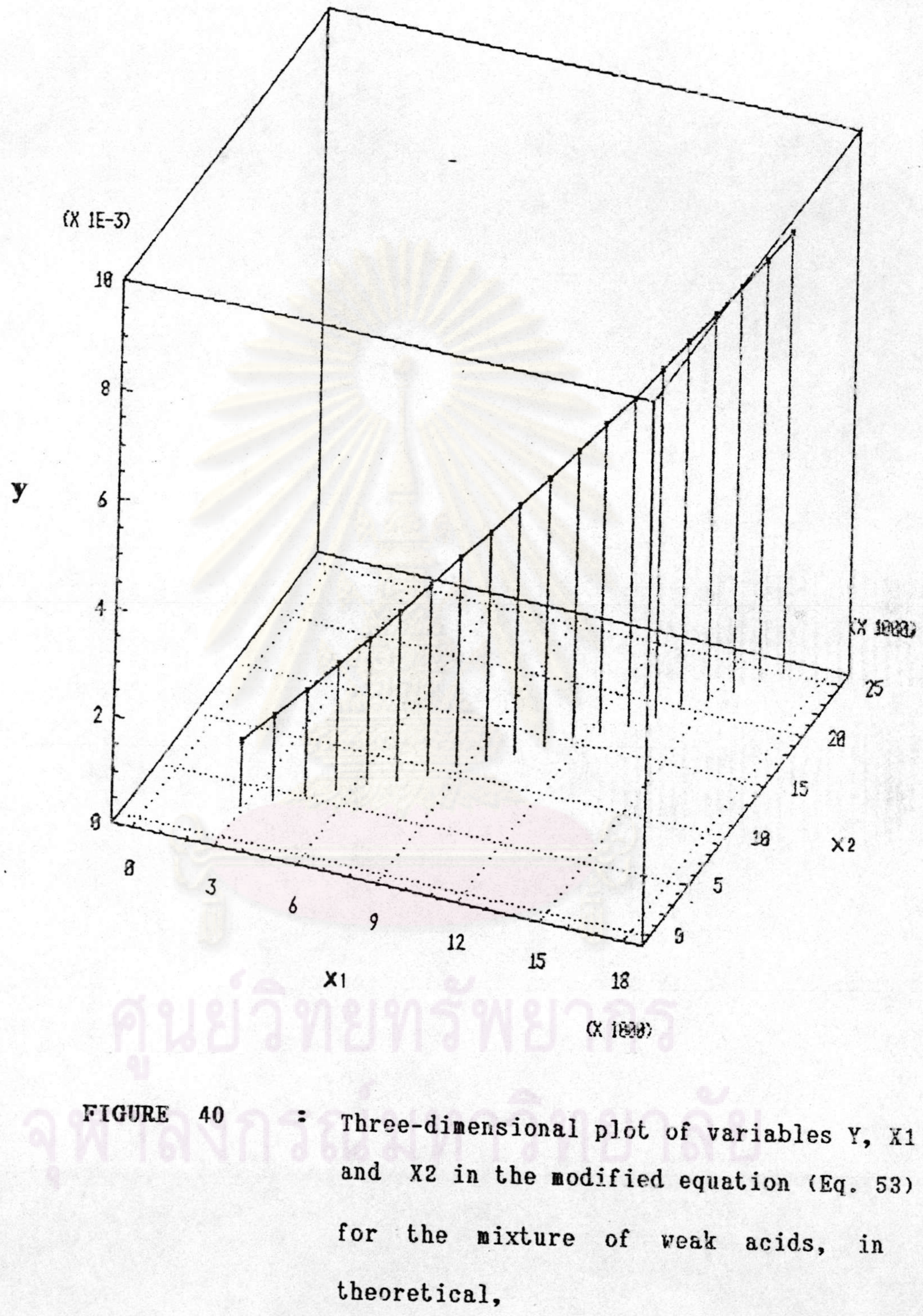

FIGURE 40 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 6

pKa2 = 6.2

ΔpKa = 0.2

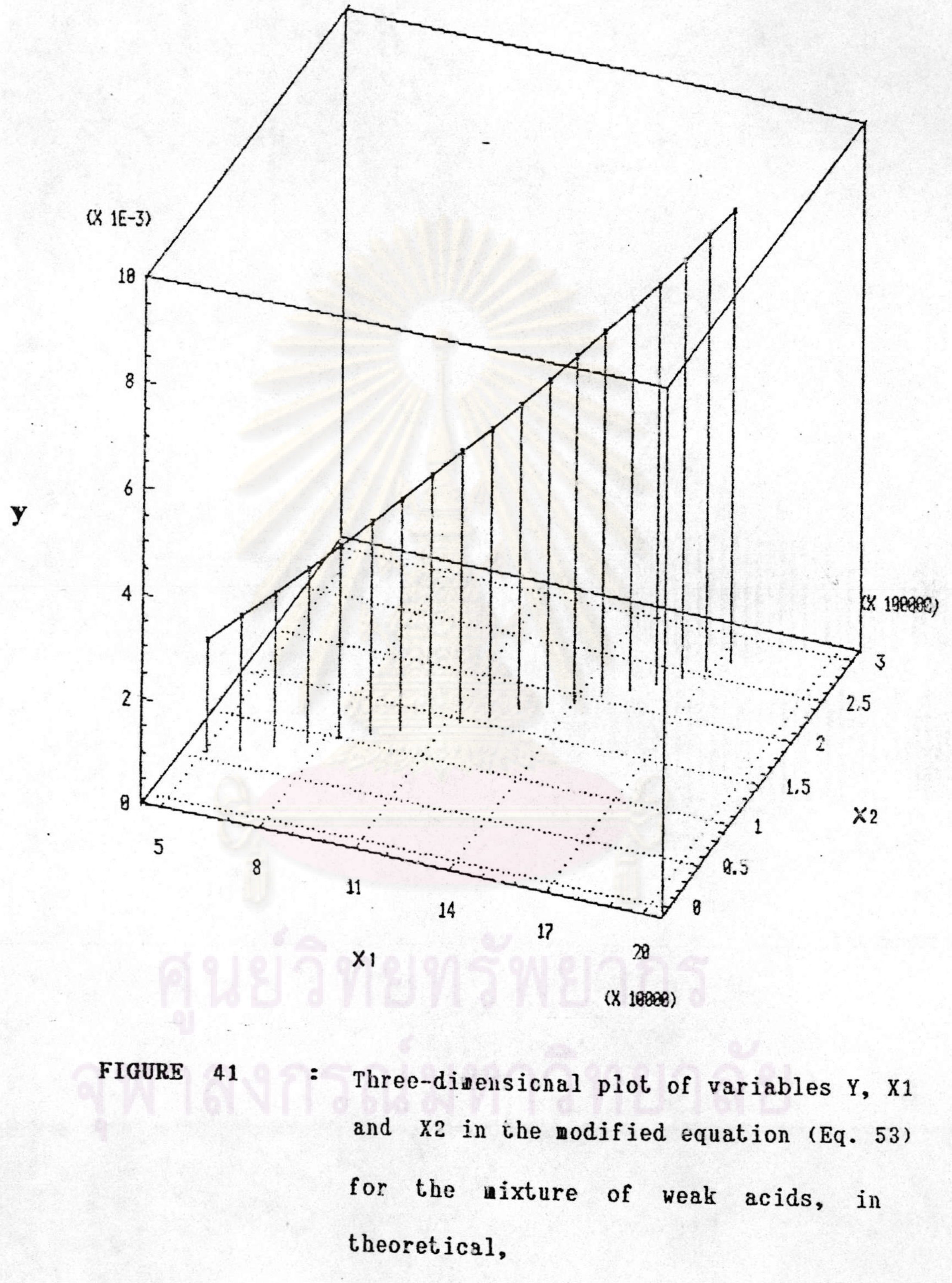

FIGURE 41 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 7

pKa2 = 7.2

ΔpKa = 0.2

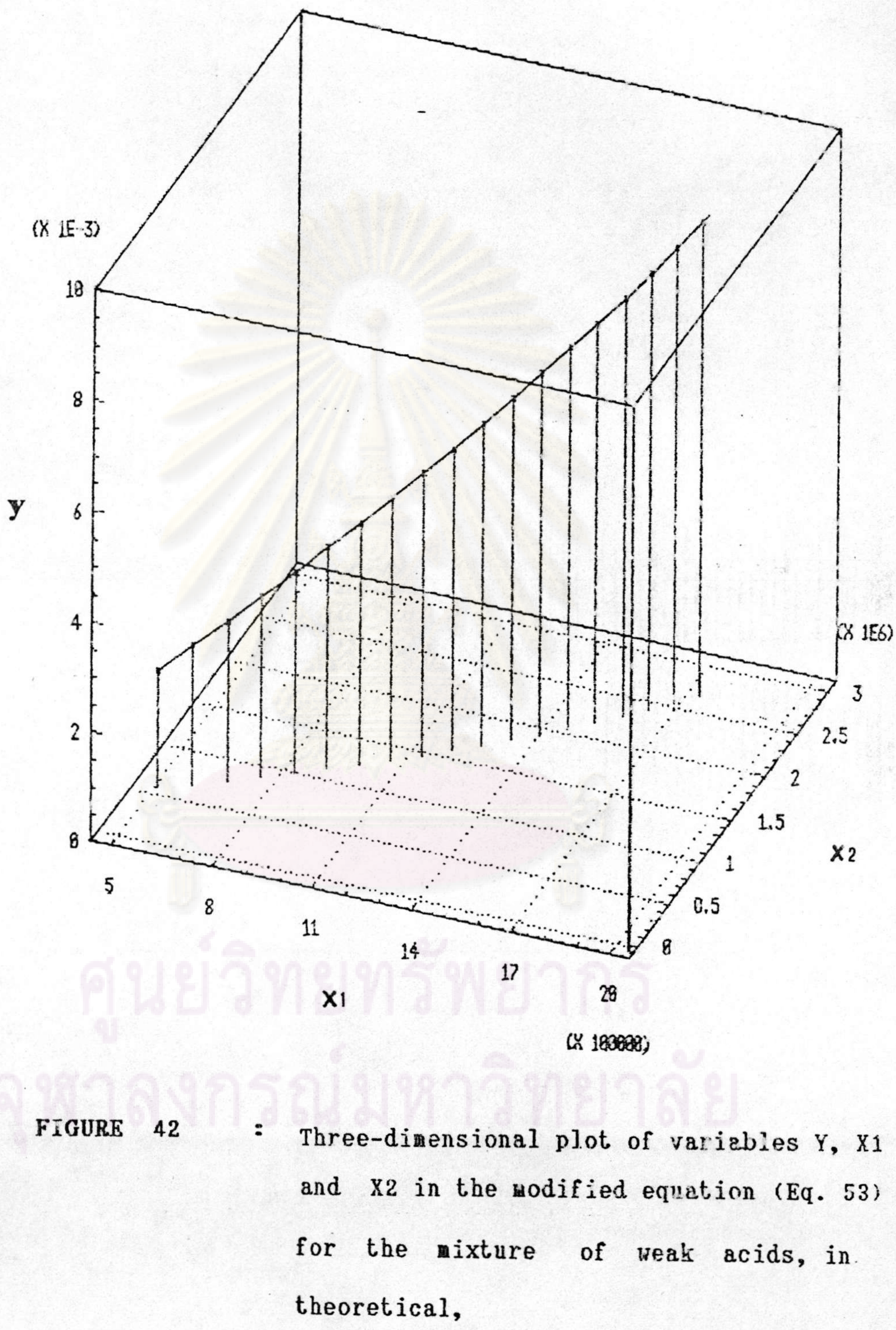

FIGURE 42 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 8

pKa2 = 8.2

ΔpKa = 0.2

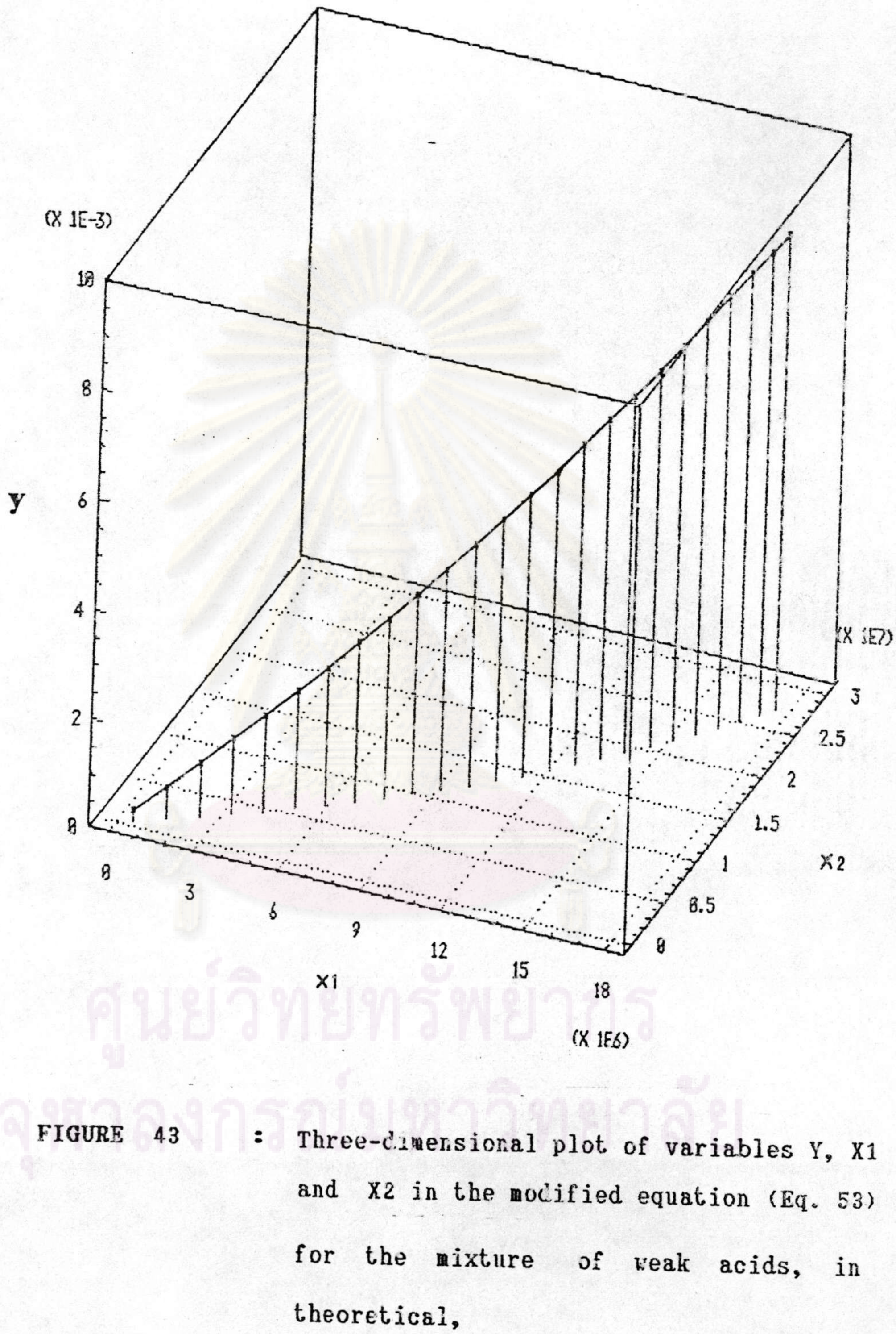

FIGURE 43 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of weak acids, in theoretical,

which pKa1 = 9

pKa2 = 9.2

ΔpKa = 0.2

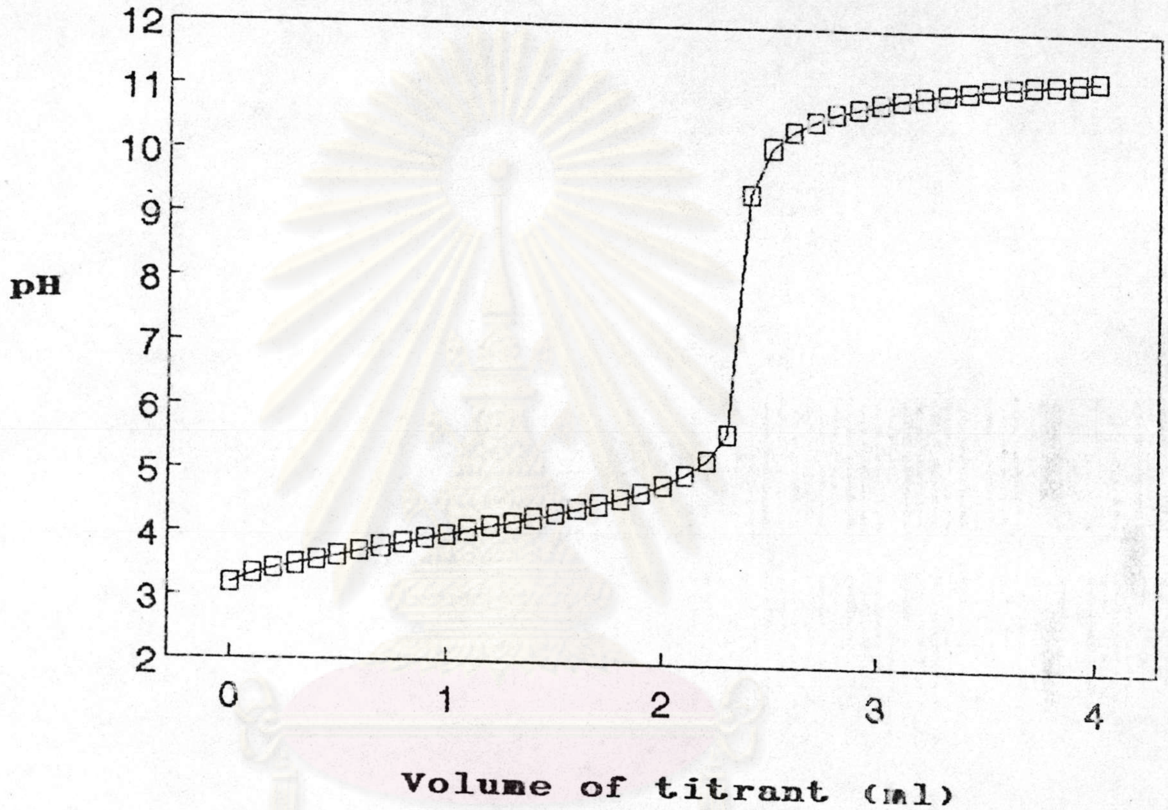

FIGURE 44 : Titration curve of benzoic acid in 0.1 M potassium chloride solution with sodium hydroxide solution

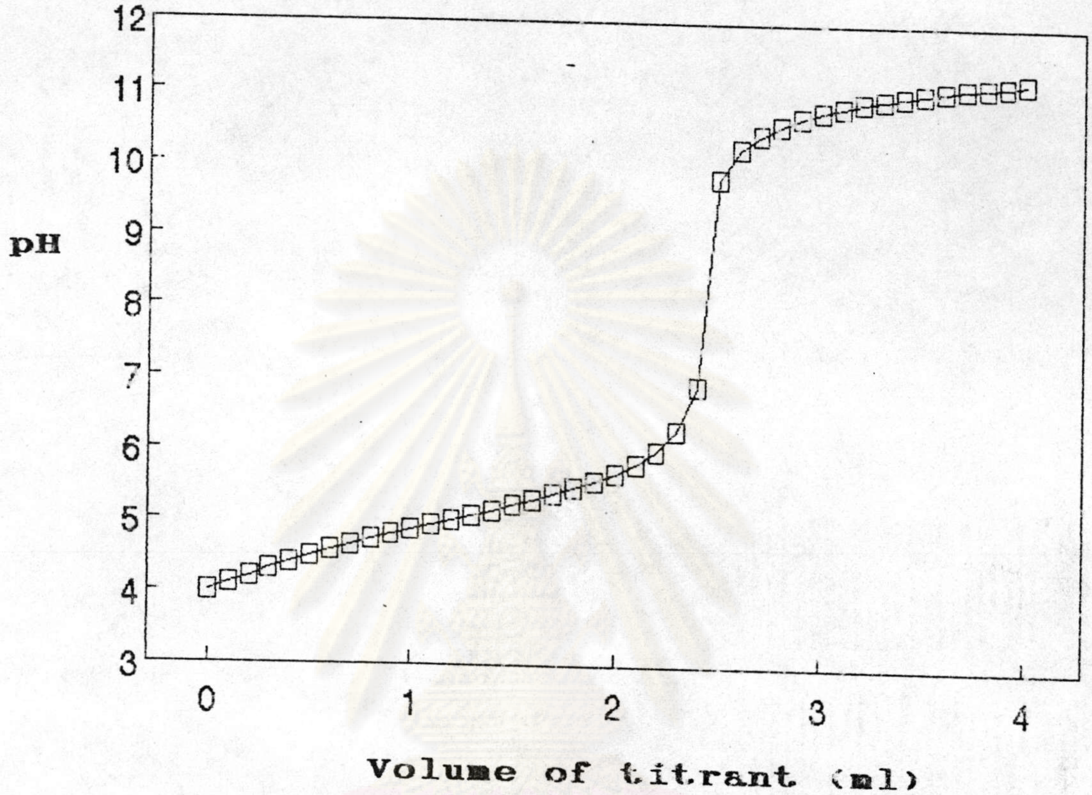

FIGURE 45 : Titration curve of potassium biphthalate in 0.1 M potassium chloride solution with sodium hydroxide solution

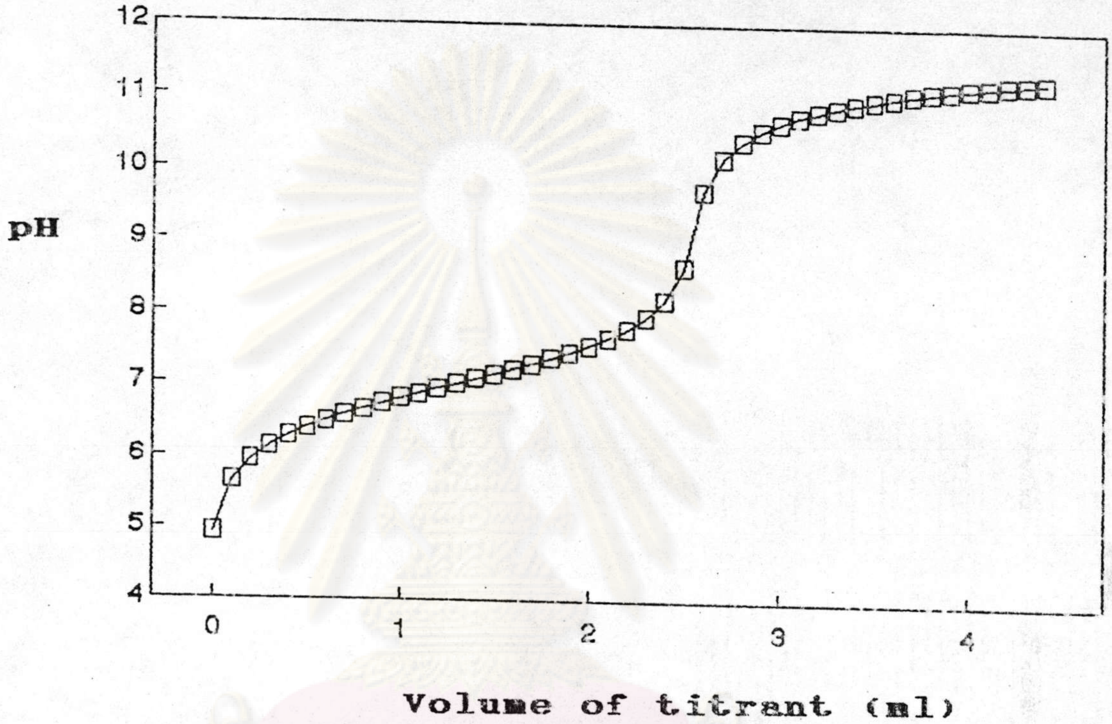

FIGURE 46 : Titration curve of p-nitrophenol in 0.1 M potassium chloride solution with sodium hydroxide solution

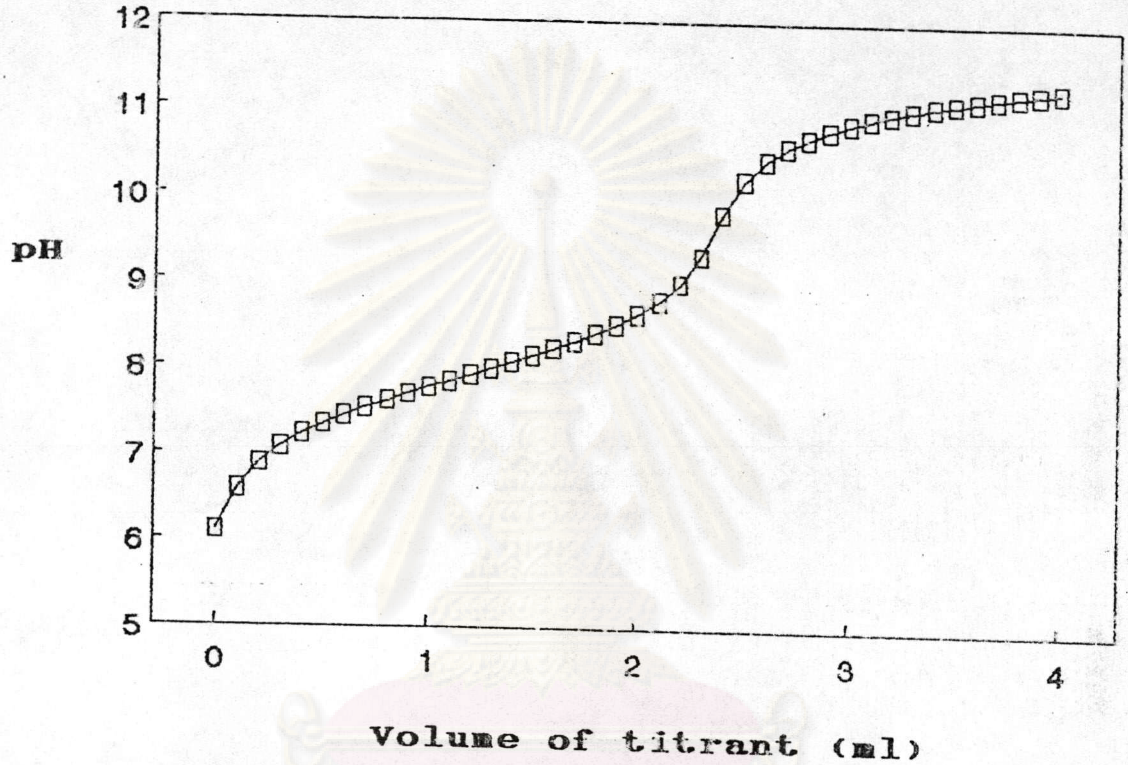

FIGURE 47 : Titration curve of pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

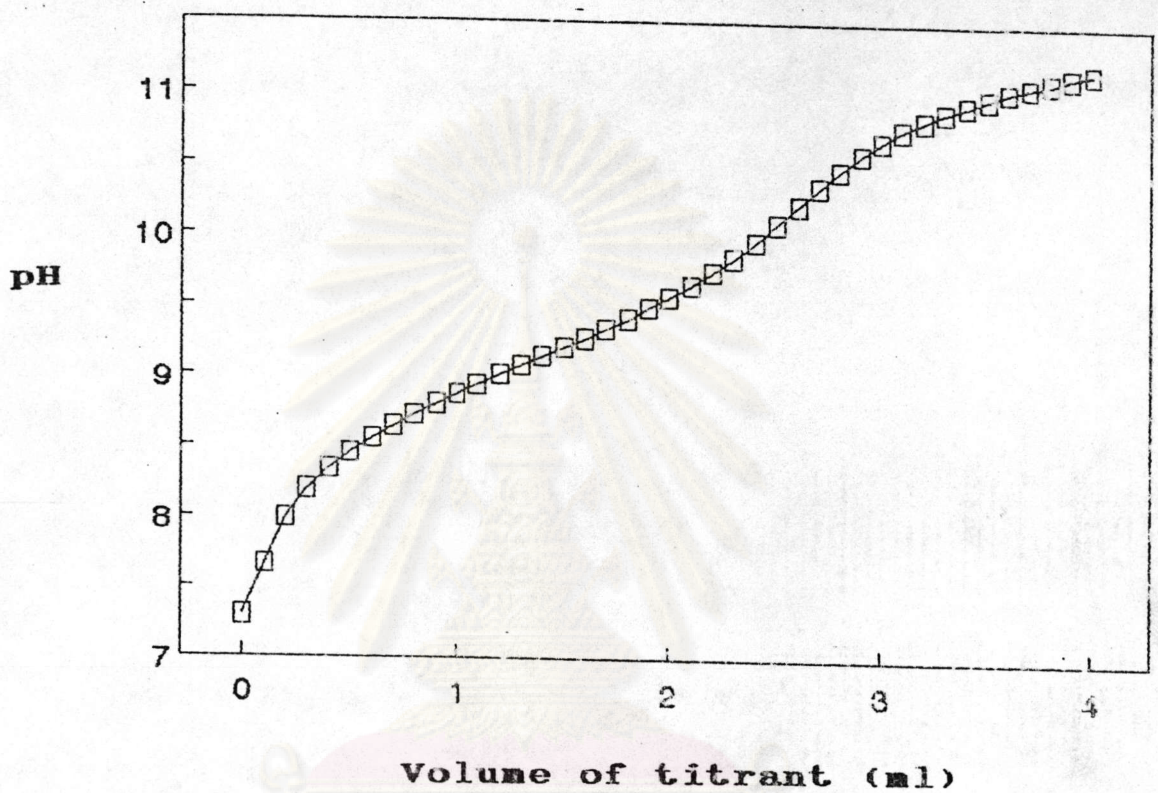

FIGURE 48 : Titration curve of boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

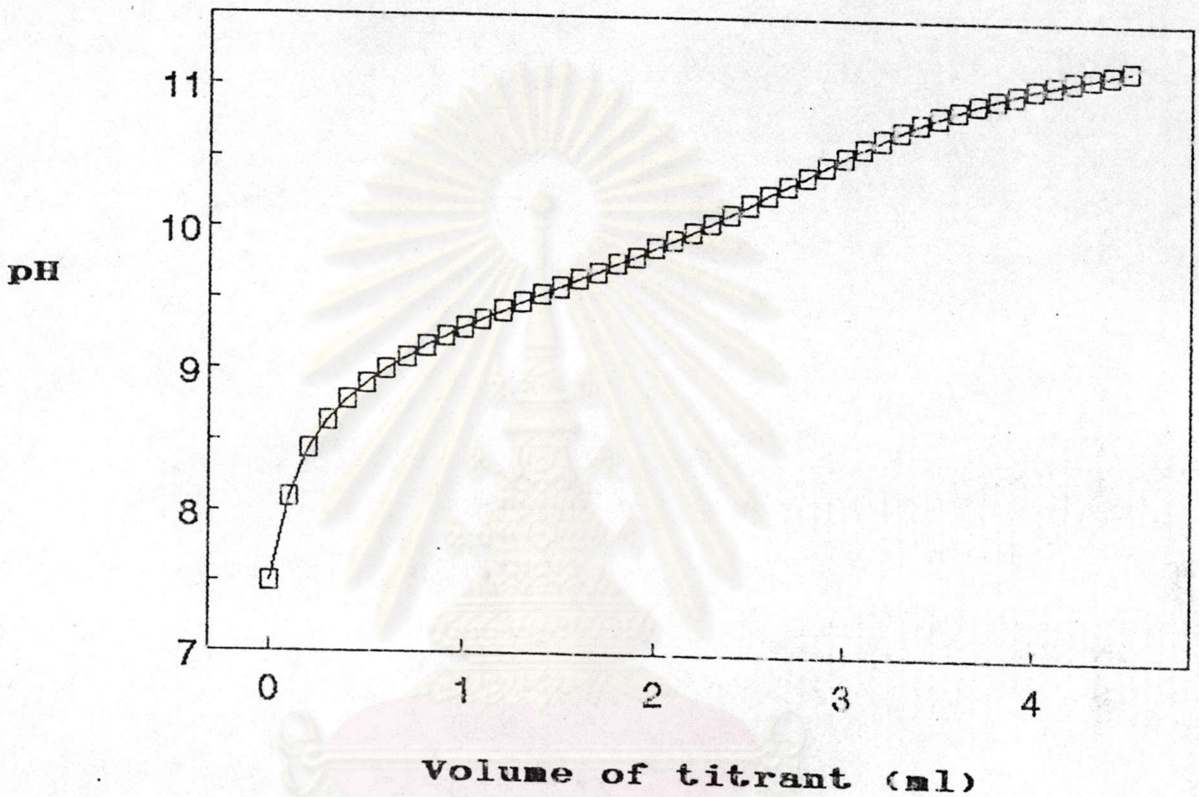

FIGURE 49 : Titration curve of ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

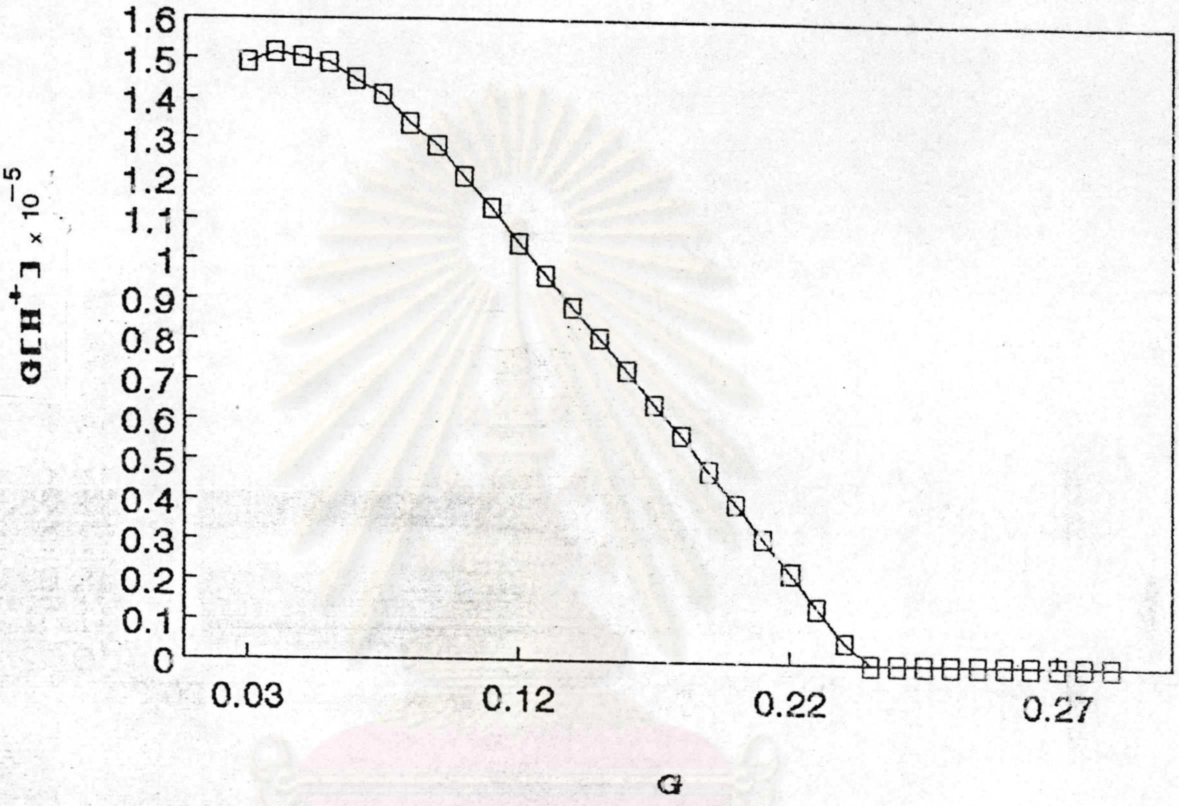

FIGURE 50 : Gran's plot (G plot) for the titration of benzoic acid in 0.1 M potassium chloride solution with sodium hydroxide solution

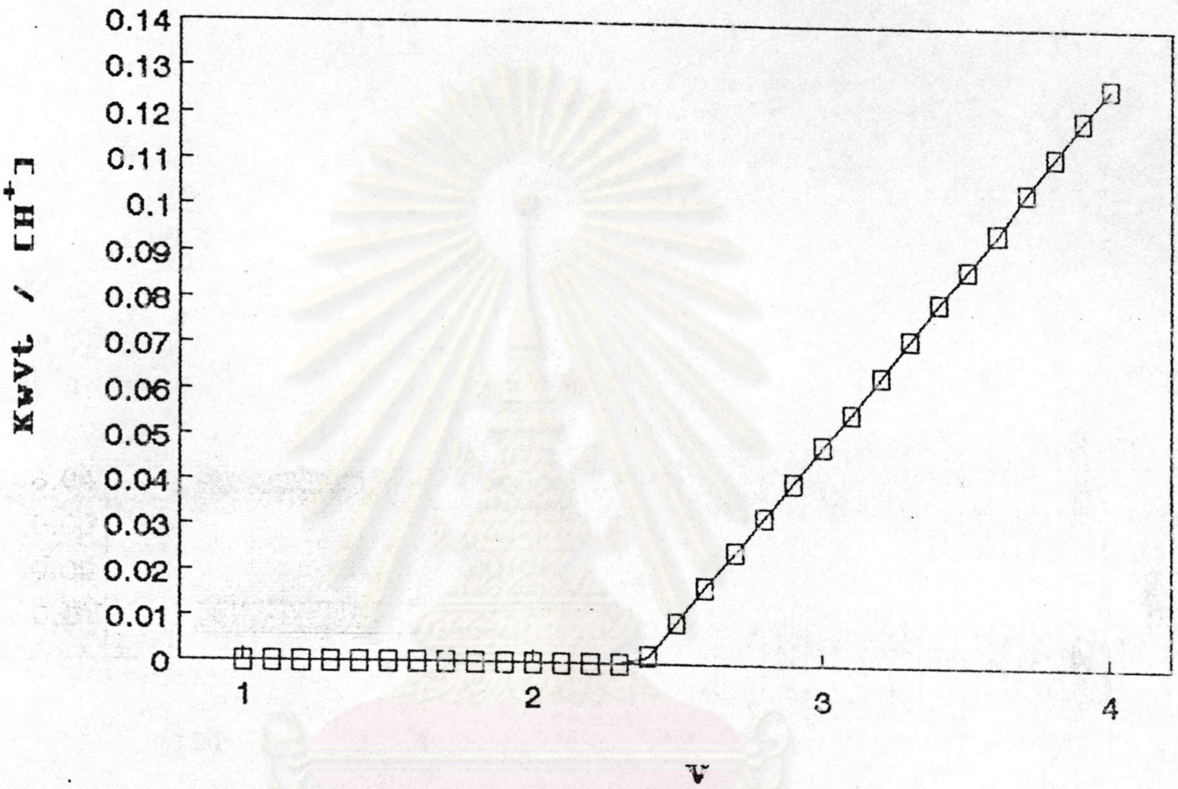

FIGURE 51 : Gran's plot (V plot) for the titration of benzoic acid in 0.1 M potassium chloride solution with sodium hydroxide solution

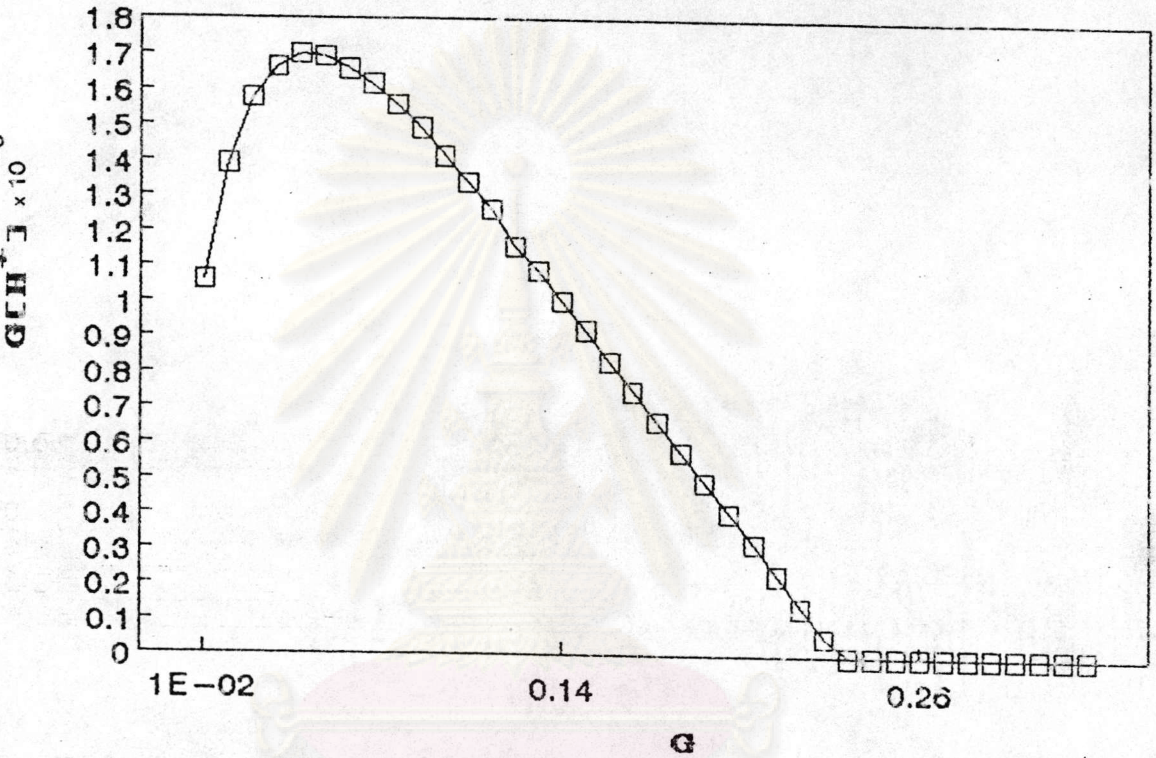

FIGURE 52 : Gran's plot (G plot) for the titration of potassium biphthalate in 0.1 M potassium chloride solution with sodium hydroxide solution

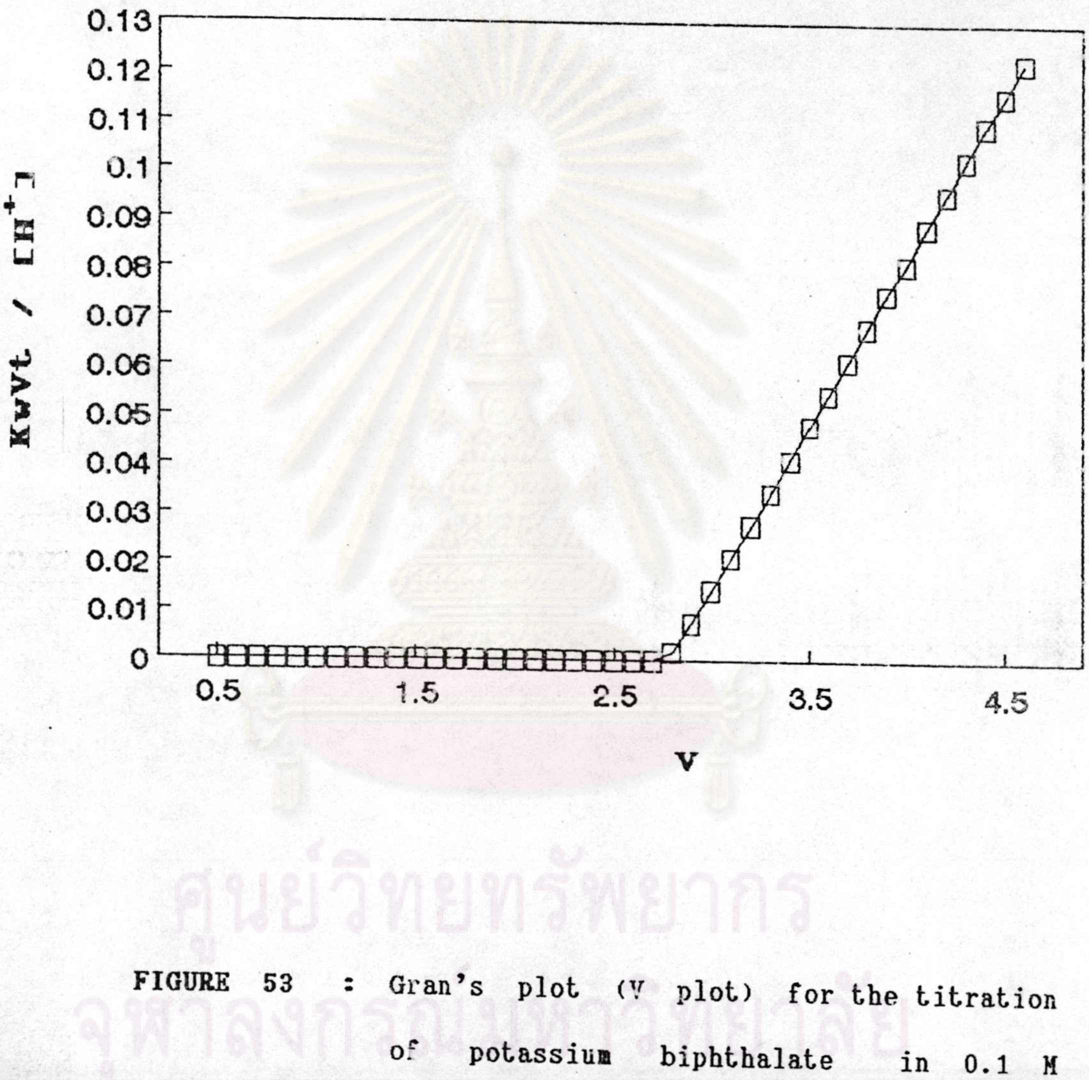

FIGURE 53 : Gran's plot (V plot) for the titration of potassium biphthalate in 0.1 M potassium chloride solution with sodium hydroxide solution

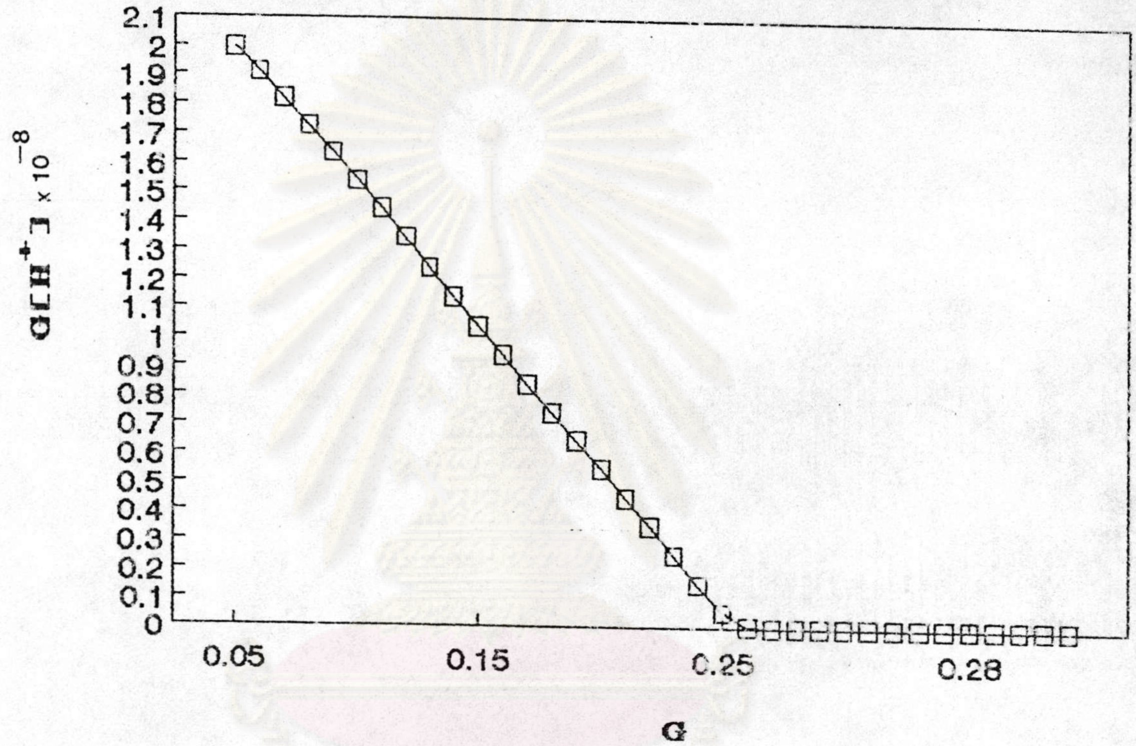

FIGURE 54 : Gran's plot (G plot) for the titration of p-nitrophenol in 0.1 M potassium chloride solution with sodium hydroxide solution

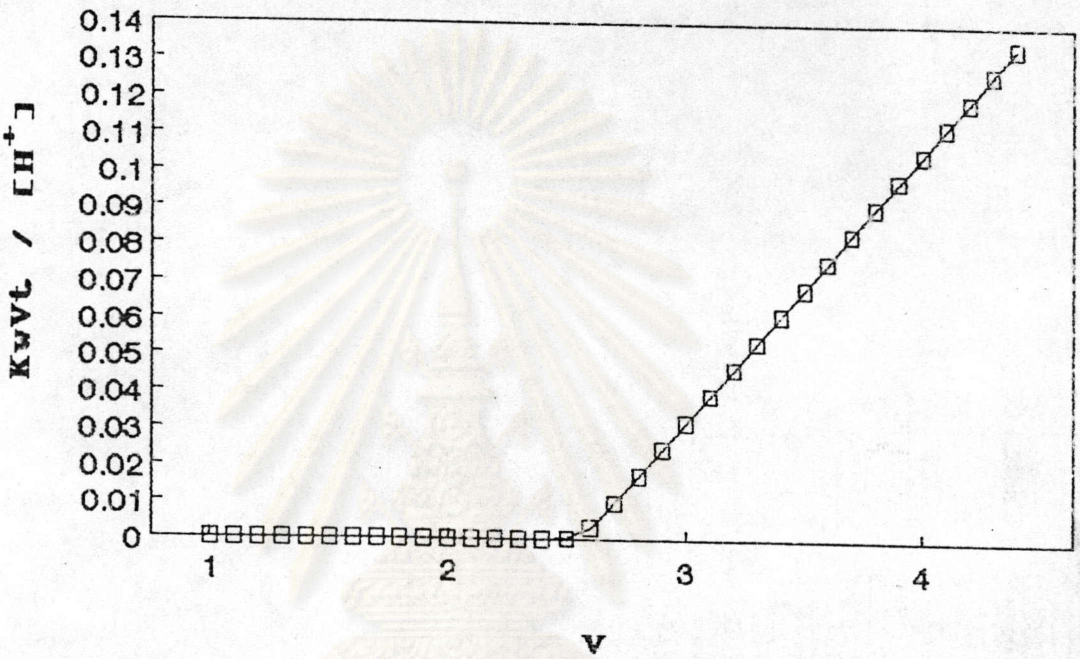

FIGURE 55 : Gran's plot (V plot) for the titration of p-nitrophenol in 0.1 M potassium chloride solution with sodium hydroxide solution

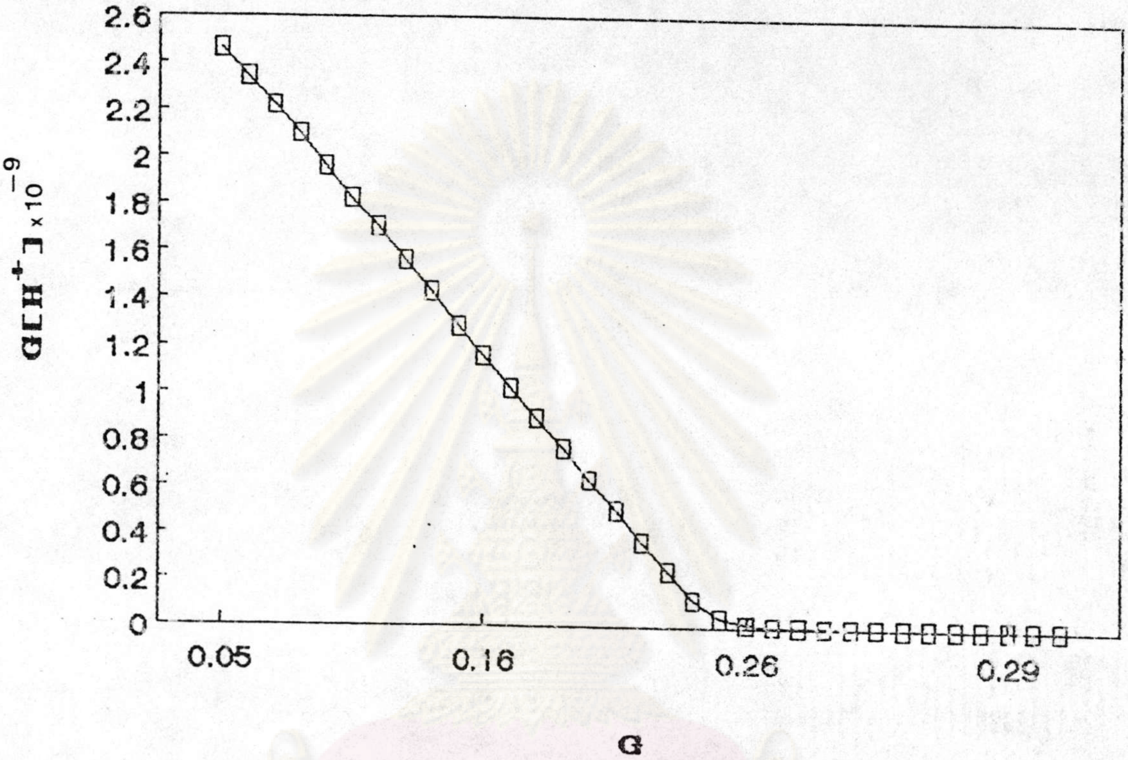

FIGURE 56 : Gran's plot (G plot) for the titration of pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

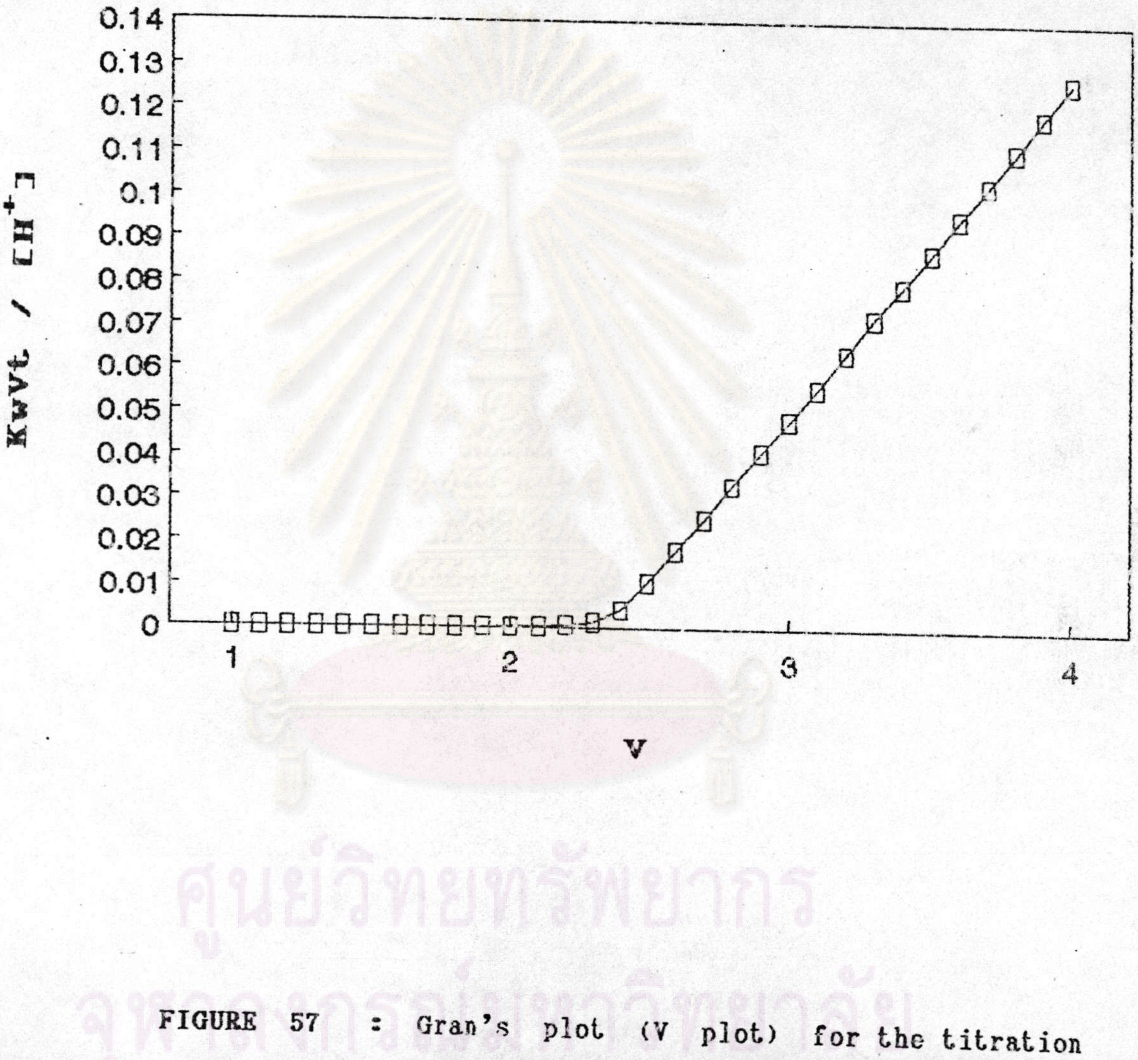

FIGURE 57 : Gran's plot (V plot) for the titration of pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

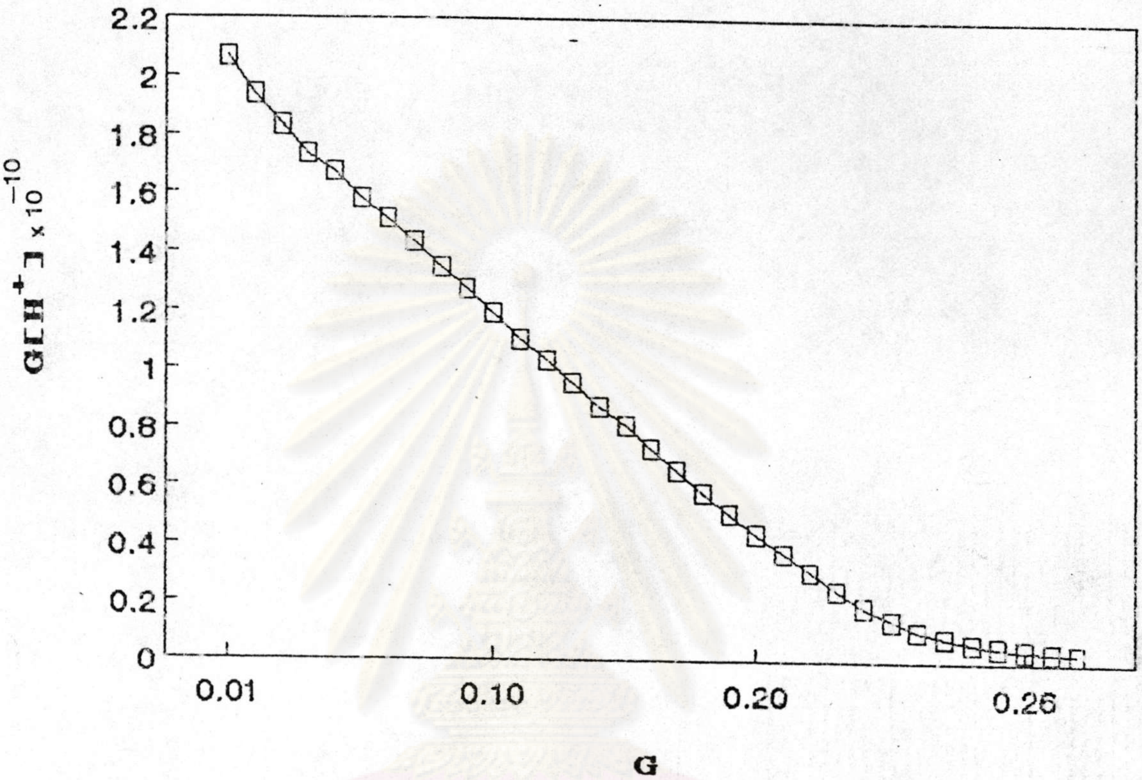

FIGURE 58 : Gran's plot (G plot) for the titration of boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

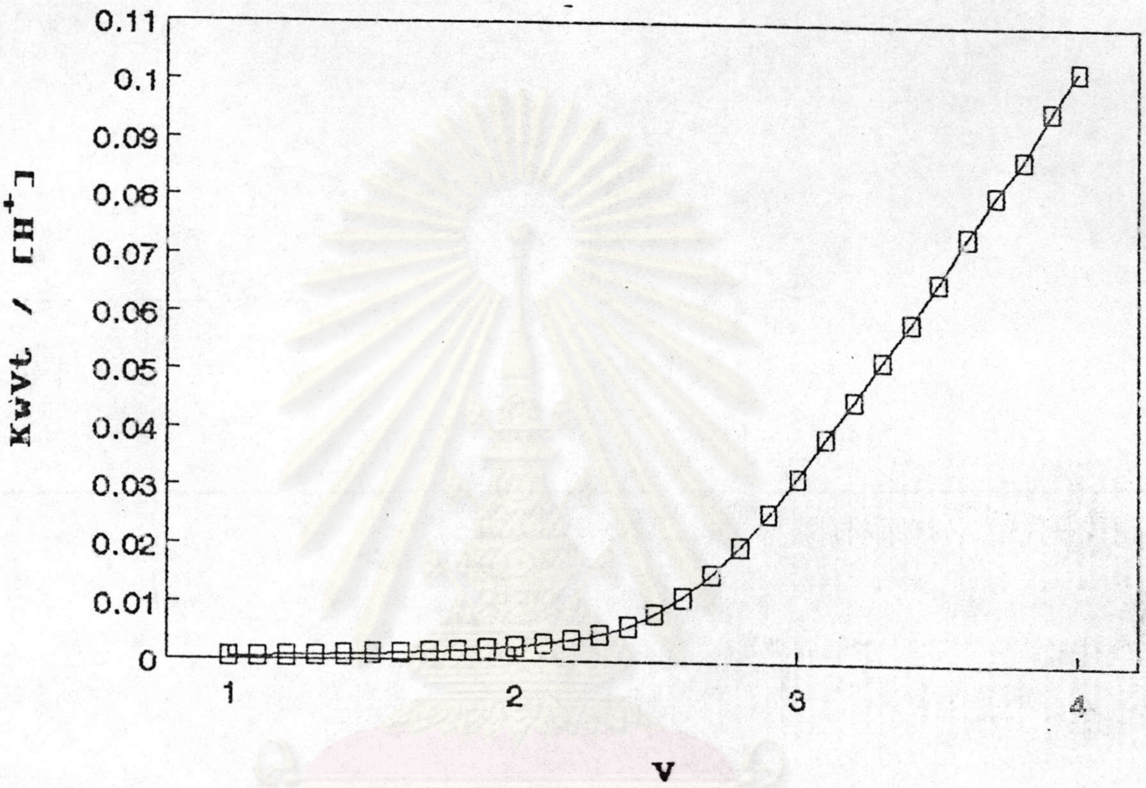

FIGURE 59 : Gran's plot (V plot) for the titration of boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

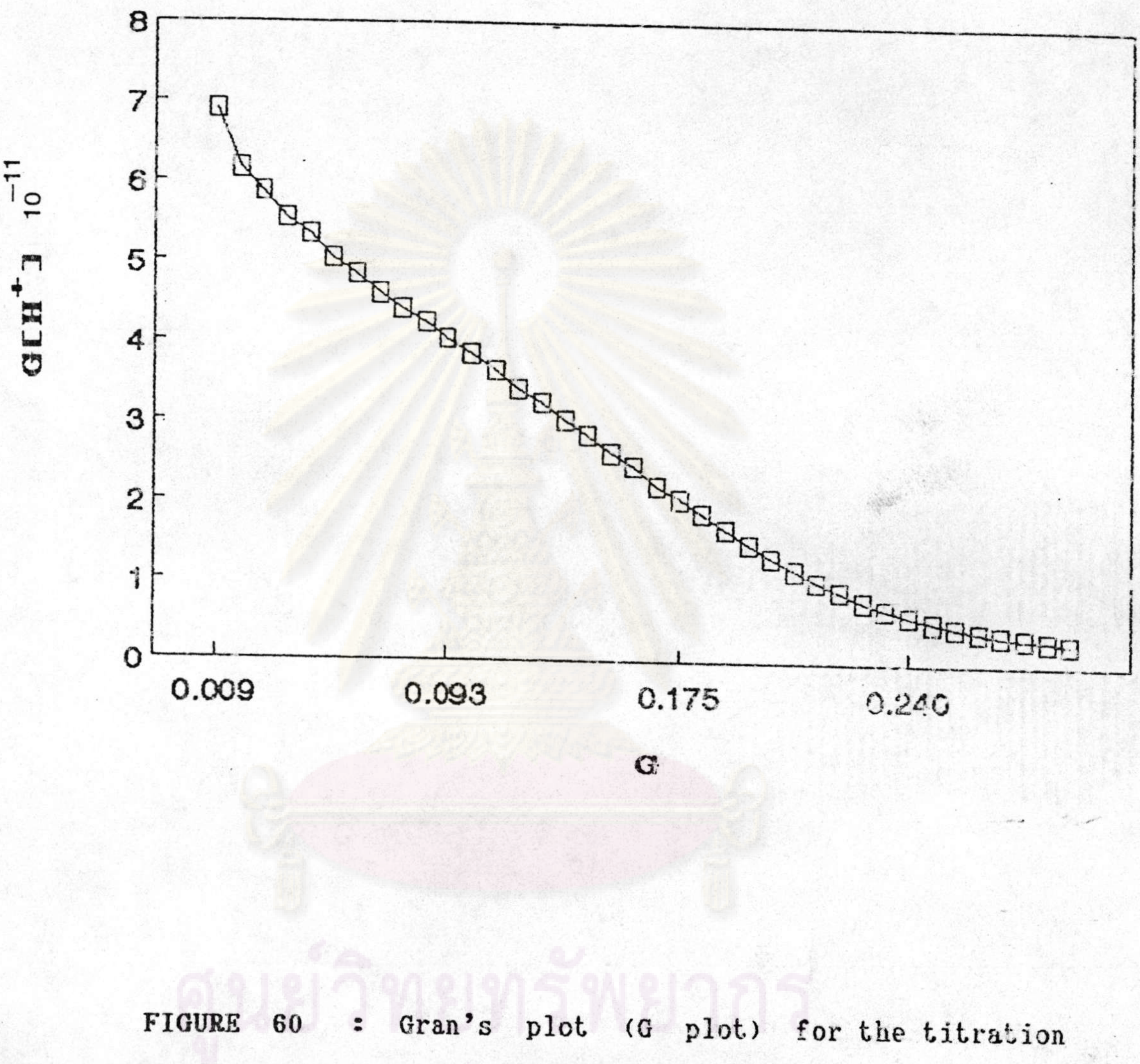

FIGURE 60 : Gran's plot (G plot) for the titration of ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

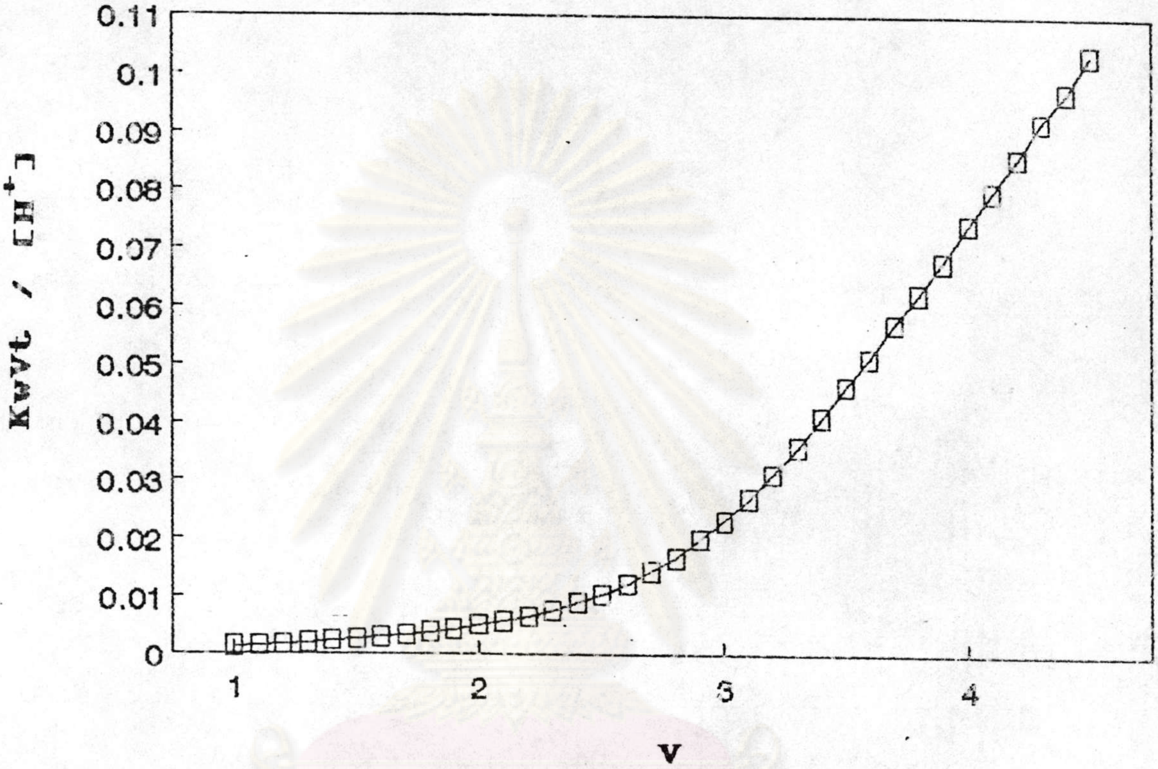

FIGURE 61 : Gran's plot (V plot) for the titration of ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

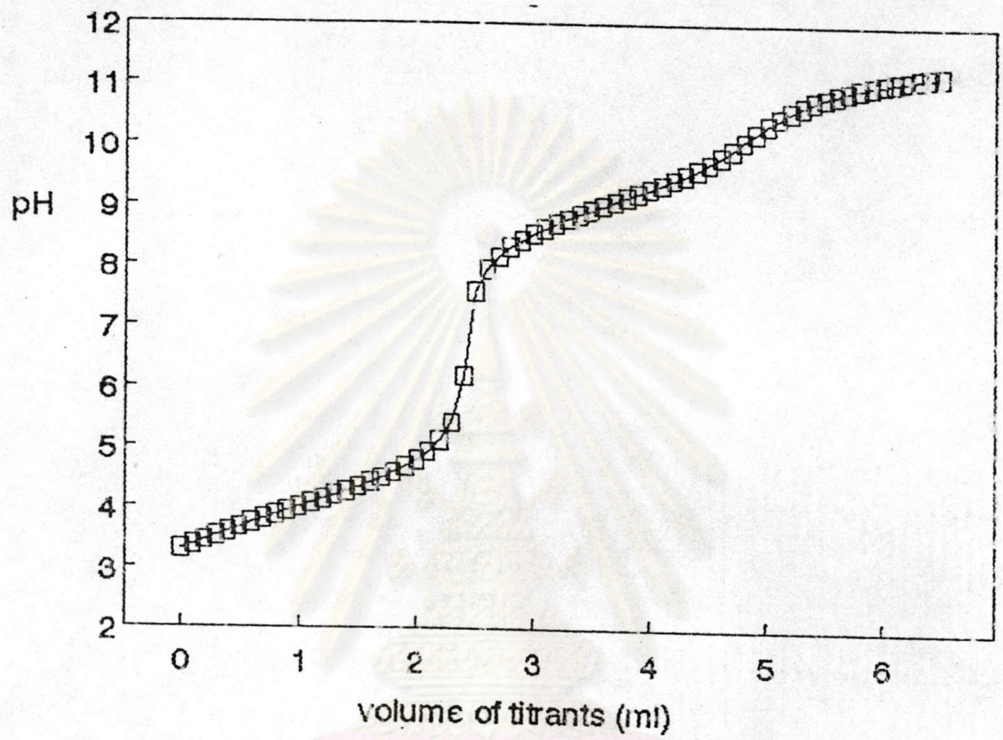

FIGURE 62 : Titration curve of the mixture of benzoic acid and boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

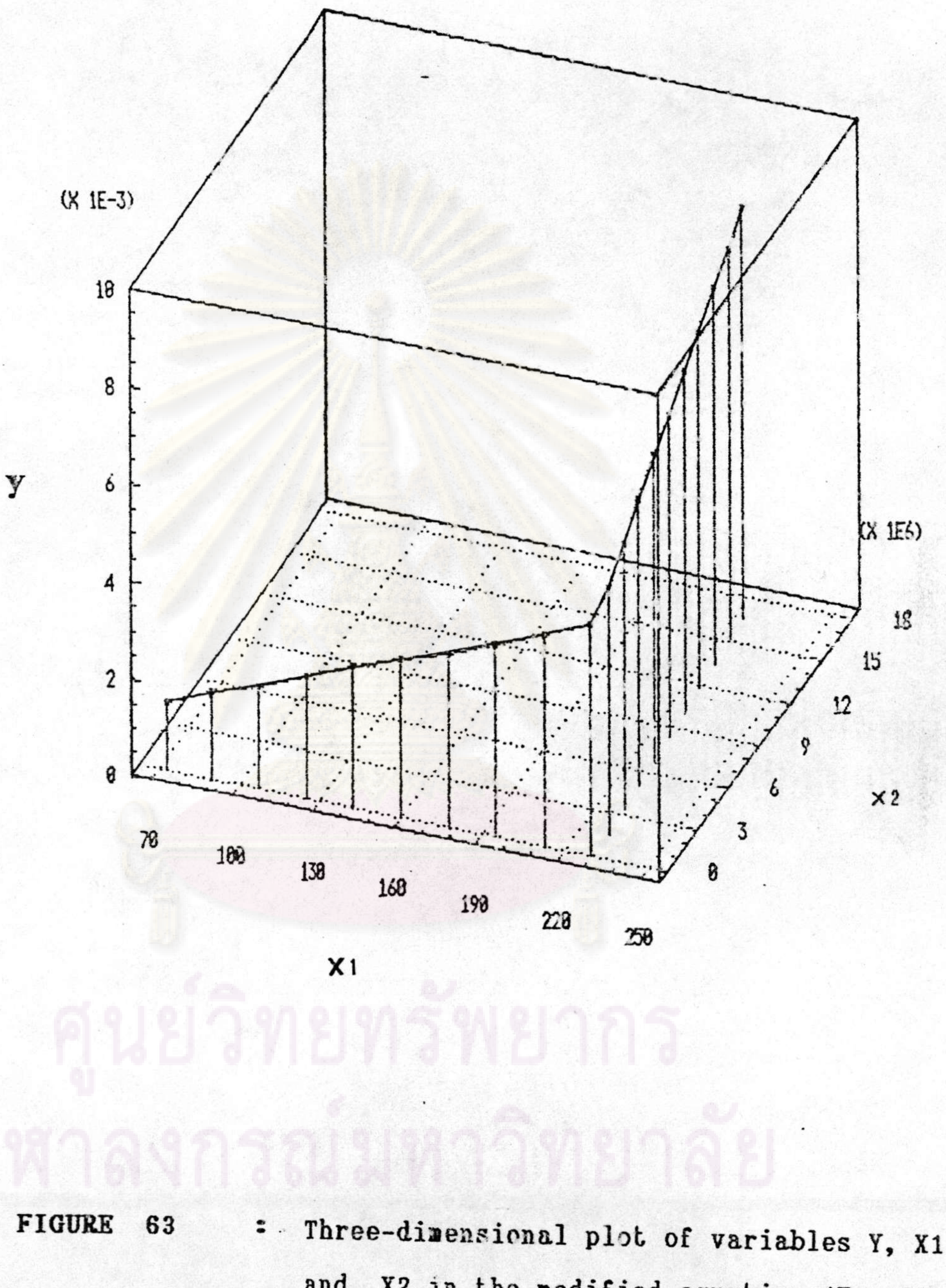

FIGURE 63 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of benzoic acid and boric acid

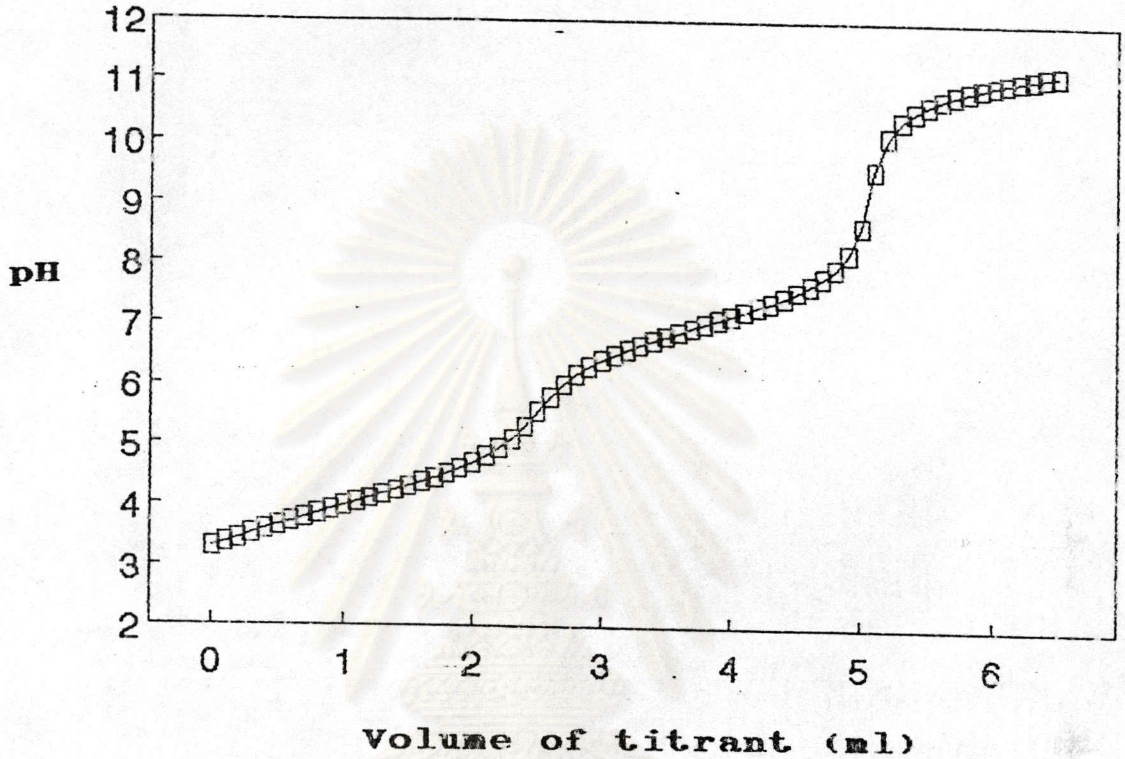

FIGURE 64 : Titration curve of the mixture of benzoic acid and p-nitrophenol in 0.1 M potassium chloride solution with sodium hydroxide solution

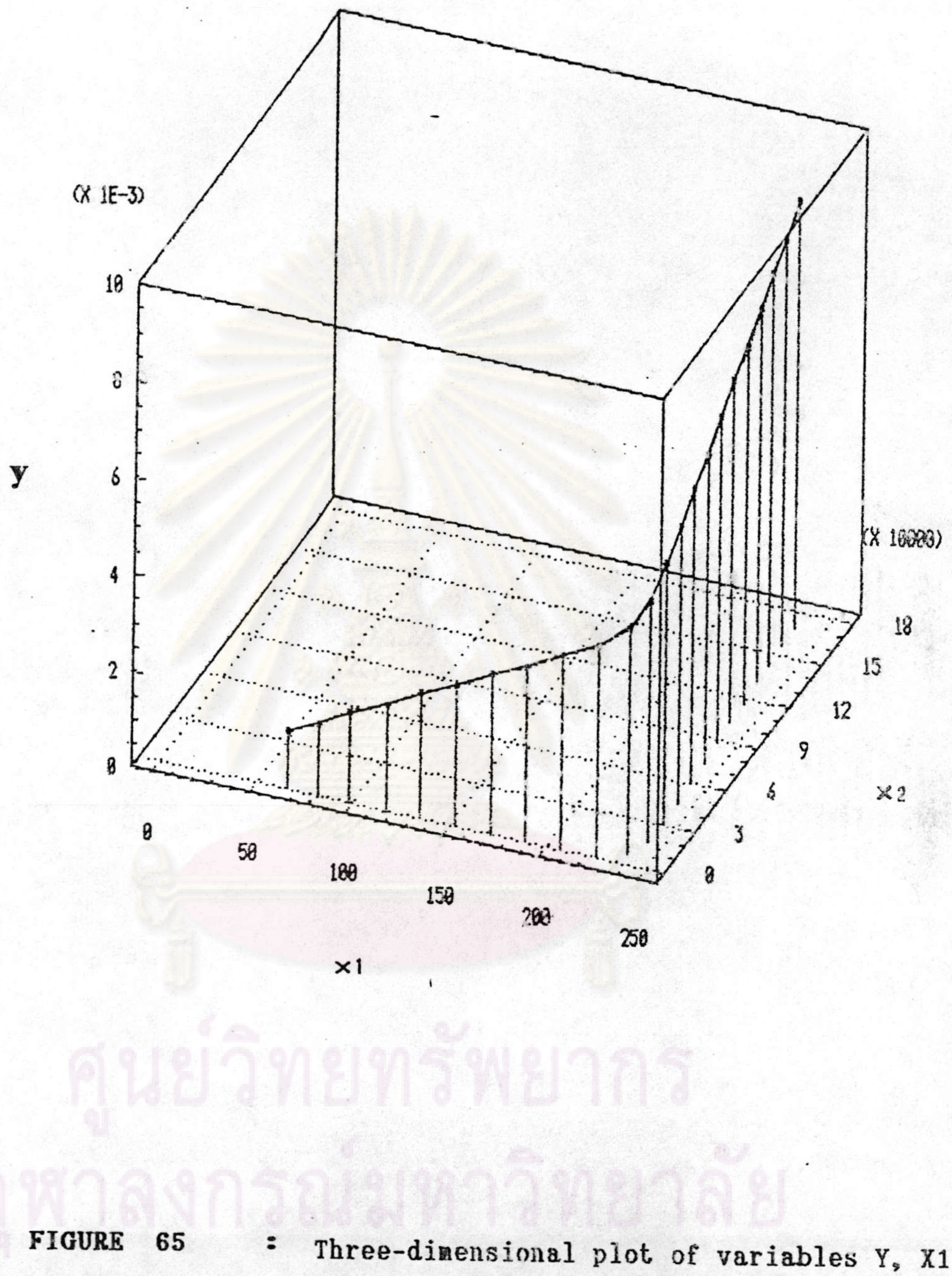

FIGURE 65 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of benzoic acid and p-nitrophenol

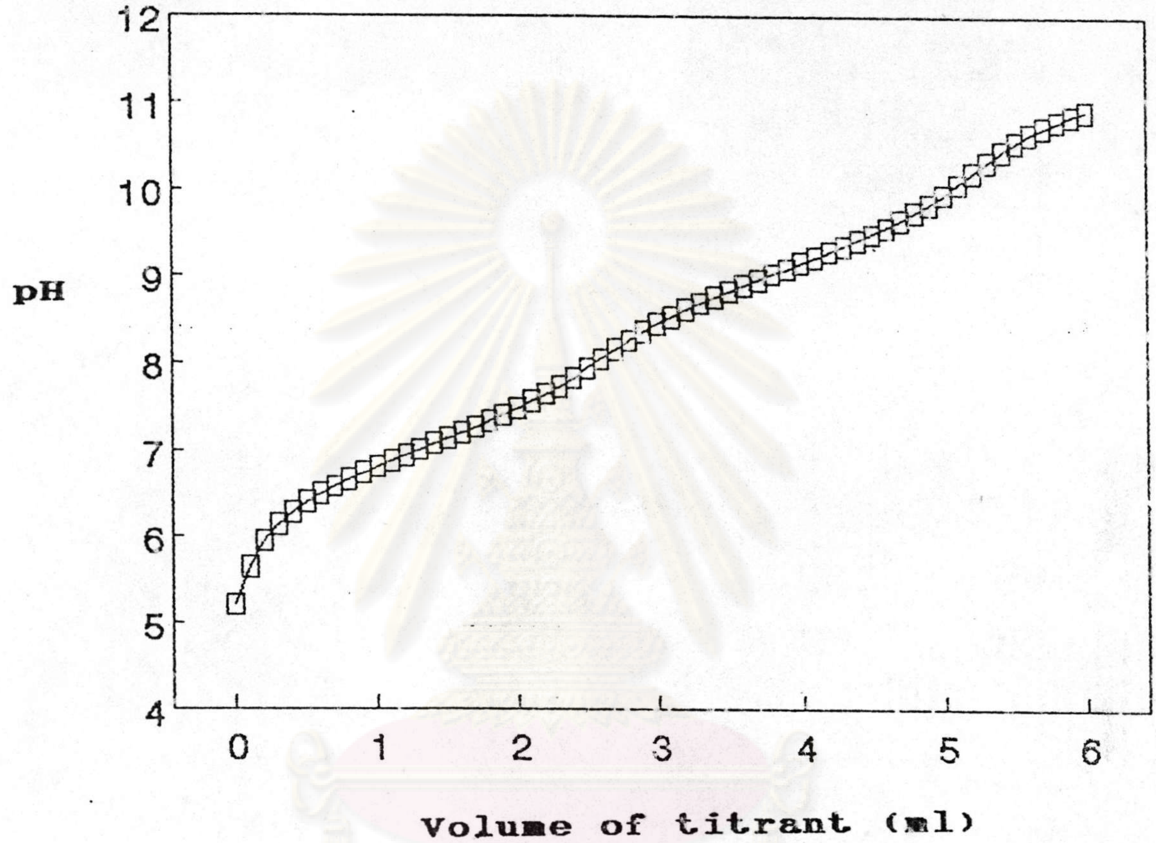

FIGURE 66 : Titration curve of the mixture of p- nitrophenol and boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

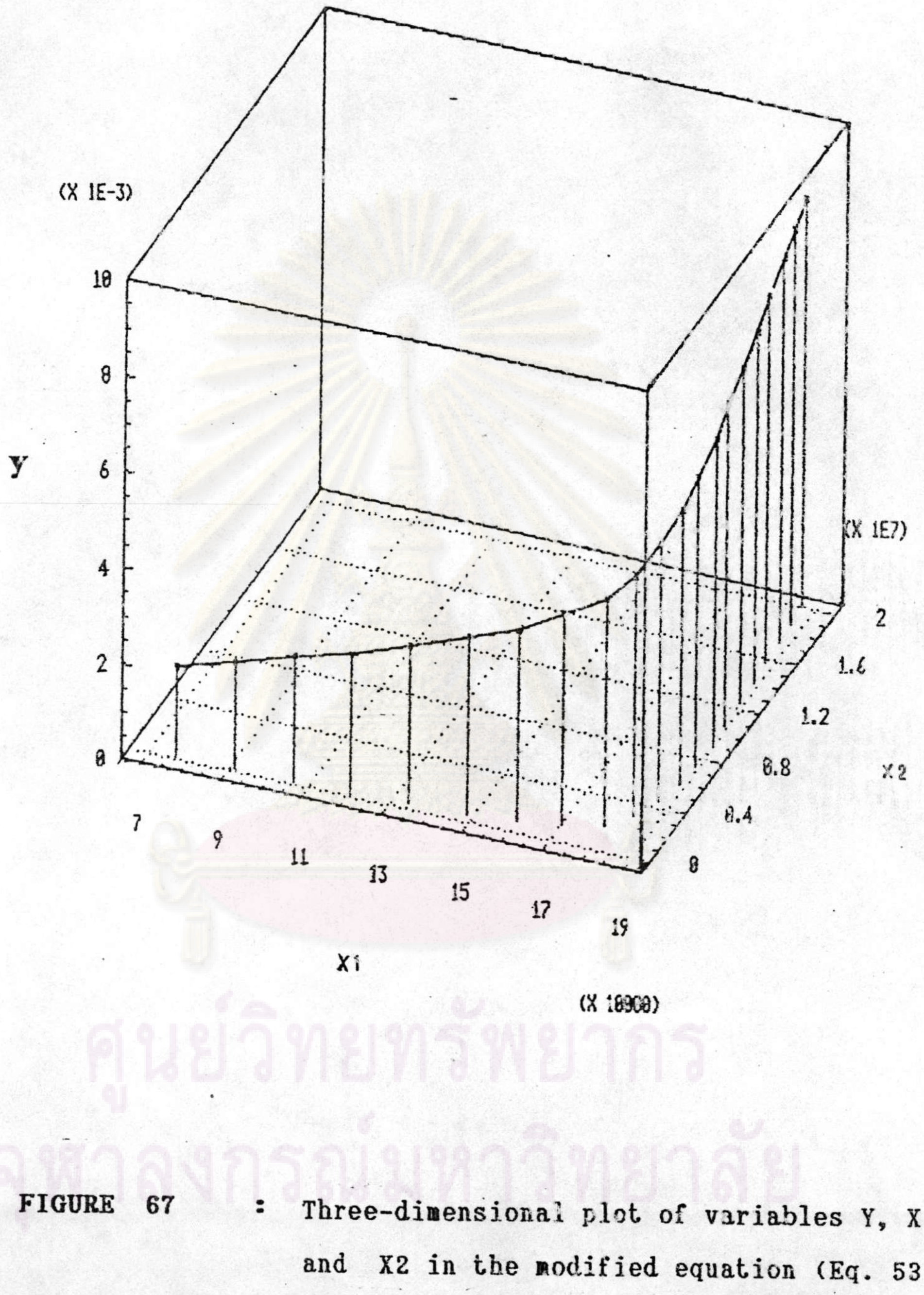

FIGURE 67 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of p-nitrophenol and boric acid

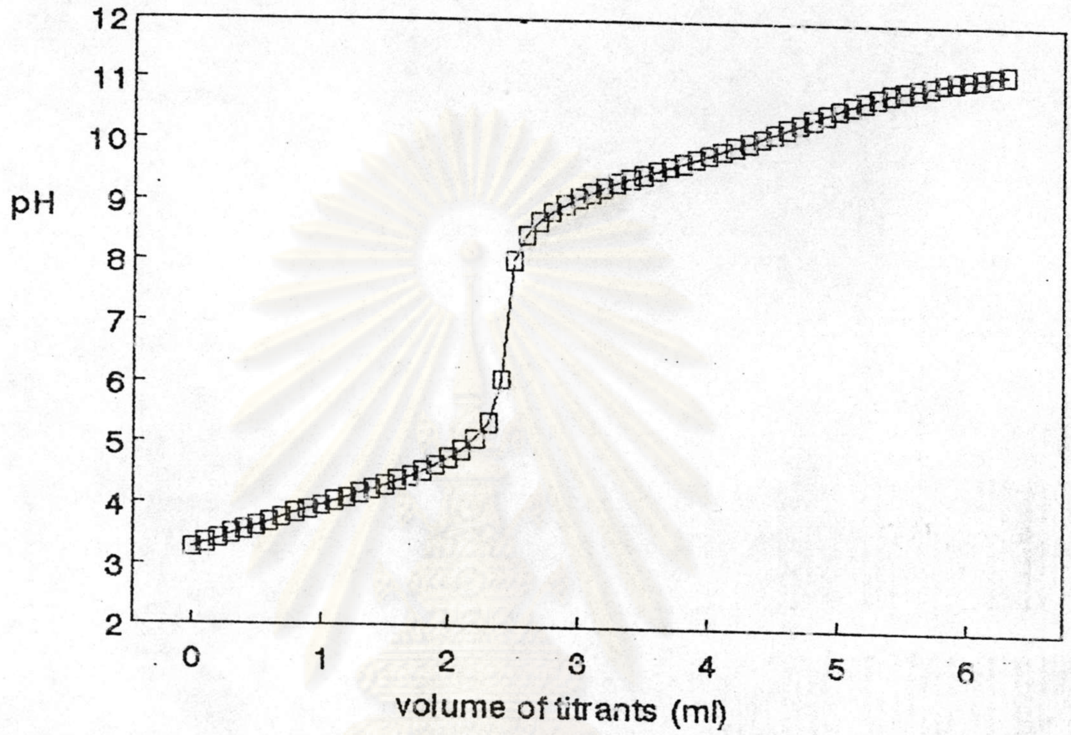

FIGURE 68 : Titration curve of the mixture of benzoic acid and ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

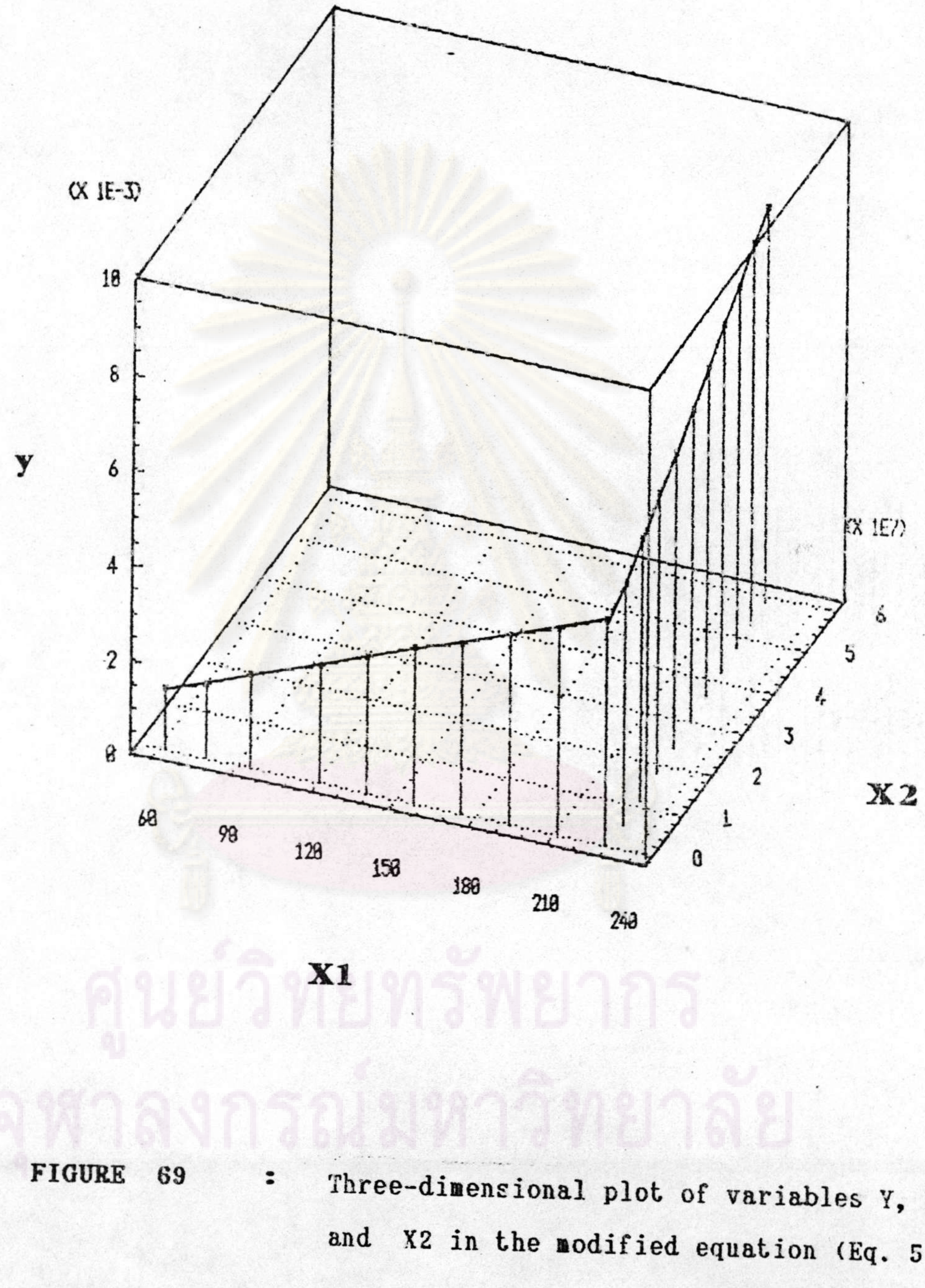

FIGURE 69 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of benzoic acid and ephedrine hydrochloride

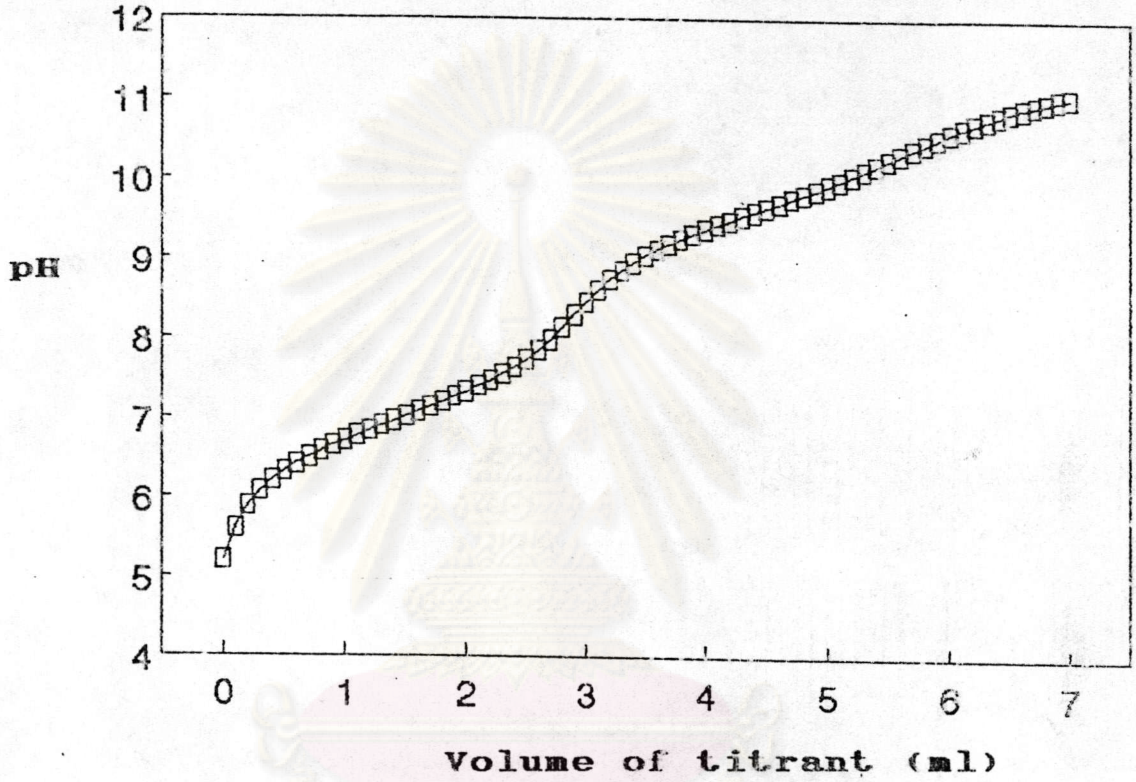

FIGURE 70 : Titration curve of the mixture of p- nitrophenol and ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

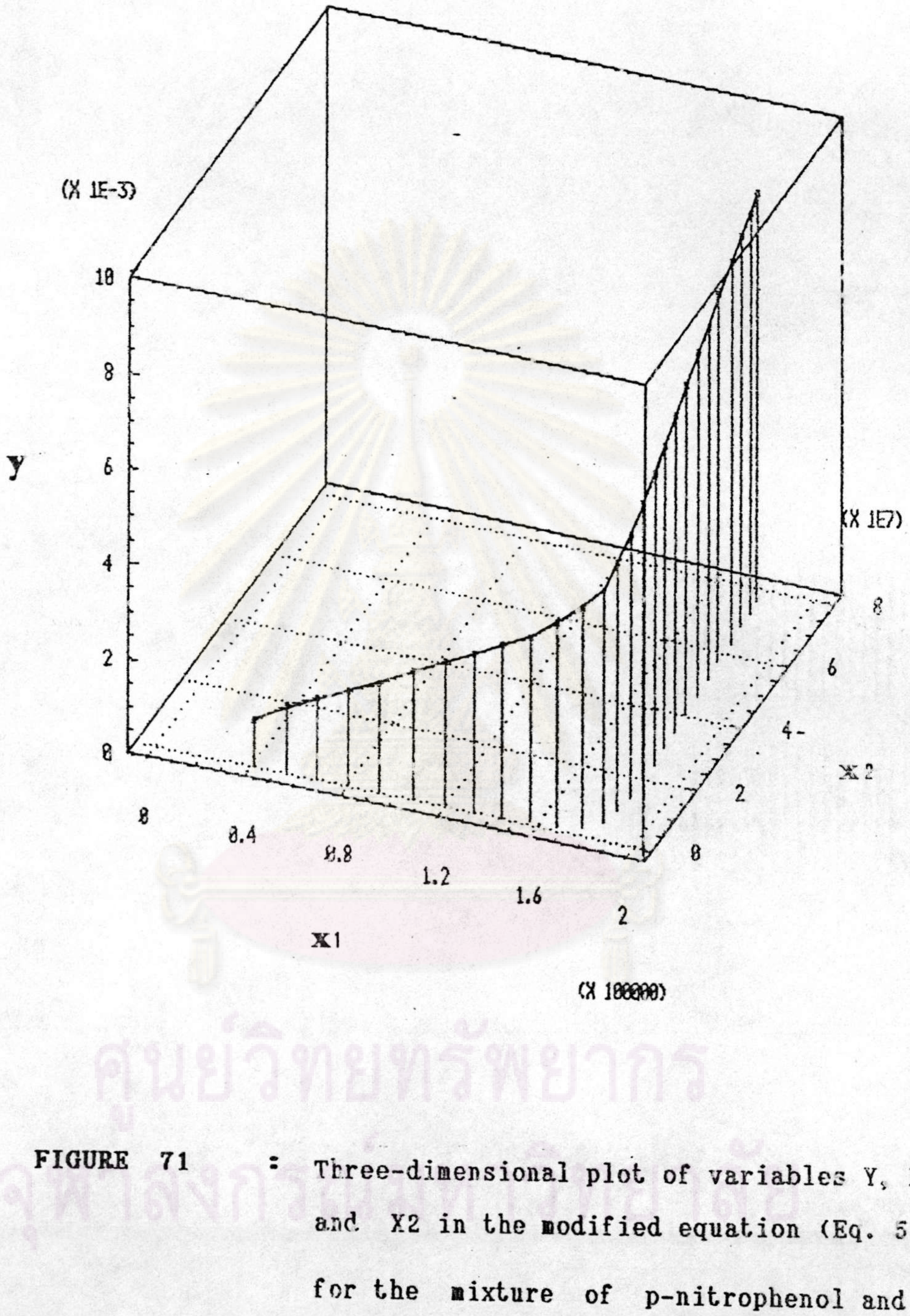

FIGURE 71 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of p-nitrophenol and ephedrine hydrochloride

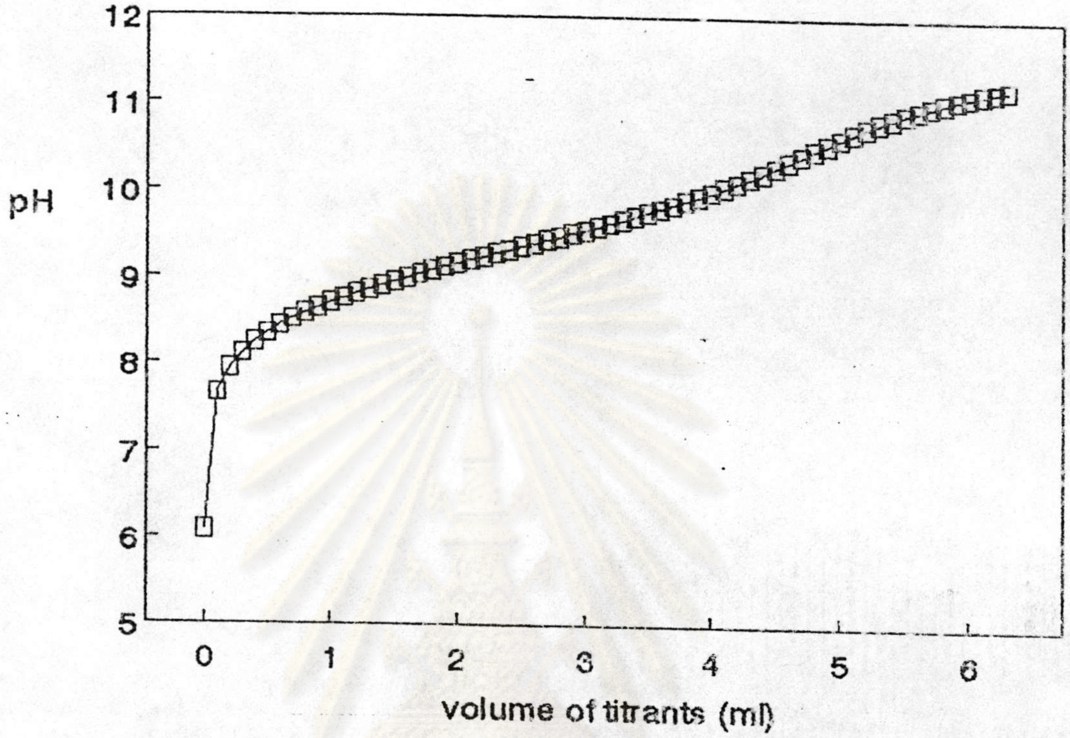

FIGURE 72 : Titration curve of the mixture of boric acid and ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

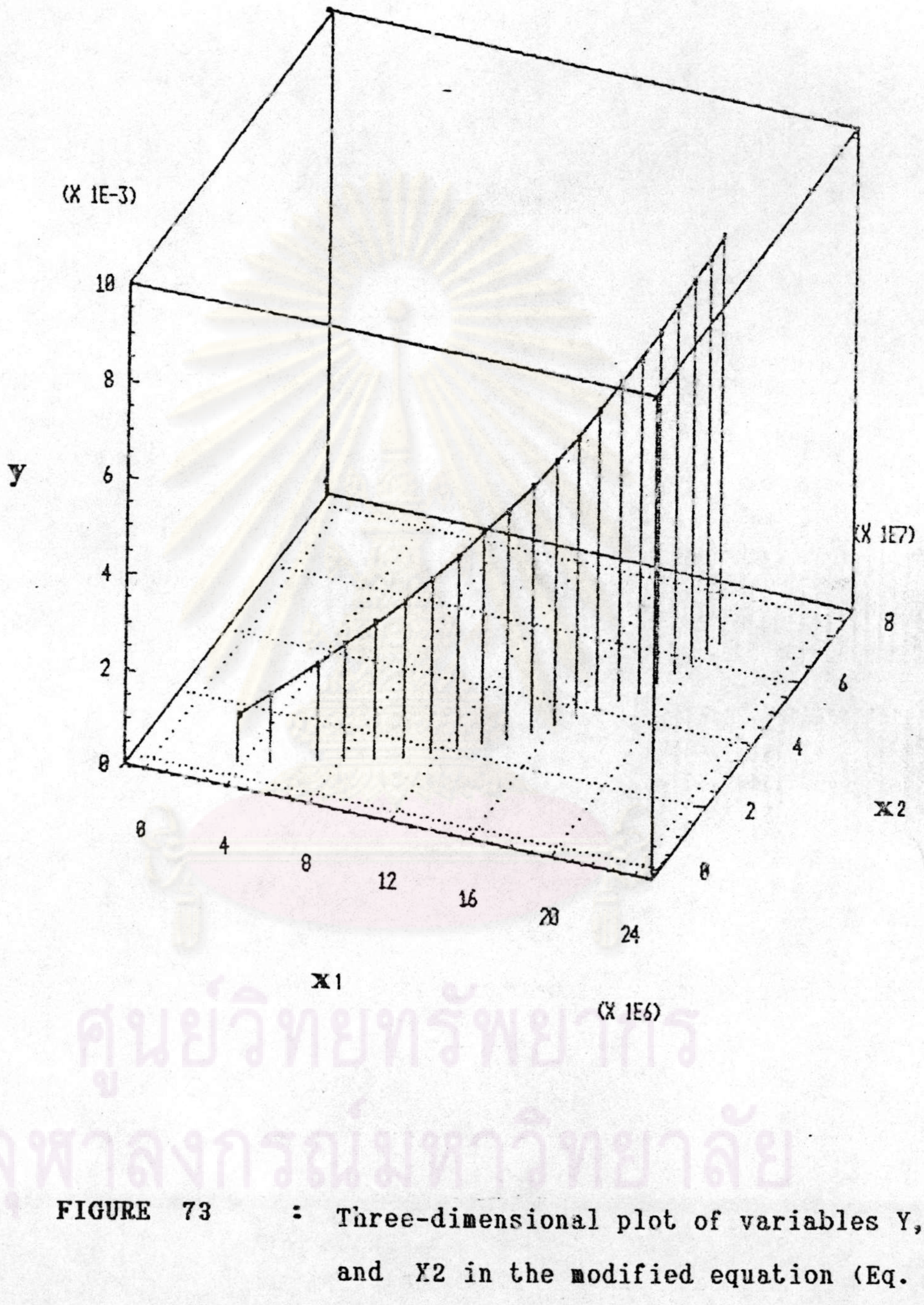

FIGURE 73 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of boric acid and ephedrine hydrochloride

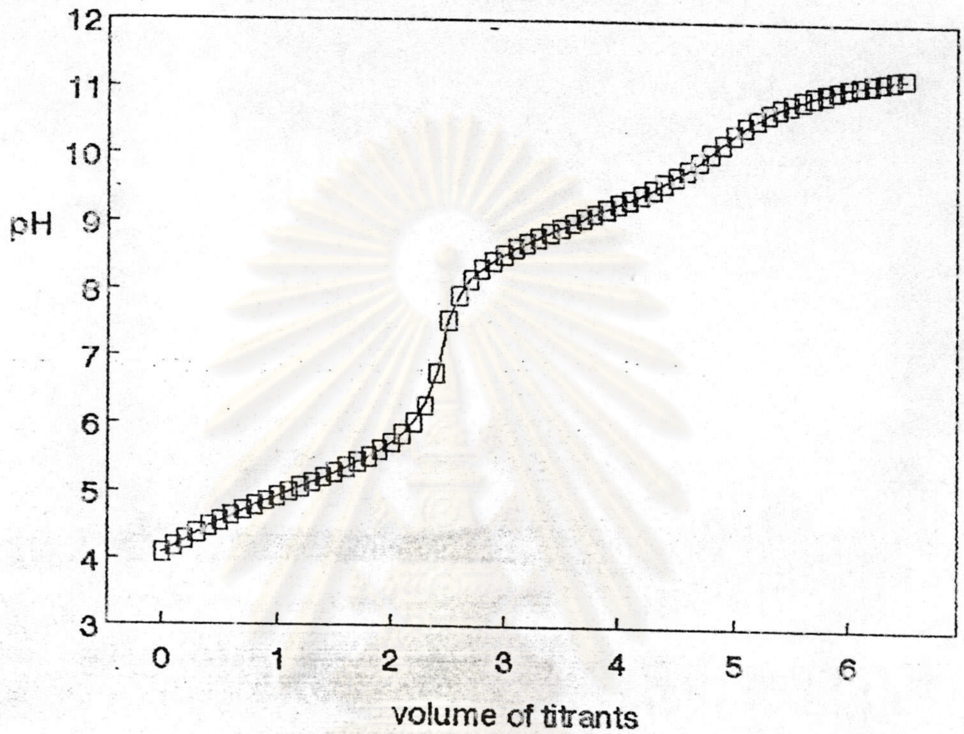

FIGURE 74 : Titration curve of the mixture of potassium biphthalate and boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

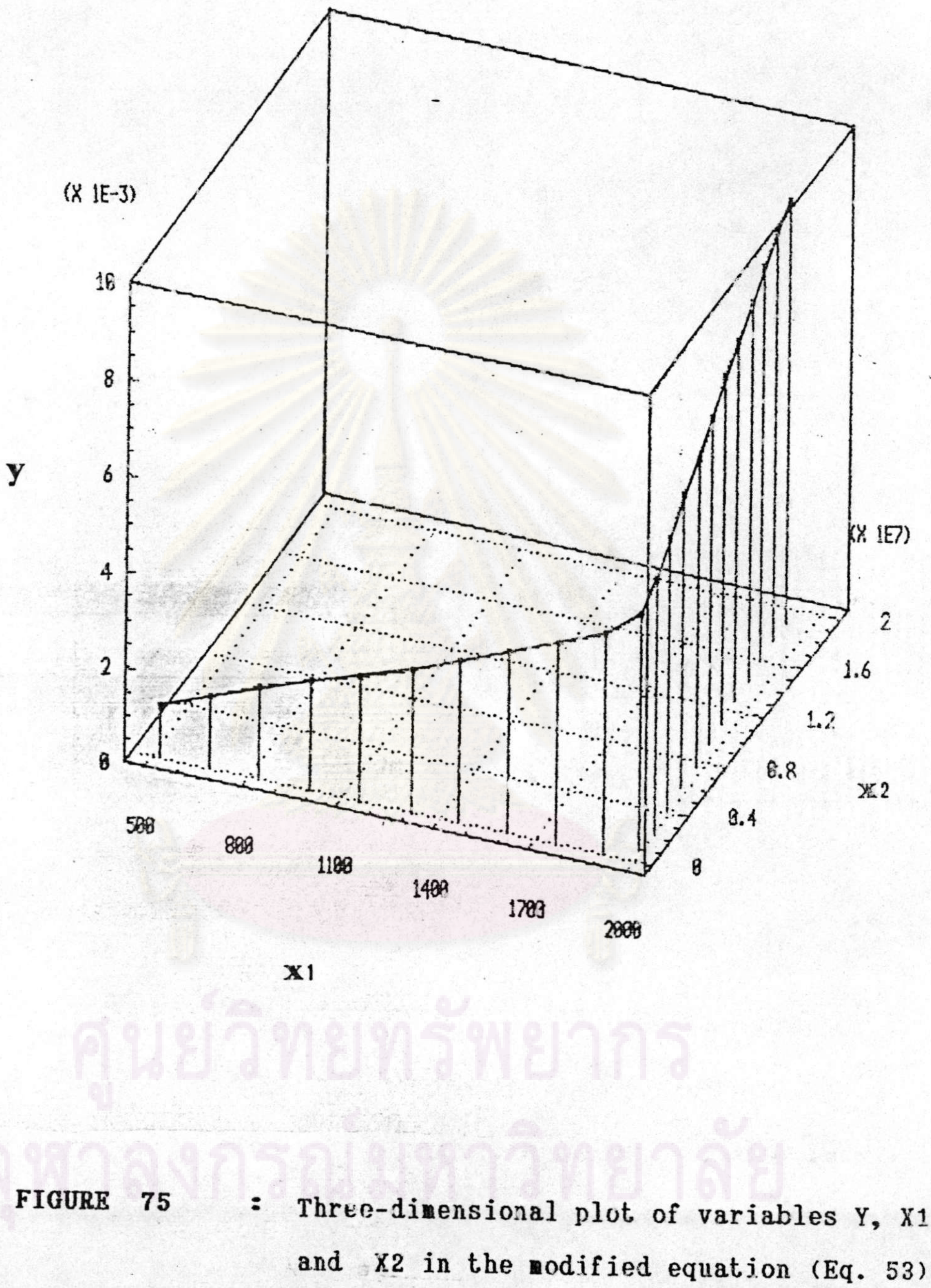

FIGURE 75 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of potassium biphthalate and boric acid

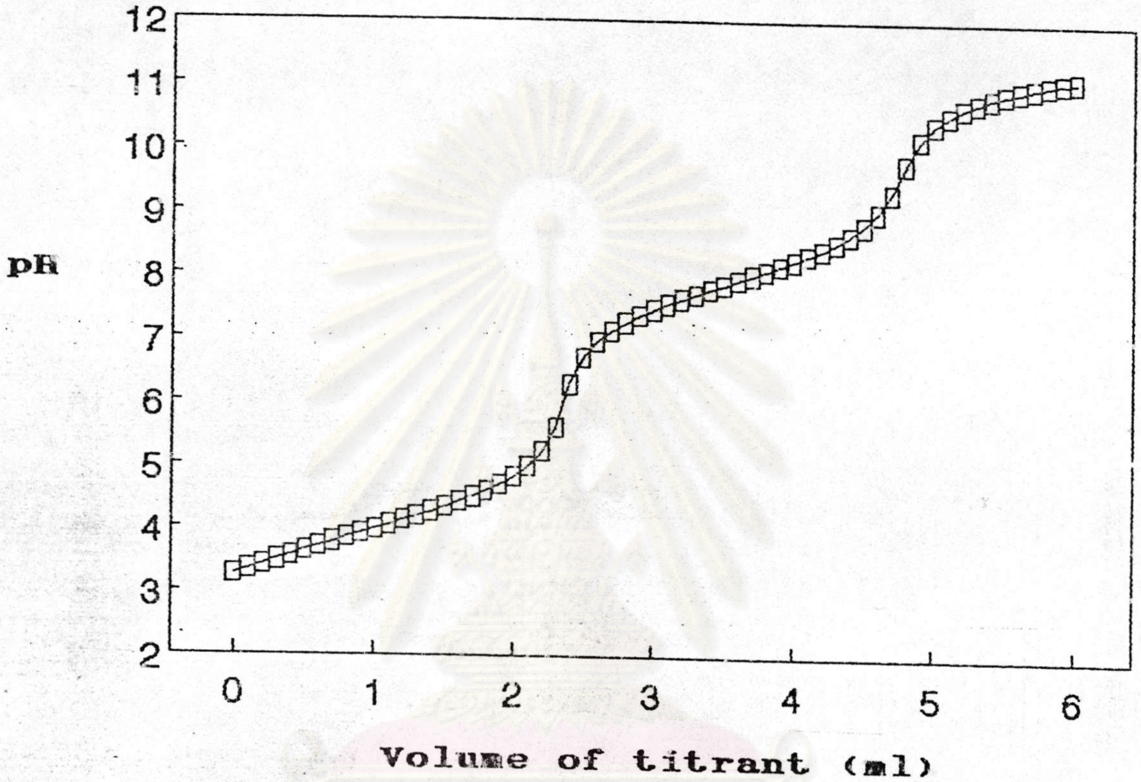

FIGURE 76 : Titration curve of the mixture of benzoic acid and pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

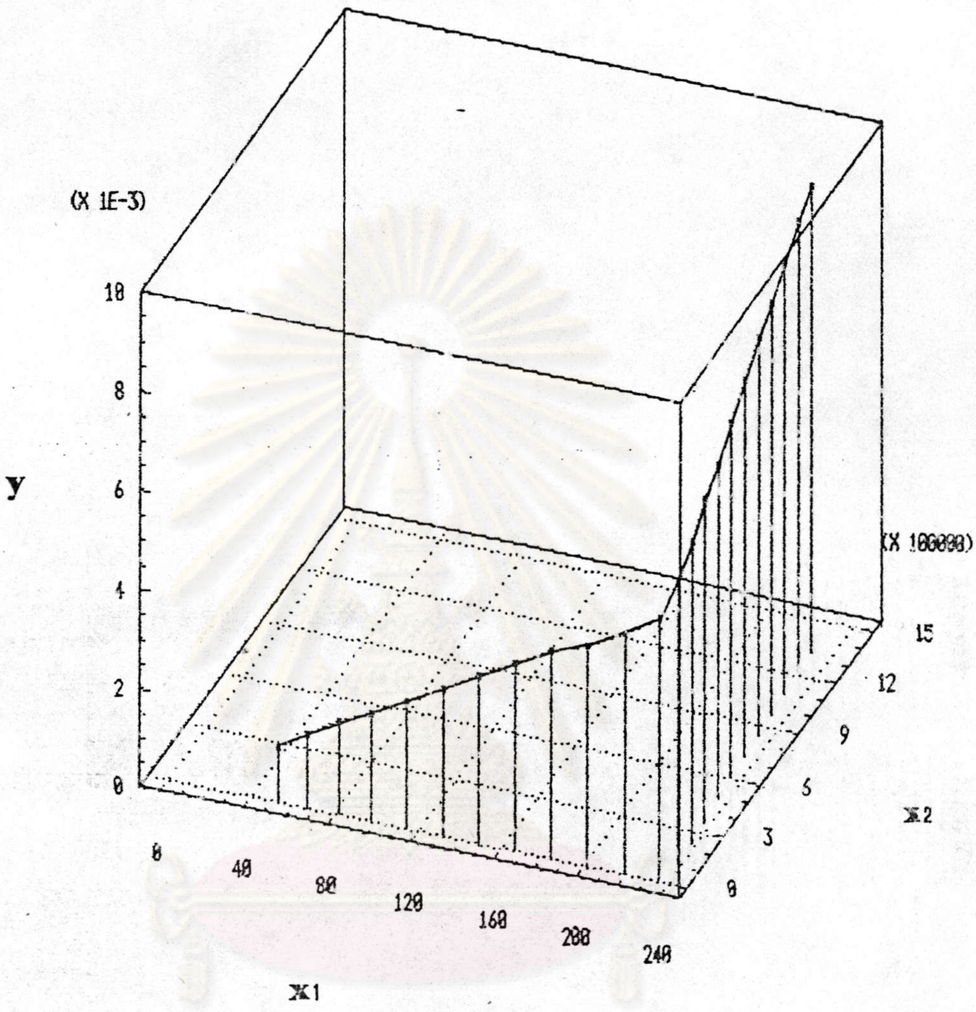

FIGURE 77 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of benzoic acid and pralidoxime chloride

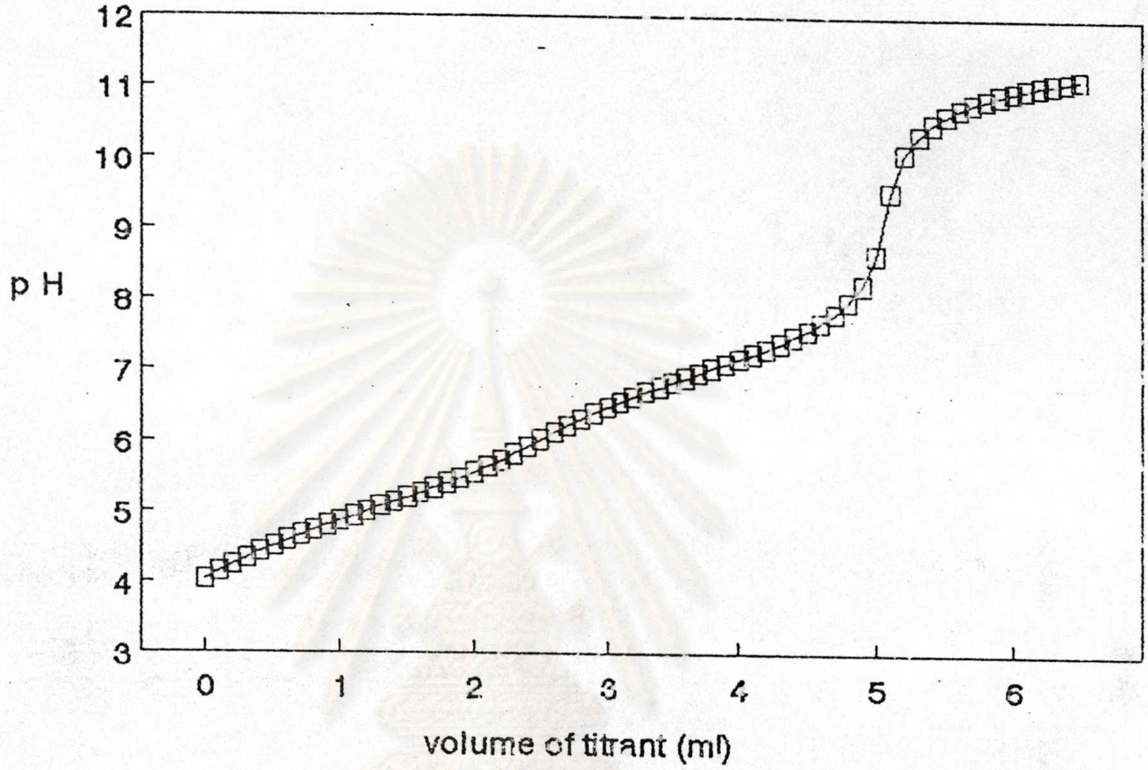

FIGURE 78 : Titration curve of the mixture of potassium biphthalate and p-nitrophenol in 0.1 M potassium chloride solution with sodium hydroxide solution

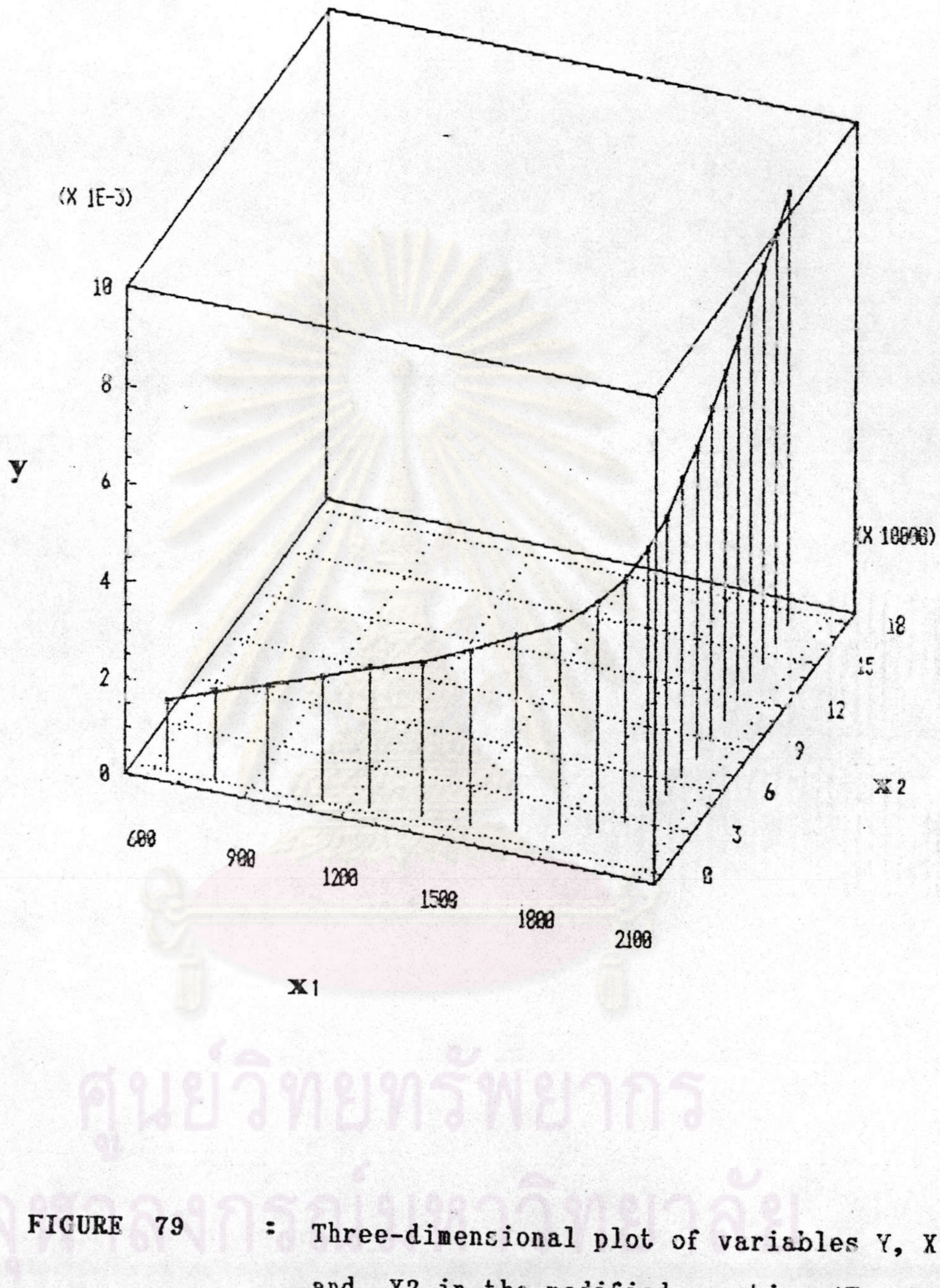

FIGURE 79 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of potassium biphthalate and p-nitrophenol

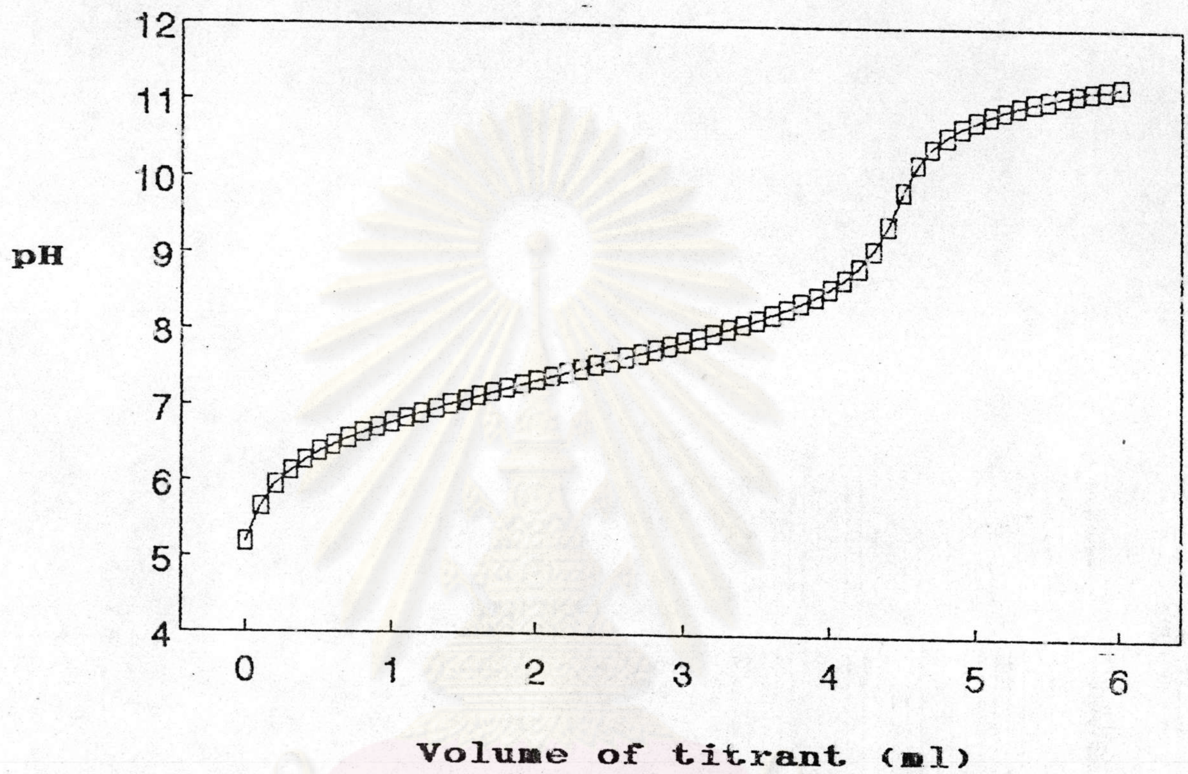

FIGURE 80 : Titration curve of the mixture of p-nitrophenol and pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

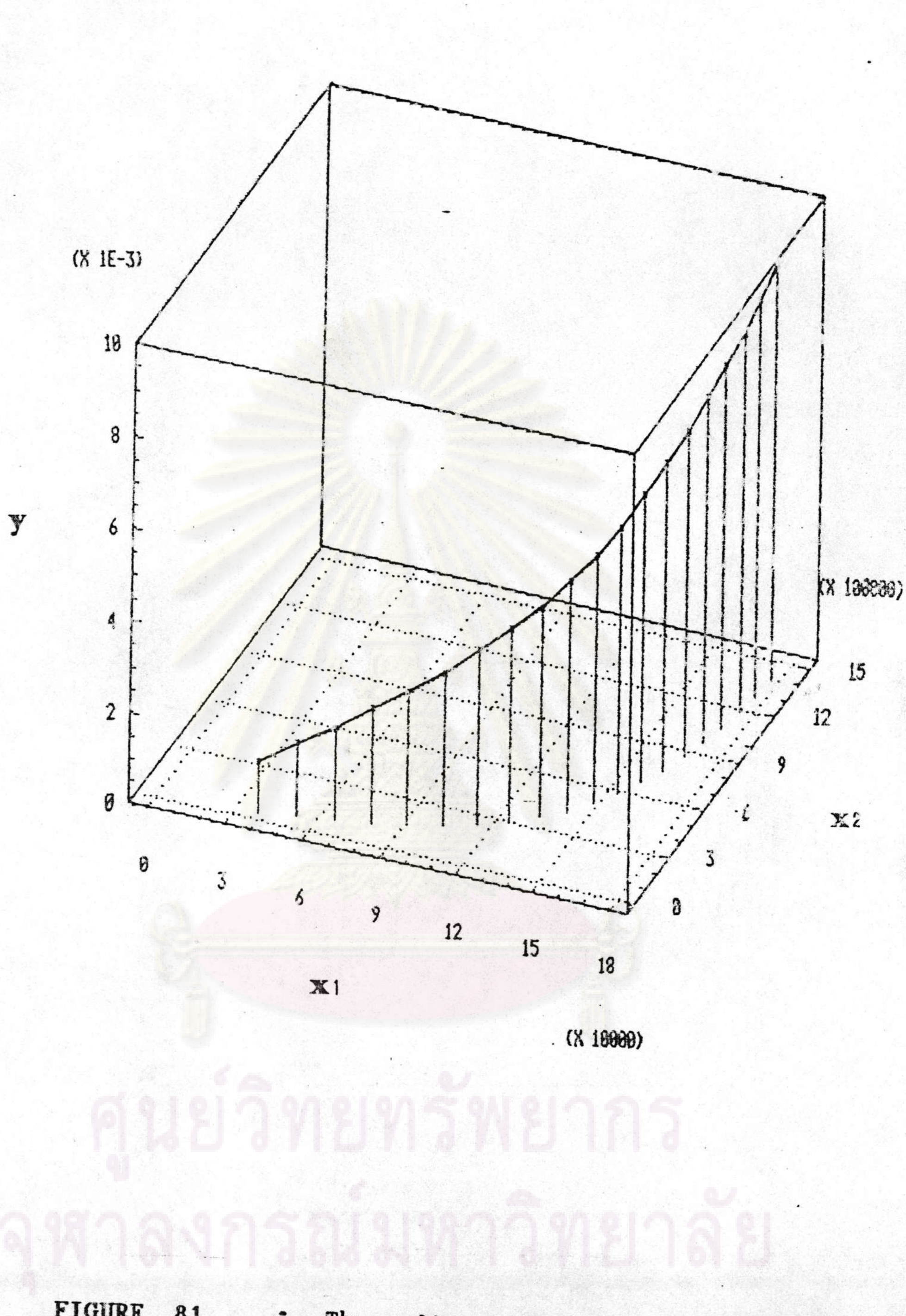

FIGURE 81 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of p-nitrophenol and pralidoxime chloride

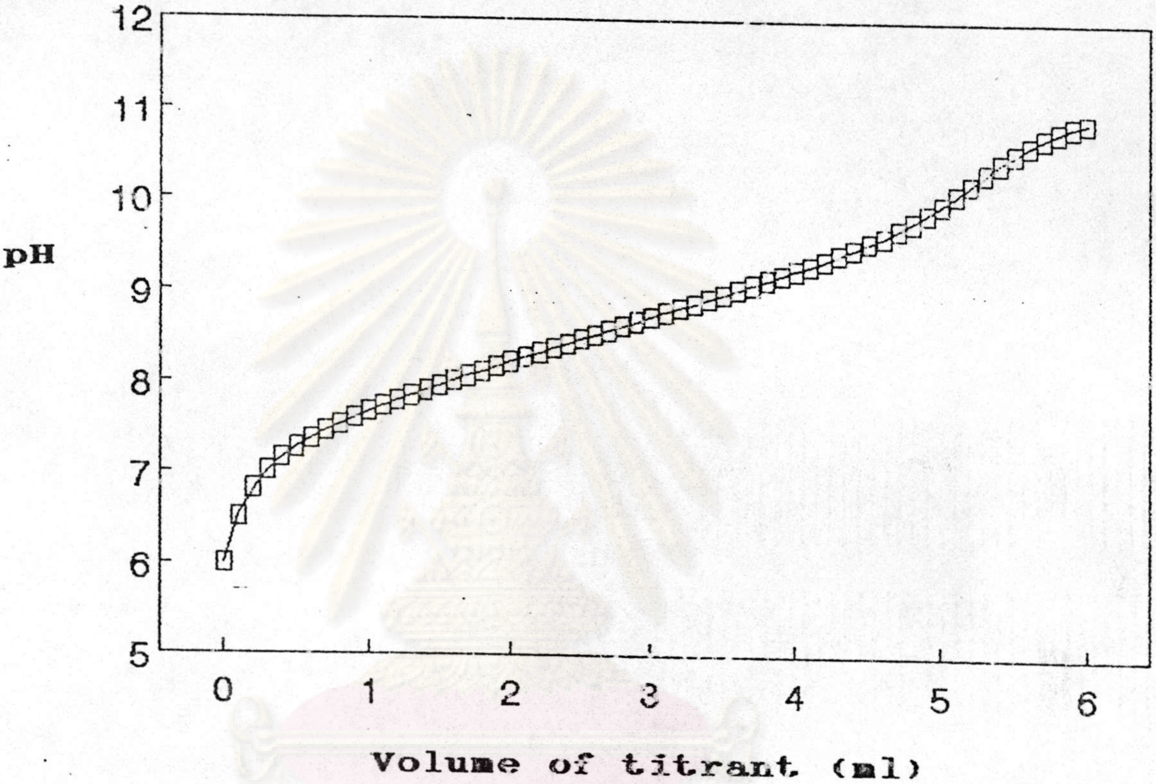

FIGURE 82 : Titration curve of the mixture of pralidoxime chloride and boric acid in 0.1 M potassium chloride solution with sodium hydroxide solution

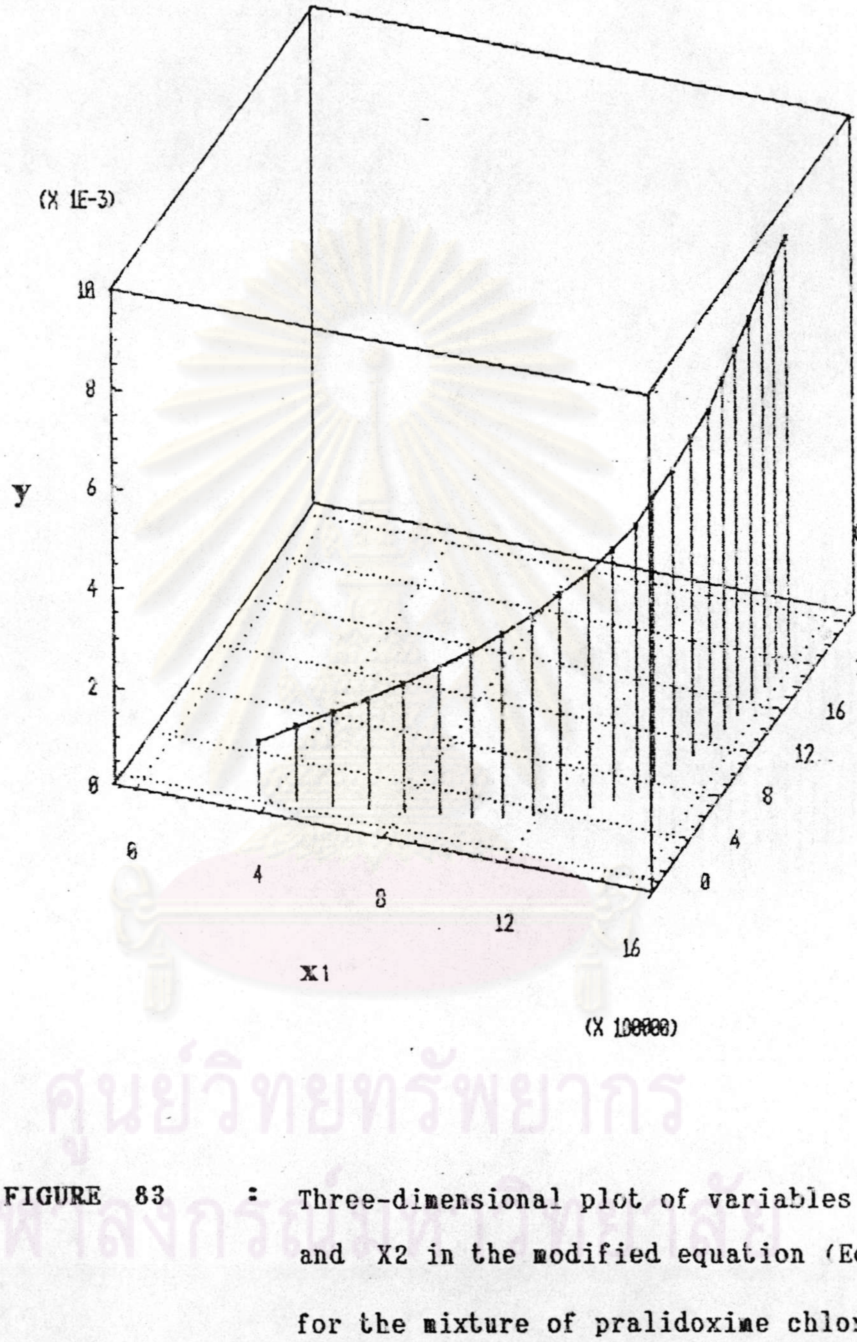

FIGURE 83 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of pralidoxime chloride and boric acid

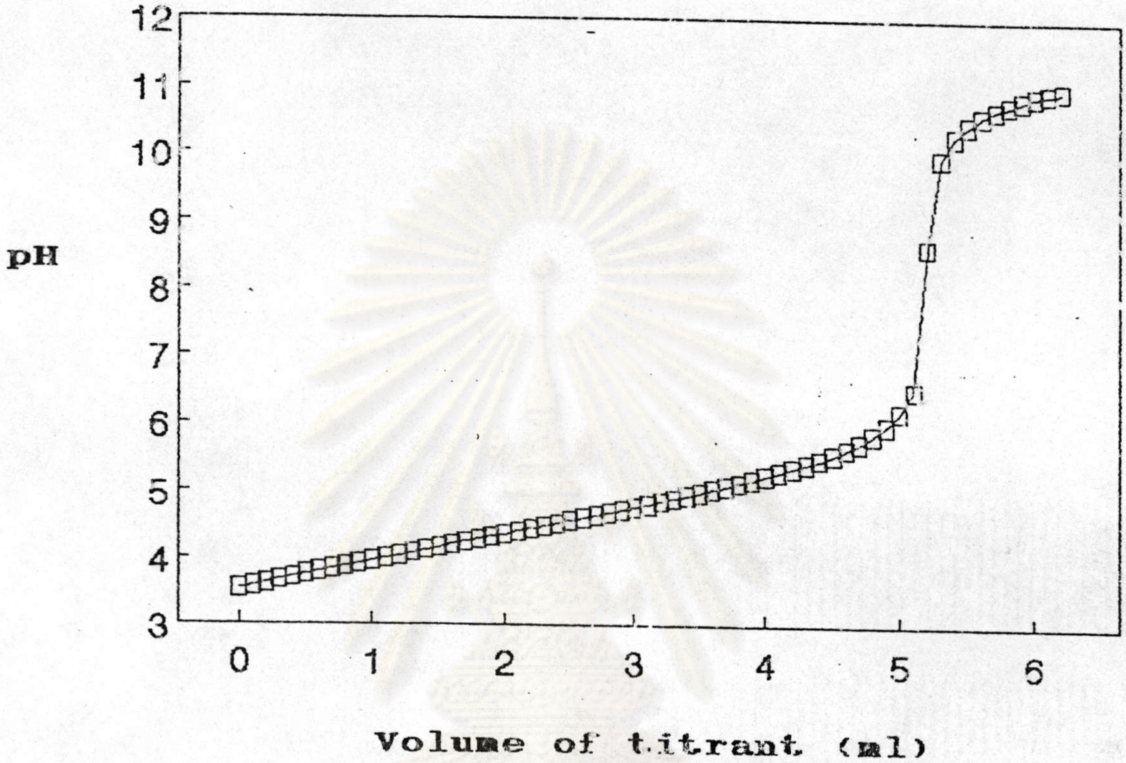

FIGURE 84 : Titration curve of the mixture of benzoic acid and potassium biphthalate in 0.1 M potassium chloride solution with sodium hydroxide solution

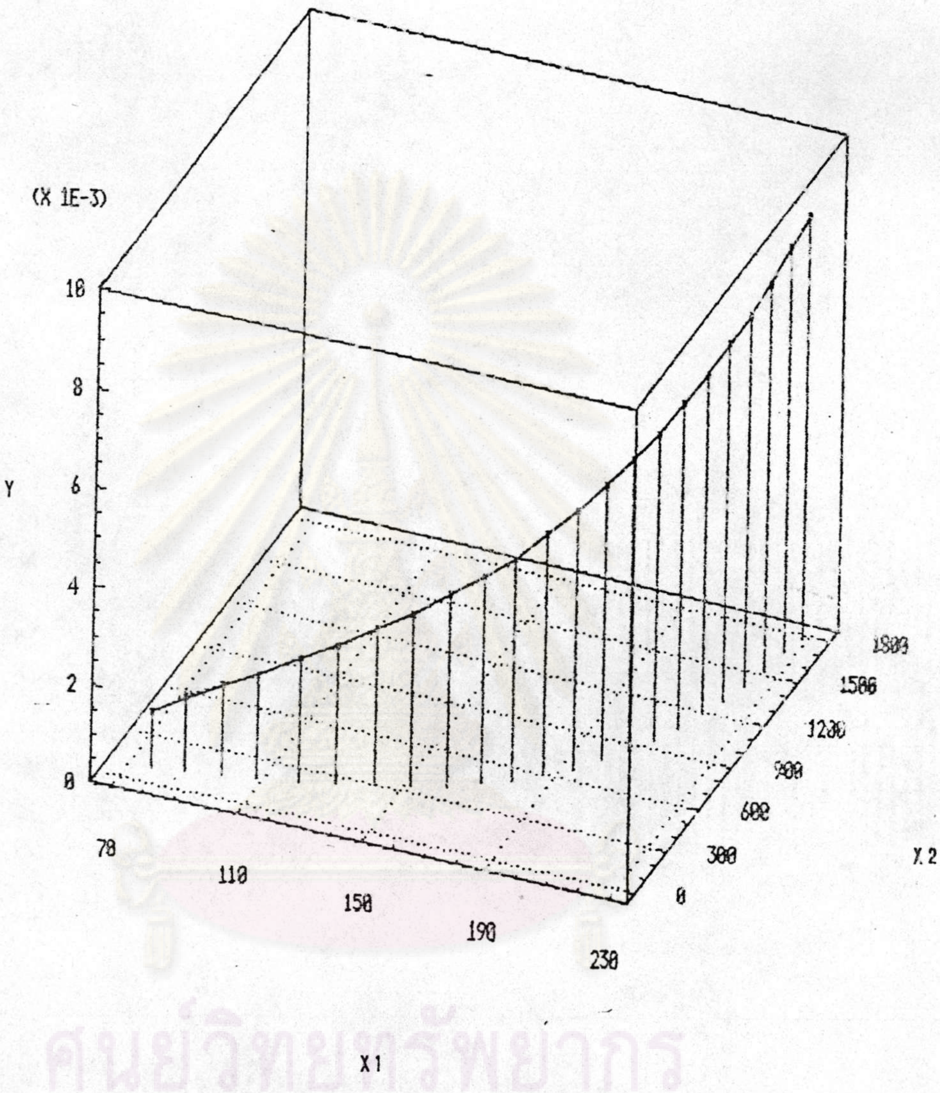

FIGURE 85 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of benzoic acid and potassium biphthalate

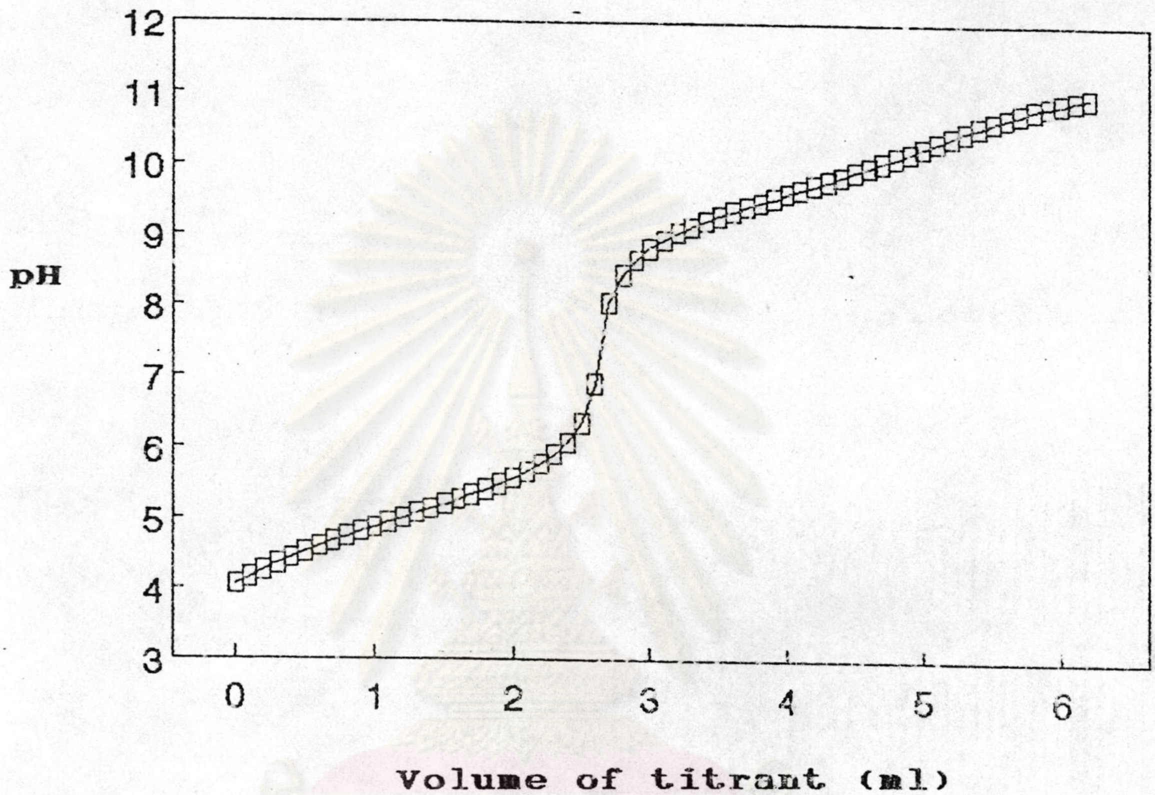

FIGURE 86 : Titration curve of the mixture of potassium biphthalate and ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

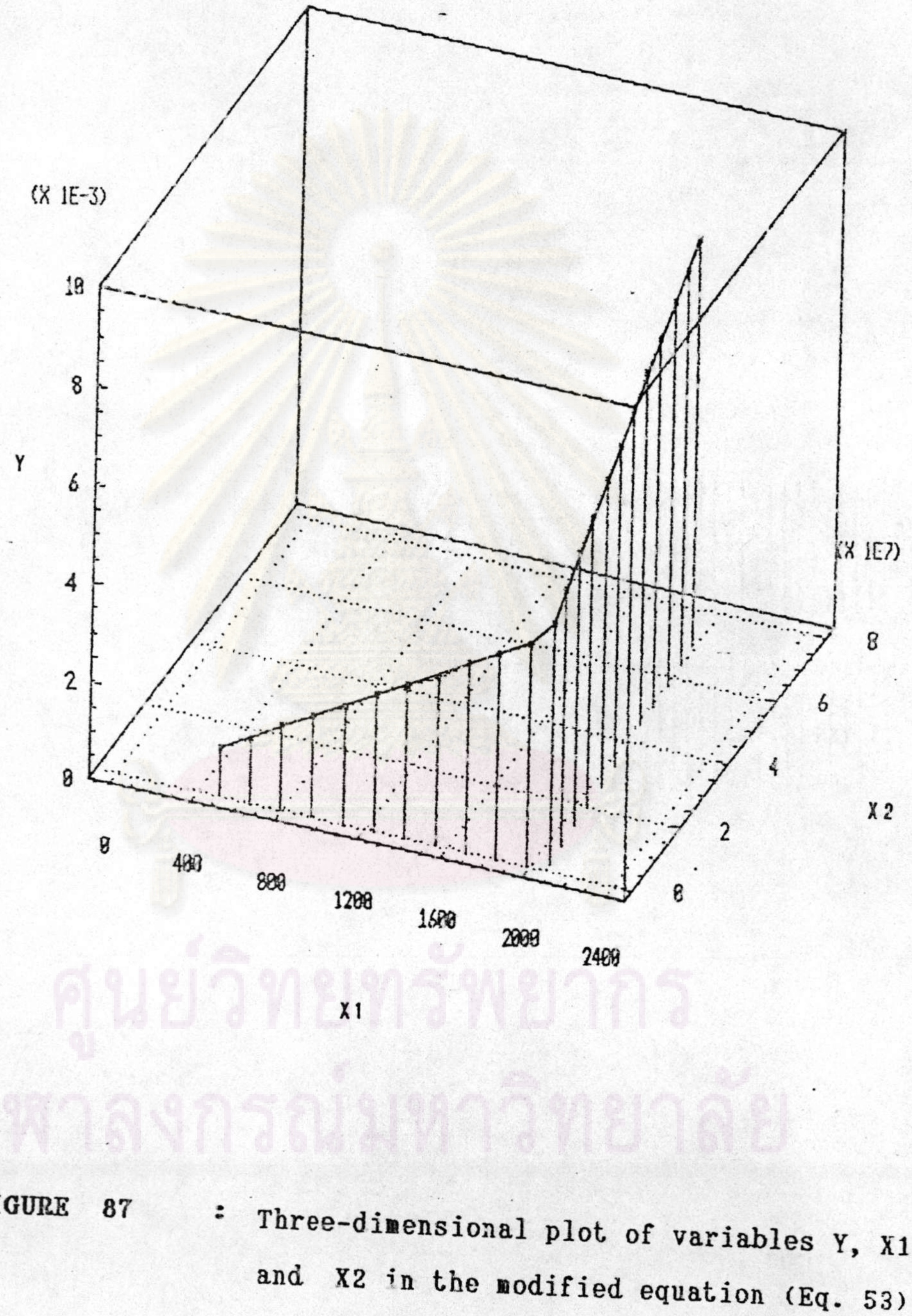

FIGURE 87 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of potassium biphthalate and ephedrine hydrochloride

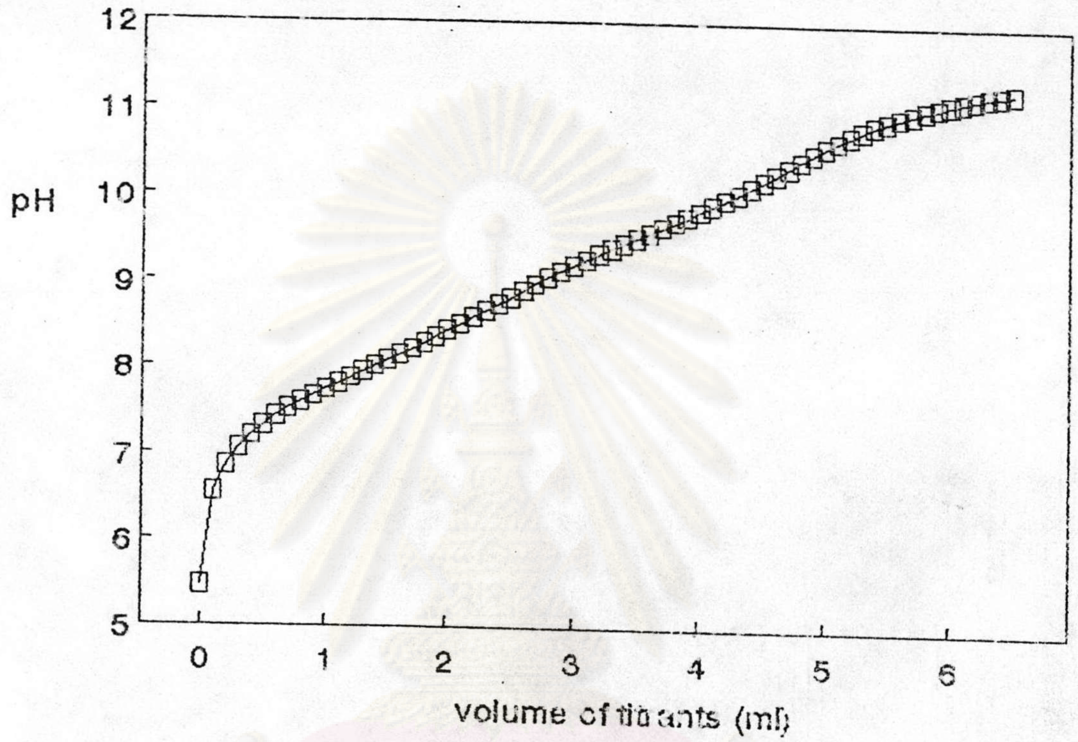

FIGURE 88 : Titration curve of the mixture of pralidoxime chloride and ephedrine hydrochloride in 0.1 M potassium chloride solution with sodium hydroxide solution

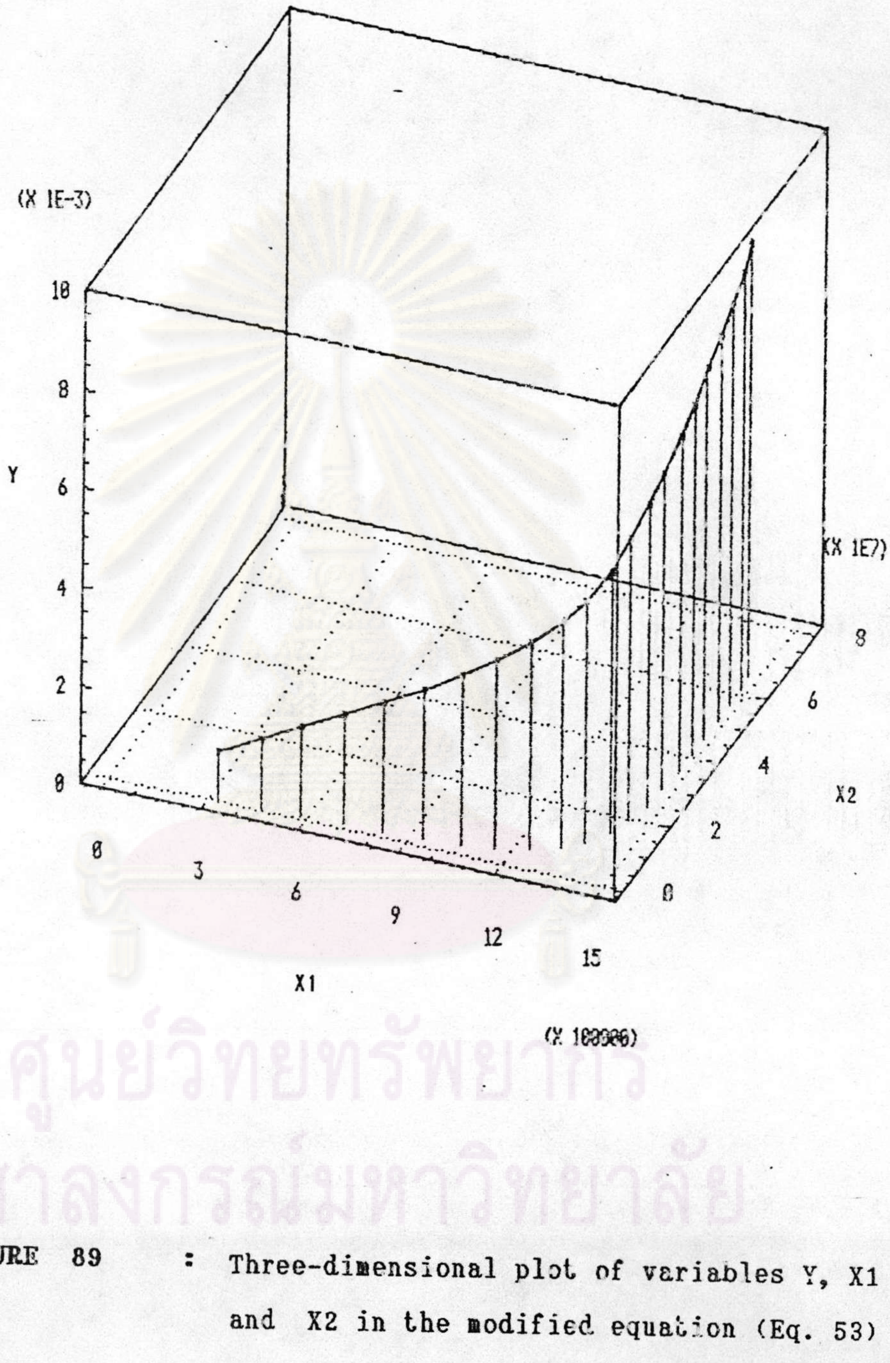

FIGURE 89 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of pralidoxime chloride and ephedrine hydrochloride

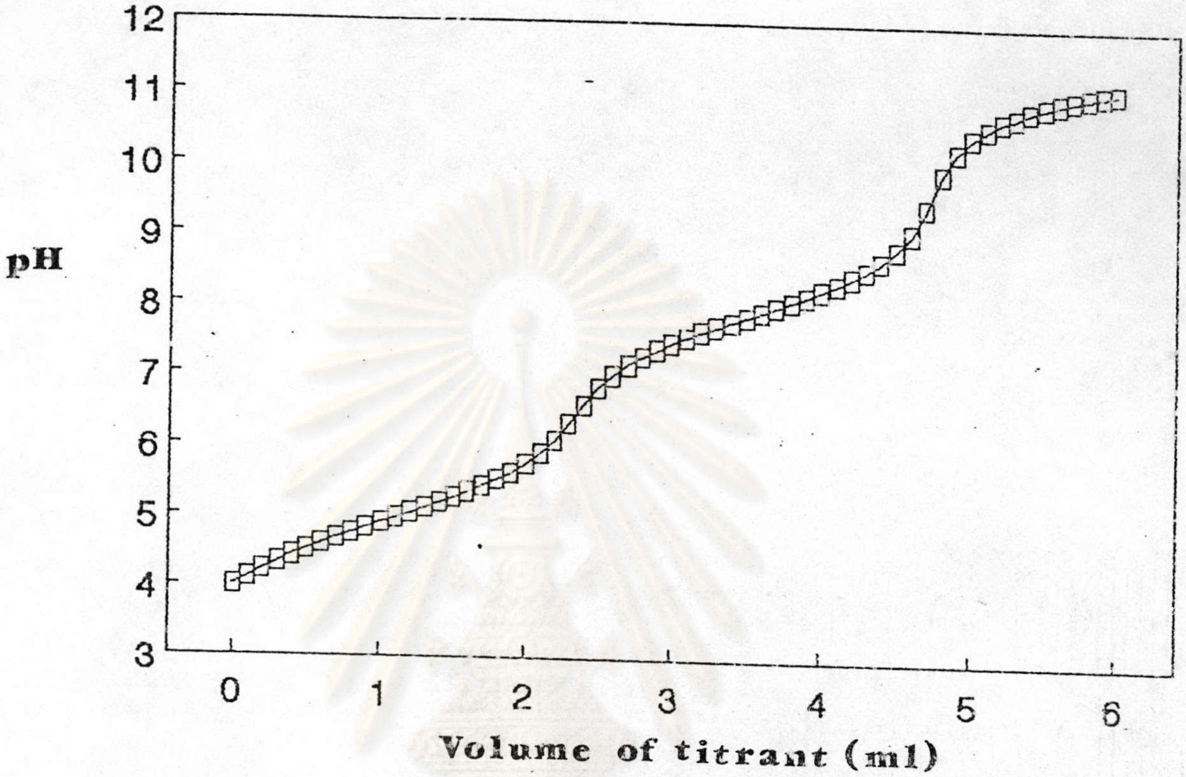

FIGURE 90 : Titration curve of the mixture of potassium biphthalate and pralidoxime chloride in 0.1 M potassium chloride solution with sodium hydroxide solution

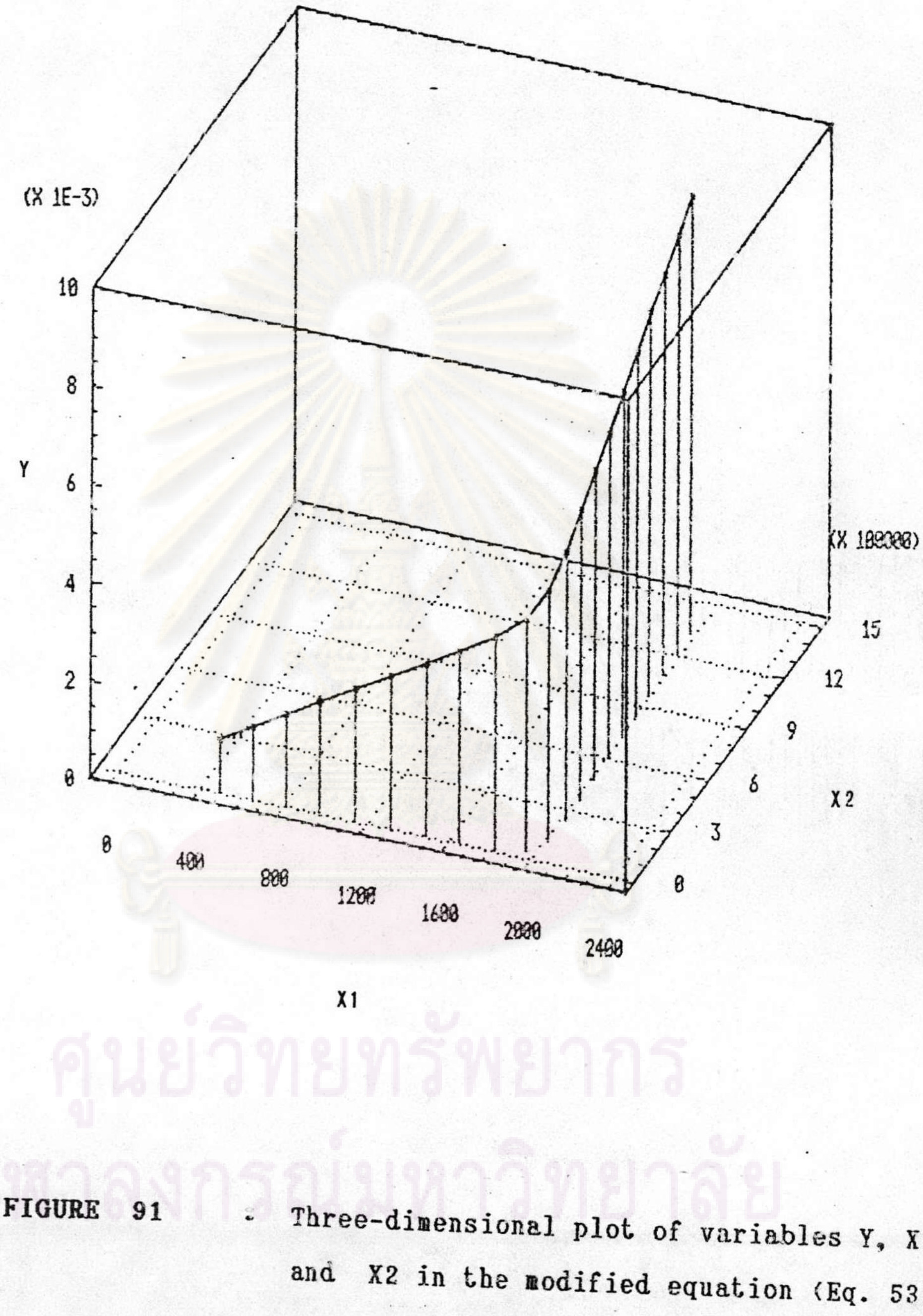

FIGURE 91 : Three-dimensional plot of variables Y, X1 and X2 in the modified equation (Eq. 53) for the mixture of potassium biphthalate and pralidoxime chloride

VITA

Miss Supawadee Chieawchanwatana was born on December 16, 1968, in Udornthanee, Thailand. She graduated with a Bachelor degree of Pharmacy from Faculty of Pharmacy, Chiangmai University, Chiangmai in 1990.