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Appendix A

Determination of calibration curve

Method of determination of nifedipine concentration.

At $t = 0$; nifedipine is in the reduced form.

$$\text{At } 238 \text{ nm} : y = E_{238}^R C^R + I_{238}^R$$

$$\text{At } 280 \text{ nm} : y = E_{280}^R C^R + I_{280}^R$$

At $t = \alpha$; nifedipine is in the oxidized form.

$$\text{At } 238 \text{ nm} : y = E_{238}^O C^O + I_{238}^O$$

$$\text{At } 280 \text{ nm} : y = E_{280}^O C^O + I_{280}^O$$

At each wavelength,

$$A_{238} = (E_{238}^R C^R + I_{238}^R) + (E_{238}^O C^O + I_{238}^O) \dots\dots\dots (1)$$

$$A_{280} = (E_{280}^R C^R + I_{280}^R) + (E_{280}^O C^O + I_{280}^O) \dots\dots\dots (2)$$

Oxidized form of the drug will always be equal.

From equation 1

$$C^O = [A_{238} - (E_{238}^R \times C^R) - I_{238}^R - I_{238}^O] / E_{238}^O \dots\dots\dots (3)$$

From equation 2

$$C^O = [A_{280} - (E_{280}^R \times C^R) - I_{280}^R - I_{280}^O] / E_{280}^O \dots\dots\dots (4)$$

Solving equation (3) and (4)

$$E_{238}^O A_{280} - (E_{238}^O E_{280}^R C^R) - E_{238}^O I_{280}^R - E_{238}^O I_{280}^O =$$

$$E_{280}^O A_{238} - (E_{280}^O E_{238}^R C^R) - E_{280}^O I_{238}^R - E_{280}^O I_{238}^O$$

$$(E_{280}^O E_{238}^R C^R) - (E_{238}^O E_{280}^R C^R) =$$

$$E_{280}^O A_{238} - E_{280}^O I_{238}^R - E_{280}^O I_{238}^O + E_{238}^O I_{280}^R +$$

$$E_{238}^O I_{280}^O - E_{238}^O A_{280}$$

$$(E_{280}^O E_{238}^R - E_{238}^O E_{280}^R) C^R =$$

$$(E_{280}^O A_{238} - E_{238}^O A_{280}) - (E_{280}^O I_{238}^R + E_{280}^O I_{238}^O) +$$

$$(E_{238}^O I_{280}^R + E_{238}^O I_{280}^O)$$

$$= (E_{280}^O A_{238} - E_{238}^O A_{280}) - E_{280}^O (I_{238}^R + I_{238}^O) + E_{238}^O$$

$$(I_{280}^R + I_{280}^O)$$

$$CR = \frac{(E_{280}^O A_{238} - E_{238}^O A_{280})}{(E_{280}^O E_{238}^R - E_{238}^O E_{280}^R)} - \frac{E_{280}^O (I_{238}^R + I_{238}^O) + E_{238}^O (I_{280}^R + I_{280}^O)}{(E_{280}^O E_{238}^R - E_{238}^O E_{280}^R)}$$

$$CR = \frac{(E_{280}^O A_{238} - E_{238}^O A_{280})}{(E_{280}^O E_{238}^R - E_{238}^O E_{280}^R)} - \frac{E_{280}^O (I_{238}^R + I_{238}^O) + E_{238}^O (I_{280}^R + I_{280}^O)}{(E_{280}^O E_{238}^R - E_{238}^O E_{280}^R)}$$

Validation of calibration curve

Validation for quantitative determination of nifedipine from dissolution test and percentage of content in various ratios was made by UV spectrophotometry. The parameters evaluated to ensure the validation of the selected analytical method were accuracy, precision and linearity (USPXXI)

1. Accuracy.

Nifedipine solution were prepared at various concentrations. Three sets of each concentration were prepared. Each individual sample was analyzed by UV spectrophotometry, and percent recovery of each sample was calculated.

2. Precision

2.1 Within run precision.

The within run precision was determined by analyzing of two sets of calibration curve in the same day. Inverse concentrations of nifedipine were compared, and the percent coefficient of variation (% CV) for each concentration was calculated.

2.2 Between run precision.

The between run precision was determined by comparing each concentration of three sets of calibrationcurve prepared on different days for three days. Inverse concentration for the three standard curves on different days were determined and the percent coefficient of variation (% CV) for each concentration was calculated.

3. Linearity

Linear regression analysis of the absorbances versus the corresponding concentrations was performed and the coefficient of determination was calculated. The results of process are as following tables.

Table 21 Accuracy data of inversely estimated concentration.

Expected conc. (Molar x 10 ⁻⁵)	Inversely estimated conc (Molar x 10 ⁻⁵)	% Recovery
0.895	0.944	105.52
	0.903	100.84
	0.919	102.63
1.343	1.386	103.20
	1.382	102.89
	1.370	102.02
1.79	1.861	103.99
	1.853	103.55
	1.844	103.00
2.24	2.261	100.95
	2.277	101.67
	2.283	101.93
2.68	2.753	102.72
	2.751	102.65
	2.721	101.53
3.58	3.578	99.96
	3.585	100.13
	3.582	100.06
4.03	4.092	101.53
	4.092	101.53
	4.064	100.84
4.48	4.514	100.75
	4.506	100.57
	4.550	101.56
Mean		101.92
S.D		1.37
% CV		1.34

Table 22 Within run precision data

Expected conc. (Molar x 10 ⁻⁵)	Inversely estimated conc (Molar x 10 ⁻⁵)			Mean	S.D.	%CV
	0.938	0.914	0.916			
0.895	0.938	0.914	0.916	0.936	0.914	0.943
1.343	1.382	1.378	1.412	1.412	1.372	1.384
1.79	1.824	1.850	1.860	1.840	1.856	1.862
2.24	2.299	2.300	2.300	2.335	2.319	2.287
2.68	2.771	2.760	2.760	2.815	2.771	2.793
3.58	3.696	3.680	3.680	3.746	3.763	3.758
4.03	4.116	4.130	4.140	4.201	4.227	4.235
4.48	4.564	4.560	4.560	4.649	4.647	4.629
				0.927	0.014	1.472
				1.390	0.018	1.262
				1.849	0.015	0.792
				2.307	0.017	0.751
				2.778	0.022	0.775
				3.720	0.039	1.058
				4.175	0.052	1.256
				4.601	0.045	0.370

Table 23 Between run precision data

Expected conc. (Molar x 10 ⁻⁵)	Inversely estimated conc (Molar x 10 ⁻⁵)			Mean	S.D.	%CV
	0.912	0.910	0.919			
0.895	0.944	0.903	0.919	0.912	0.910	0.912
1.343	1.386	1.382	1.370	1.362	1.362	1.350
1.79	1.860	1.850	1.840	1.832	1.820	1.834
2.24	2.260	2.280	2.280	2.291	2.217	2.210
2.68	2.750	2.750	2.720	2.691	2.697	2.715
3.58	3.580	3.580	3.580	3.642	3.620	3.573
4.03	4.090	4.090	4.060	4.016	4.038	4.042
4.48	4.510	4.510	4.550	4.462	4.486	4.438
				0.938	0.914	0.916
				1.382	1.378	1.412
				1.824	1.850	1.860
				2.299	2.300	2.300
				2.771	2.760	2.760
				3.696	3.680	3.680
				4.116	4.130	4.140
				4.564	4.560	4.560
				0.919	0.013	1.468
				1.376	0.018	1.304
				1.841	0.015	0.802
				2.271	0.035	1.540
				2.735	0.030	1.082
				3.626	0.050	1.385
				4.080	0.044	1.072
				4.516	0.047	1.030

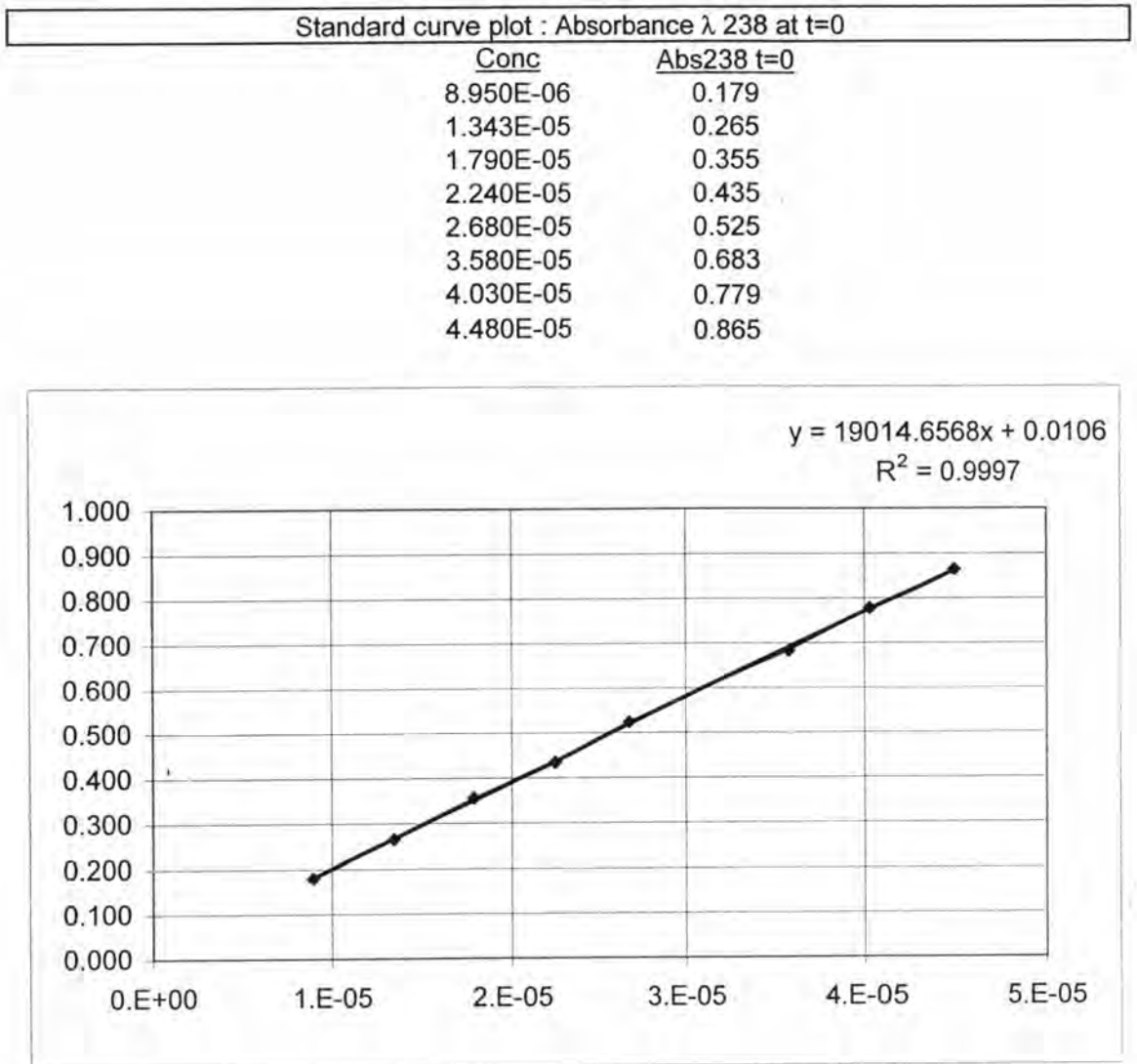


Figure 163 Calibration curve of standard solution of nifedipine at 238 nm, t=0

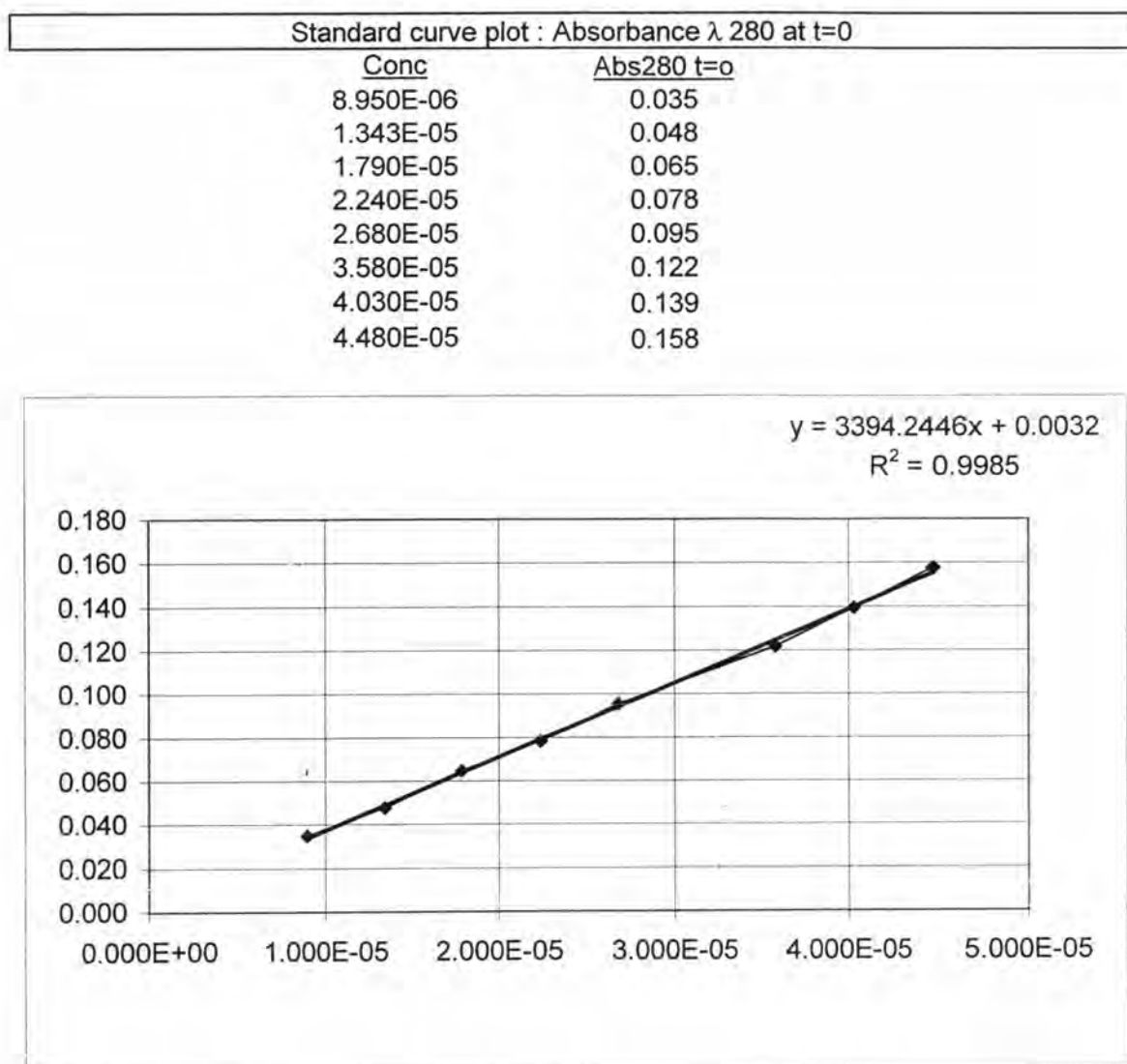


Figure 165 Calibration curve of standard solution of nifedipine at 280 nm, t=0

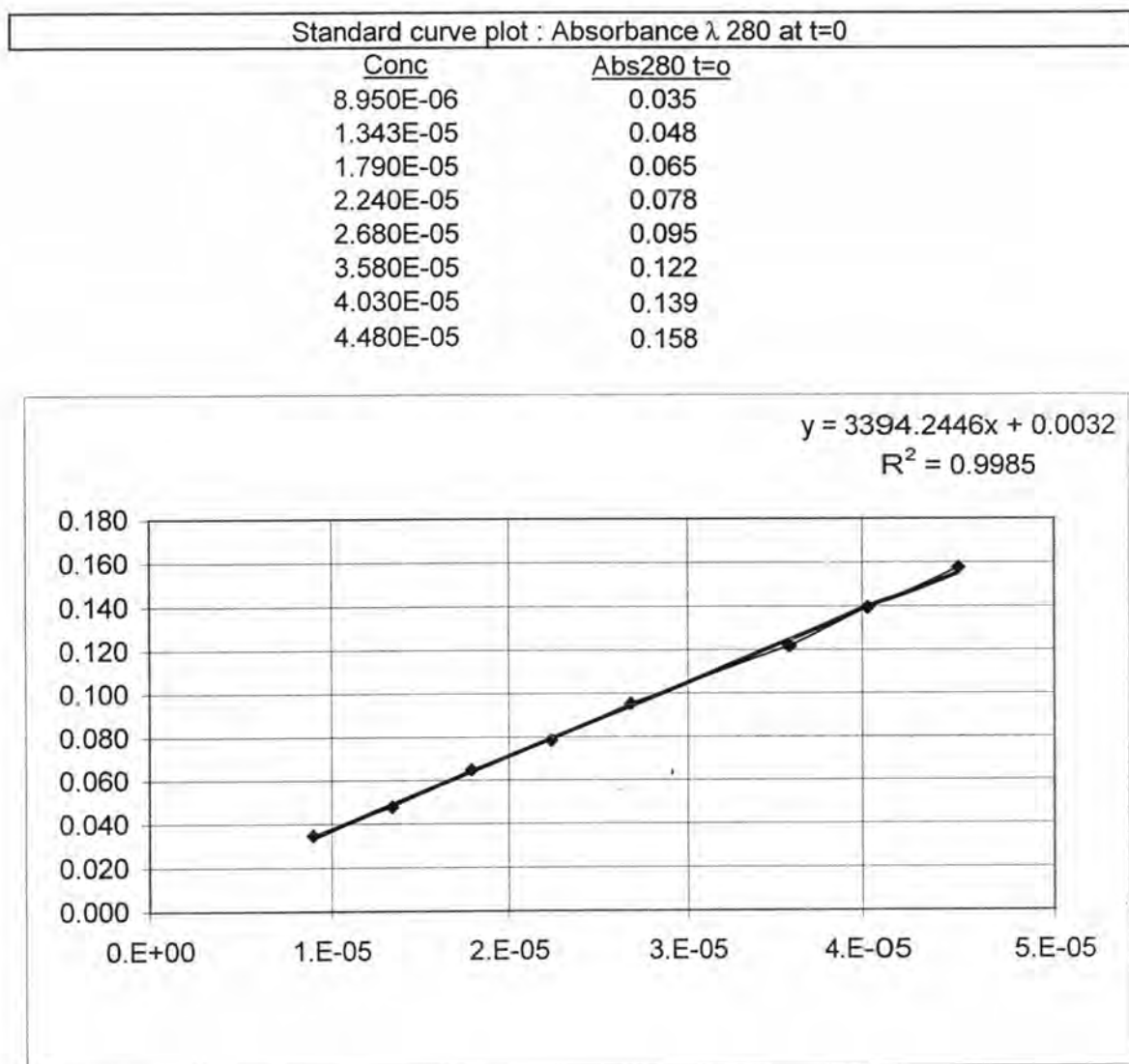


Figure 165 Calibration curve of standard solution of nifedipine at 280 nm, t=0

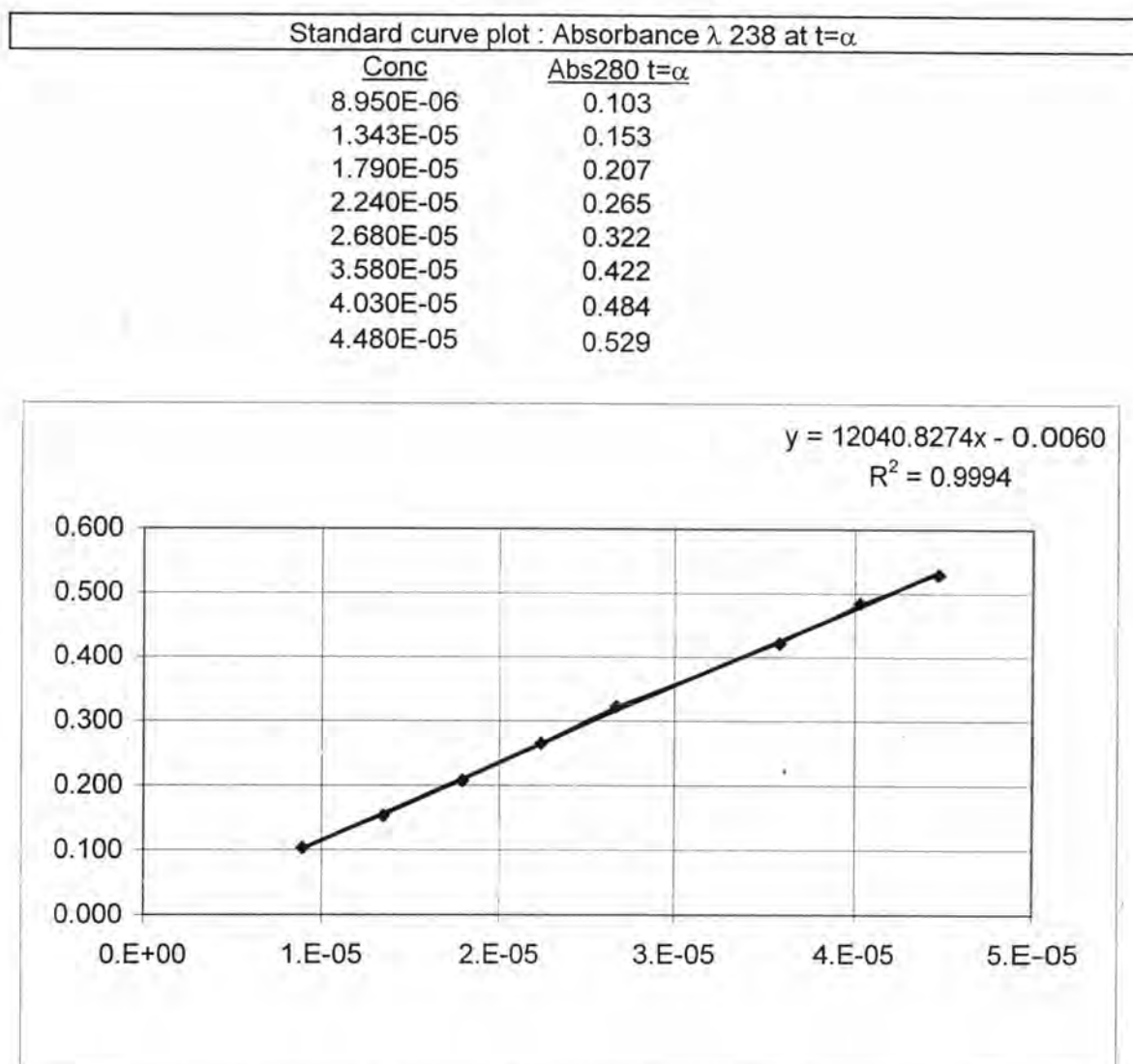


Figure 166 Calibration curve of standard solution of nifedipine at 280 nm, $t=\alpha$ (after 4 hours of light irradiation)

Appendix B

Percentage of content.

Table 24 Percent content of nifedipine in nifedipine-PEG4000 solid dispersion.

Method	Nifedipine : Percentage of content.											
	Ratio 1:1		Ratio 1:3		Ratio 1:5		Ratio 1:10					
	mg	%	mg	%	mg	%	mg	%				
Physical	# 1	10.0344	100.34	12.6246	126.25	11.2324	112.32	14.2911	142.91			
	# 2	11.0273	110.27	12.8952	128.95	10.7937	107.94	15.5582	155.58			
	# 3	10.9320	109.32	12.6938	126.94	12.0405	120.41	15.1291	151.29			
	Average	10.6646	106.65	12.7379	127.38	11.3555	113.56	14.9928	149.93			
	SD.	0.5478	5.48	0.1406	1.41	0.6325	6.32	0.6445	6.44			
Melt	# 1	8.4704	84.70	8.9127	89.13	8.3155	83.15	8.4573	84.57			
	# 2	8.6218	86.22	8.7804	87.80	8.4013	84.01	8.5002	85.00			
	# 3	8.9127	89.13	8.8233	88.23	8.6421	86.42	8.7410	87.41			
	Average	8.6683	86.68	8.8388	88.39	8.4529	84.53	8.5662	85.66			
	SD.	0.2248	2.25	0.0675	0.68	0.1693	1.69	0.1529	1.53			
Solvent	# 1	8.4573	84.57	8.6123	86.12	8.4013	84.01	8.5992	85.99			
	# 2	7.8732	78.73	9.0509	90.51	8.6123	86.12	8.6254	86.25			
	# 3	8.3846	83.85	8.9687	89.69	8.4275	84.28	8.7970	87.97			
	Average	8.2384	82.38	8.8773	88.77	8.4804	84.80	8.6739	86.74			
	SD.	0.3183	3.18	0.2332	2.33	0.1150	1.15	0.1075	1.07			
Kneading	# 1	8.7935	87.93	8.2988	82.99	7.8899	78.90	7.2856	72.86			
	# 2	8.8137	88.14	8.3846	83.85	8.1569	81.57	7.7779	77.78			
	# 3	9.3513	93.51	8.5265	85.26	8.1009	81.01	8.1700	81.70			
	Average	8.9862	89.86	8.4033	84.03	8.0492	80.49	7.7445	77.44			
	SD.	0.3164	3.16	0.1150	1.15	0.1408	1.41	0.4432	4.43			

Appendix C

**Percentage dissolved of nifedipine
at various time in each chambers.**

Table 31 Percent dissolved of nifedipine-PEG4000 prepared by physical mixing method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	14.65	14.79	16.05	15.15	0.77
		10	20.75	20.76	23.08	21.53	1.34
		15	28.15	27.31	31.40	28.96	2.16
		20	34.16	33.59	36.55	34.77	1.57
		30	43.95	44.72	45.57	44.75	0.81
		45	53.51	50.80	53.33	52.58	1.55
		60	55.22	57.09	59.91	57.41	2.36
		90	62.10	65.33	66.54	64.66	2.29
		120	66.49	70.91	71.76	69.72	2.83
		180	70.93	78.10	78.61	75.88	4.29
		240	76.58	82.64	82.92	80.71	3.58
		300	81.03	85.61	84.42	83.69	2.38
		360	88.00	88.59	86.60	87.73	1.02
		420	92.04	89.16	88.10	89.77	2.04
physical mixing	1:3	5	25.59	26.58	22.13	24.77	2.34
		10	23.51	24.16	23.77	23.81	0.33
		15	28.75	30.31	31.35	30.14	1.31
		20	34.20	36.10	37.15	35.82	1.49
		30	42.37	46.10	46.09	44.85	2.15
		45	52.37	56.74	56.80	55.31	2.54
		60	57.05	63.67	63.96	61.56	3.91
		90	64.17	72.56	72.13	69.62	4.72
		120	70.17	79.41	77.57	75.72	4.89
		180	77.23	86.96	84.27	82.82	5.03
		240	82.59	91.13	88.17	87.30	4.33
		300	87.13	93.34	90.72	90.40	3.12
		360	89.25	96.16	92.91	92.78	3.46
		420	91.09	98.57	93.98	94.55	3.77
physical mixing	1:5	5	14.89	14.25	14.67	14.60	0.33
		10	22.61	24.14	24.64	23.80	1.06
		15	29.17	30.45	31.64	30.42	1.24
		20	35.87	36.94	37.65	36.82	0.90
		30	45.60	47.99	47.58	47.05	1.28
		45	56.80	57.74	56.96	57.17	0.50
		60	62.49	64.87	63.75	63.70	1.19
		90	72.47	73.48	71.64	72.53	0.92
		120	77.65	77.59	76.53	77.26	0.63
		180	83.92	84.28	83.21	83.80	0.54
		240	88.66	88.24	86.13	87.68	1.36
		300	90.03	89.74	89.80	89.86	0.16
		360	91.16	91.58	89.47	90.73	1.12
		420	91.93	93.06	91.29	92.09	0.90
physical mixing	1:10	5	11.45	14.38	15.50	13.78	2.09
		10	27.36	29.18	29.12	28.55	1.04
		15	37.12	38.81	36.26	38.06	0.86
		20	43.05	45.74	45.82	44.88	1.57
		30	52.22	55.82	53.85	53.96	1.80
		45	61.32	64.92	61.75	62.66	1.96
		60	68.33	70.79	66.58	68.56	2.12
		90	74.37	78.47	71.87	74.90	3.33
		120	79.41	84.07	77.85	80.44	3.24
		180	83.99	87.05	82.53	84.52	2.31
		240	86.97	91.06	84.59	87.54	3.27
		300	88.60	92.55	86.84	89.33	2.93
		360	89.53	92.91	88.90	90.45	2.16
		420	91.08	95.10	88.89	91.69	3.15
540	93.05	96.94	90.80	93.60	3.10		
660	95.79	98.56	92.15	95.50	3.21		
1200	97.74	104.04	95.78	99.19	4.31		
1440	96.36	102.15	94.67	97.73	3.92		

Table 32 Percent dissolved of nifedipine-PEG4000 prepared by melting method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Melting	1:1	5	18.65	17.11	19.35	18.37	1.15
		10	20.79	22.68	25.63	23.03	2.44
		15	26.63	30.08	31.42	29.38	2.47
		20	31.71	34.74	36.85	34.43	2.59
		30	37.07	41.28	43.41	40.59	3.23
		45	43.77	48.34	50.40	47.50	3.39
		60	48.99	54.20	57.51	53.57	4.29
		90	55.49	61.46	63.24	60.05	4.06
		120	59.93	67.26	68.18	65.12	4.52
		180	67.12	74.10	75.51	72.24	4.49
		240	72.98	78.84	80.47	77.43	3.94
		300	76.10	81.68	82.87	80.22	3.62
		360	79.41	84.63	86.54	83.53	3.69
		420	84.28	86.14	86.71	85.71	1.27
		540	87.05	88.04	89.31	88.13	1.13
		660	88.61	88.97	90.94	89.51	1.26
		1200	97.47	98.10	101.97	99.18	2.44
1440	94.79	97.05	99.45	99.45			
Melting	1:3	5	17.71	17.79	17.85	17.78	0.07
		10	23.55	26.58	25.80	25.31	1.57
		15	30.32	32.51	33.35	32.06	1.57
		20	36.04	37.80	42.13	38.66	3.13
		30	44.13	46.04	51.36	47.18	3.75
		45	51.69	53.94	54.67	53.43	1.56
		60	56.85	58.83	60.44	58.71	1.80
		90	62.49	65.16	69.46	65.71	3.52
		120	67.92	69.21	78.49	71.87	5.77
		180	73.99	74.84	82.04	76.96	4.42
		240	78.31	79.29	89.30	82.30	6.08
		300	81.14	81.49	93.15	85.26	6.84
		360	83.82	83.96	94.50	87.43	6.12
		420	85.32	85.30	97.39	89.34	6.98
		540	90.18	88.76	103.23	94.06	7.97
		660	88.38	86.88	103.33	92.86	9.10
		1200	95.19	94.06	107.64	98.97	7.54
1440	93.55	94.11	107.74	98.47	8.04		
Melting	1:5	5	18.85	18.57	18.92	18.78	0.18
		10	31.37	33.47	33.83	32.89	1.33
		15	43.29	44.64	44.50	44.14	0.74
		20	50.17	51.72	52.63	51.50	1.24
		30	57.92	60.04	59.55	59.17	1.11
		45	64.83	65.41	66.25	65.50	0.71
		60	68.95	71.12	70.49	70.19	1.12
		90	75.07	77.40	76.41	76.30	1.17
		120	78.75	81.30	79.88	79.97	1.28
		180	83.76	87.14	83.97	84.96	1.89
		240	88.35	91.53	90.13	90.13	1.63
		300	90.48	93.44	92.66	92.19	1.54
		360	91.46	95.92	94.50	93.96	2.28
		420	92.75	96.35	95.98	95.03	1.99
		540	94.87	98.34	98.82	97.34	2.16
		660	97.97	101.03	101.85	100.28	2.04
		1200	98.22	102.53	104.48	101.74	3.20
1440	99.06	102.53	105.41	102.33	3.18		
Melting	1:10	5	8.52	8.65	12.72	9.96	2.39
		10	39.43	35.15	34.31	36.30	2.74
		15	51.73	49.10	48.76	49.86	1.62
		20	60.27	58.45	57.46	58.73	1.43
		30	69.17	66.99	67.26	67.81	1.19
		45	77.36	74.33	74.68	75.46	1.66
		60	81.61	78.23	78.94	79.59	1.78
		90	86.83	85.20	85.20	85.74	0.94
		120	89.37	87.62	88.18	88.39	0.90
		180	93.19	93.89	92.34	93.14	0.77
		240	93.77	94.62	94.41	94.27	0.44
		300	94.89	94.90	94.06	94.62	0.48
		360	93.93	96.00	93.67	94.53	1.27
		420	93.79	93.52	94.20	93.84	0.34
		540	92.74	91.61	93.09	92.48	0.77
		660	91.34	91.69	91.27	91.43	0.23

Table 33 Percent dissolved of nifedipine-PEG4000 prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Solvent	1:1	5	15.02	14.31	19.30	16.21	2.70
		10	17.76	17.76	19.12	18.21	0.78
		15	23.11	24.58	29.99	25.89	3.62
		20	27.84	29.10	34.88	30.61	3.75
		30	35.16	36.25	41.44	37.63	3.35
		45	44.53	43.62	48.29	45.48	2.47
		60	54.14	49.27	53.17	52.19	2.57
		90	58.96	56.75	60.27	58.66	1.78
		120	62.90	61.21	65.79	63.30	2.32
		180	70.72	68.11	70.86	69.90	1.55
		240	74.62	72.78	76.09	74.50	1.66
		300	78.22	77.79	79.43	78.48	0.85
		360	81.04	79.85	81.62	80.84	0.90
		420	82.18	80.50	83.03	81.90	1.29
		540	83.11	81.63	84.17	82.97	1.27
		660	87.55	83.89	87.35	86.26	2.06
		1200	90.87	88.26	90.58	89.90	1.43
1440	90.13	87.36	91.17	89.55	1.97		
Solvent	1:3	5	19.28	18.79	20.18	19.42	0.71
		10	28.50	29.69	30.82	29.67	1.16
		15	38.30	38.80	40.07	39.06	0.91
		20	42.99	45.38	46.93	45.10	1.98
		30	49.96	53.12	55.25	52.78	2.66
		45	55.26	60.39	63.21	59.62	4.03
		60	68.87	64.15	68.74	63.92	4.94
		90	63.46	69.58	72.57	68.53	4.64
		120	66.42	73.20	77.50	72.37	5.58
		180	71.00	78.82	82.37	77.40	5.82
		240	76.56	82.45	86.19	81.73	4.85
		300	77.32	84.08	89.23	83.54	5.97
		360	78.01	87.19	90.93	85.38	6.65
		420	80.13	87.05	93.18	86.79	6.53
		540	85.28	89.38	94.47	89.71	4.61
		660	85.01	90.73	95.74	90.49	5.37
		1200	93.39	95.96	100.48	96.61	3.59
1440	92.39	96.76	100.93	96.69	4.27		
Solvent	1:5	5	16.23	17.97	20.24	18.15	2.01
		10	36.60	33.29	34.92	34.94	1.66
		15	48.13	44.96	44.19	45.76	2.09
		20	53.73	52.52	51.05	52.43	1.34
		30	62.88	61.54	59.65	61.35	1.62
		45	70.85	69.87	66.99	69.24	2.01
		60	75.95	74.27	73.59	74.60	1.22
		90	81.03	80.38	76.25	79.22	2.59
		120	84.64	84.43	79.72	82.93	2.78
		180	88.03	88.94	84.01	86.99	2.63
		240	88.95	90.38	85.22	88.18	2.66
		300	89.73	93.20	86.85	89.93	3.18
		360	89.11	92.45	86.85	89.47	2.81
		420	90.17	92.29	87.85	90.10	2.22
		540	91.66	95.61	88.19	91.82	3.71
		660	90.06	94.43	90.18	91.55	2.49
		1200	88.82	92.56	93.74	91.70	2.57
1440	0.11	0.13	0.14	0.12	0.01		
Solvent	1:10	5	14.68	17.69	21.26	17.88	3.29
		10	40.57	46.35	46.14	44.02	3.01
		15	58.46	60.10	61.31	59.96	1.43
		20	66.20	67.62	68.04	67.29	0.96
		30	76.42	76.92	78.67	77.34	1.18
		45	83.00	82.37	86.17	83.84	2.04
		60	85.99	87.74	90.98	88.24	2.54
		90	89.79	92.27	93.25	91.77	1.78
		120	90.44	93.35	96.49	93.43	3.03
		180	91.23	94.76	98.40	94.80	3.59
		240	94.24	97.93	100.10	97.42	2.96
		300	95.32	99.37	100.11	98.27	2.58
		360	96.31	99.73	100.89	98.98	2.38
		420	96.10	100.30	103.42	99.94	3.67
		540	94.01	98.61	115.73	102.78	11.44
		660	94.35	98.67	116.29	103.10	11.62

Table 34 Percent dissolved of nifedipine-PEG4000 prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Kneading	1:1	5	23.87	24.22	23.16	23.75	0.54
		10	30.80	30.95	30.66	30.80	0.15
		15	37.08	37.44	36.10	36.87	0.69
		20	41.76	43.15	40.34	41.75	1.41
		30	47.95	51.18	46.89	48.67	2.24
		45	56.60	58.60	54.77	56.66	1.91
		60	61.84	64.39	61.14	62.45	1.71
		90	69.31	71.58	72.03	70.97	1.46
		120	73.12	77.37	74.21	74.90	2.21
		180	78.84	82.94	80.88	80.89	2.05
		240	83.93	85.71	83.03	84.22	1.37
		300	92.25	88.74	87.67	89.55	2.39
		360	90.03	89.67	87.84	89.18	1.18
		420	93.33	90.65	89.11	91.03	2.13
540	93.77	92.78	91.29	92.61	1.25		
660	94.61	94.27	92.00	93.63	1.42		
1200	99.28	98.50	95.68	97.82	1.89		
1440	99.17	97.47	95.91	97.51	1.63		
Kneading	1:3	5	18.87	20.90	21.31	20.36	1.31
		10	29.20	31.59	32.52	31.10	1.71
		15	36.63	38.96	40.45	36.68	1.92
		20	42.37	44.47	46.09	44.31	1.87
		30	51.58	53.13	57.14	53.95	2.87
		45	60.19	62.23	64.23	62.22	2.02
		60	65.36	67.54	70.09	67.67	2.37
		90	72.34	74.73	76.79	74.62	2.23
		120	84.88	78.51	80.40	81.26	3.27
		180	81.99	82.93	84.92	83.28	1.49
		240	91.18	88.16	87.40	88.92	2.00
		300	94.95	89.56	87.89	90.81	3.69
		360	91.25	90.16	90.94	90.78	0.56
		420	98.58	90.09	90.88	93.18	4.69
540	95.70	91.64	91.02	92.79	2.54		
660	102.42	92.91	91.79	95.71	5.84		
1200	101.35	94.00	93.71	96.35	4.33		
1440	100.09	93.86	93.58	95.84	3.68		
Kneading	1:5	5	18.95	19.15	20.26	19.45	0.71
		10	36.64	35.77	35.67	36.03	0.54
		15	44.81	43.98	43.83	44.21	0.53
		20	51.88	49.42	49.70	50.33	1.35
		30	58.51	58.22	57.09	57.94	0.75
		45	65.15	65.98	66.04	65.72	0.50
		60	68.77	70.30	69.25	69.44	0.78
		90	73.62	76.08	75.09	74.93	1.24
		120	78.22	78.36	78.00	78.19	0.18
		180	82.69	82.44	81.95	82.33	0.34
		240	90.15	83.58	83.73	85.82	3.75
		300	85.81	85.14	84.36	85.10	0.72
		360	87.33	85.65	84.93	85.97	1.23
		420	87.98	85.22	83.18	85.46	2.41
540	87.06	86.06	85.06	86.06	1.00		
660	88.26	85.79	85.35	86.47	1.57		
1200	90.95	89.45	87.00	89.13	2.00		
1440	90.90	89.05	86.72	88.89	2.10		
Kneading	1:10	5	28.90	32.84	32.48	31.41	2.18
		10	44.90	46.20	46.43	45.84	0.82
		15	53.57	54.07	55.33	54.32	0.91
		20	59.01	60.13	59.31	59.48	0.58
		30	65.49	65.93	66.56	65.99	0.54
		45	71.25	70.52	70.72	70.83	0.38
		60	75.24	73.85	75.69	74.93	0.96
		90	79.54	77.32	78.85	78.57	1.14
		120	82.65	78.58	81.83	81.02	2.15
		180	85.01	80.70	82.74	82.82	2.15
		240	85.78	81.55	84.10	83.81	2.13
		300	86.57	82.69	84.18	84.48	1.95
		360	86.14	82.83	84.45	84.48	1.65
		420	87.36	83.31	84.87	85.18	2.04
540	86.51	83.13	85.31	84.98	1.72		
660	86.51	82.98	84.54	84.68	1.77		
1200	84.25	79.81	81.77	81.94	2.23		
1440	0.08	0.06	0.07	0.07	0.01		

Table 35 Table Percent dissolved of nifedipine-PEG6000 prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	13.94	15.98	15.76	15.23	1.12
		10	18.30	23.40	20.13	20.61	2.58
		15	24.30	26.27	24.99	25.19	1.00
		20	27.82	30.43	28.88	29.04	1.31
		30	36.11	39.57	37.25	37.65	1.76
		45	44.02	45.17	42.20	43.80	1.50
		60	47.16	50.25	46.30	47.90	2.08
		90	54.47	58.56	52.77	55.27	2.97
		120	60.68	64.49	57.44	60.87	3.53
		180	68.15	70.55	62.66	67.12	4.05
		240	74.72	74.24	66.34	71.77	4.71
		300	79.59	78.12	69.59	75.77	5.40
		360	78.51	80.18	73.90	77.53	3.26
		420	82.71	82.23	75.68	80.20	3.93
540	84.08	86.94	75.19	82.07	6.13		
660	84.43	85.64	78.07	82.71	4.07		
1200	89.29	93.09	84.91	89.10	4.09		
1440	90.93	93.70	86.21	90.28	3.79		
physical mixing	1:3	5	20.44	20.86	21.20	20.84	0.38
		10	25.10	26.79	27.97	26.62	1.45
		15	30.24	31.86	31.23	31.11	0.82
		20	34.90	37.15	37.64	36.56	1.46
		30	47.35	43.35	44.13	44.94	2.12
		45	58.73	50.89	50.26	53.29	4.71
		60	69.31	55.42	54.93	59.89	8.16
		90	74.27	64.64	60.91	66.61	6.89
		120	84.41	68.21	64.46	72.36	10.60
		180	85.93	74.11	70.23	76.76	8.18
		240	89.38	77.45	72.93	79.92	8.50
		300	93.97	80.42	75.12	83.17	9.72
		360	96.87	81.71	77.11	85.23	10.34
		420	98.93	82.84	78.38	86.71	10.81
540	99.85	84.17	80.43	88.15	10.30		
660	100.77	86.22	82.26	89.75	9.75		
1200	105.29	90.89	86.71	94.30	9.75		
1380	105.47	92.18	88.21	95.29	9.04		
physical mixing	1:5	5	15.85	15.99	17.55	16.46	0.95
		10	26.26	27.05	27.12	26.81	0.47
		15	33.68	33.34	34.25	33.76	0.46
		20	40.31	39.41	40.04	39.92	0.46
		30	48.78	47.17	49.06	48.33	1.02
		45	58.15	54.99	57.74	56.96	1.72
		60	64.17	59.39	63.61	62.39	2.61
		90	70.88	66.64	71.16	69.56	2.53
		120	75.47	70.60	74.34	73.47	2.55
		180	79.35	74.99	79.07	77.80	2.44
		240	82.61	77.46	82.26	80.77	2.88
		300	85.23	79.58	84.74	83.18	3.13
		360	86.22	80.86	85.65	84.24	2.95
		420	87.55	81.64	86.85	85.34	3.23
540	90.65	83.68	90.87	88.40	4.09		
660	90.32	85.11	90.24	88.56	2.99		
1200	95.38	88.41	95.23	93.01	3.98		
1440	95.28	89.14	95.63	93.35	3.55		
physical mixing	1:10	5	21.30	19.64	20.76	20.57	0.84
		10	27.50	27.34	28.41	27.75	0.57
		15	33.55	33.55	34.39	33.83	0.48
		20	39.27	39.35	40.12	39.58	0.47
		30	46.67	45.98	47.29	46.65	0.66
		45	52.53	51.89	54.15	52.86	1.16
		60	57.05	56.34	58.38	57.26	1.04
		90	62.70	60.53	63.16	62.16	1.35
		120	66.65	64.26	67.34	66.08	1.62
		180	70.82	67.16	72.70	70.23	2.82
		240	73.15	69.06	76.25	72.82	3.61
		300	74.63	71.49	78.66	74.99	3.70
		360	76.26	71.91	79.66	75.94	3.89
		420	77.61	72.39	86.81	78.93	7.30
540	81.21	72.90	88.40	80.84	7.75		
660	83.61	74.31	91.00	82.98	8.37		
1200	85.34	74.05	96.40	85.27	11.17		
1440	85.28	72.28	96.29	84.61	12.02		

Table 36 Percent dissolved of nifedipine-PEG6000 prepared by melting method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.		
			# 1	# 2	# 3				
melting	1:1	5	25.05	13.58	16.25	18.29	6.00		
		10	33.39	24.47	24.21	27.36	5.22		
		15	39.19	30.29	29.16	32.88	5.50		
		20	42.51	33.98	33.54	36.67	5.06		
		30	48.29	39.67	38.55	42.17	5.33		
		45	53.93	44.96	43.90	47.60	5.51		
		60	61.68	49.55	48.71	53.31	7.26		
		90	69.66	55.34	53.78	59.59	8.75		
		120	77.98	59.72	57.67	65.12	11.18		
		180	88.19	66.27	63.52	72.66	13.52		
		240	95.14	70.09	67.96	77.73	15.11		
		300	104.37	73.20	71.43	83.00	18.53		
		360	107.09	75.46	73.57	85.37	18.83		
		420	110.34	75.84	73.16	86.44	20.73		
		540	113.73	78.86	75.88	89.49	21.04		
		660	114.59	81.12	77.09	90.94	20.59		
		1200	121.81	90.90	85.95	99.56	19.44		
		1440	121.19	89.76	84.61	98.52	19.80		
		melting	1:3	5	18.19	20.02	20.23	19.48	1.12
				10	27.47	29.32	28.89	28.56	0.97
15	34.97			36.10	35.12	35.39	0.61		
20	40.41			41.96	39.92	40.76	1.06		
30	47.31			49.36	46.82	47.83	1.35		
45	53.59			56.41	54.02	54.67	1.52		
60	59.23			61.28	58.05	59.52	1.64		
90	65.23			67.00	64.88	65.70	1.14		
120	69.82			81.78	68.70	73.43	7.25		
180	75.32			87.96	75.46	79.58	7.25		
240	78.65			88.97	79.72	82.45	5.67		
300	81.68			91.30	82.63	85.20	5.30		
360	84.24			93.84	85.38	87.82	5.24		
420	86.72			97.37	86.88	90.32	6.10		
540	87.94			99.00	89.62	92.19	5.96		
660	90.53			99.15	91.04	93.58	4.84		
1200	95.96			104.31	96.62	98.96	4.64		
1440	95.73			104.91	95.94	98.86	5.24		
melting	1:5			5	19.69	22.02	33.66	25.12	7.49
				10	44.42	47.94	59.73	50.70	8.02
		15	56.84	60.29	73.07	63.40	8.55		
		20	65.82	66.74	81.07	71.21	8.55		
		30	72.67	75.21	90.24	79.37	9.50		
		45	80.99	83.74	97.37	87.37	8.77		
		60	86.86	89.34	103.10	93.10	8.75		
		90	93.06	95.27	108.47	98.93	8.33		
		120	95.77	97.48	112.00	101.75	8.92		
		180	100.06	101.49	117.22	106.26	9.52		
		240	104.51	105.02	118.73	109.42	8.06		
		300	105.73	106.09	119.36	110.39	7.77		
		360	105.31	105.25	119.79	110.12	8.38		
		420	105.53	105.33	120.56	110.47	8.74		
		540	105.87	105.28	120.50	110.55	8.62		
		660	105.73	105.54	120.63	110.64	8.66		
		1200	105.39	105.47	120.42	110.43	8.66		
		1440	106.12	102.11	95.82	101.35	5.19		

Table 37 Percent dissolved of nifedipine-PEG6000 prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
solvent	1:1	5	14.24	18.87	18.80	17.30	2.65
		10	24.56	19.46	24.15	22.72	2.83
		15	23.49	29.37	27.77	26.88	3.04
		20	27.48	32.01	31.57	30.35	2.50
		30	33.19	38.34	36.23	35.92	2.59
		45	39.33	44.00	40.95	41.43	2.37
		60	43.63	47.53	45.13	45.43	1.97
		90	49.27	53.72	48.87	50.62	2.69
		120	53.80	57.76	52.04	54.53	2.93
		180	60.07	63.32	57.60	60.33	2.87
		240	64.59	67.42	61.77	64.59	2.83
		300	68.41	70.54	65.52	68.16	2.52
		360	70.53	72.17	67.50	70.07	2.37
		420	73.36	75.27	69.69	72.77	2.83
		540	74.71	78.65	71.96	75.11	3.36
		660	79.00	81.78	75.84	78.87	2.97
		1200	83.44	89.23	81.74	84.80	3.92
1440	85.23	90.46	83.32	86.34	3.70		
solvent	1:3	5	21.94	24.54	24.53	23.67	1.50
		10	38.76	41.72	41.58	40.69	1.67
		15	50.36	53.67	51.49	51.84	1.68
		20	58.36	60.88	58.41	59.22	1.44
		30	67.30	68.22	65.76	67.09	1.24
		45	75.29	75.00	73.23	74.51	1.11
		60	77.29	78.20	75.94	77.14	1.14
		90	82.42	83.12	80.93	82.16	1.12
		120	86.24	86.38	84.26	85.63	1.18
		180	88.78	89.77	88.50	89.02	0.67
		240	91.96	91.69	91.05	91.57	0.47
		300	93.10	91.49	92.32	92.30	0.81
		360	93.74	93.39	92.90	93.34	0.42
		420	97.67	93.74	93.95	95.12	2.21
		540	101.63	94.45	93.05	96.38	4.61
		660	99.20	93.90	94.73	95.95	2.85
		1200	100.99	95.41	95.25	97.21	3.27
1440	98.54	93.10	93.44	95.03	3.04		
solvent	1:5	5	19.95	25.35	25.12	23.47	3.05
		10	43.40	44.14	45.54	44.36	1.08
		15	55.81	55.19	59.19	56.73	2.15
		20	62.82	61.15	66.28	63.42	2.62
		30	72.18	71.28	73.19	72.22	0.96
		45	79.05	78.62	80.88	79.52	1.20
		60	84.21	82.74	85.34	84.10	1.31
		90	89.24	86.31	89.08	88.21	1.65
		120	91.42	89.66	91.42	90.83	1.02
		180	95.00	91.42	95.36	93.93	2.18
		240	96.93	93.82	96.31	95.69	1.65
		300	97.56	95.60	97.56	96.91	1.13
		360	97.58	94.63	97.36	96.52	1.65
		420	98.35	95.32	98.21	97.30	1.71
		540	97.66	97.22	97.94	97.58	0.36
		660	97.31	96.70	96.62	96.87	0.38
		1200	92.07	92.79	92.85	92.57	0.44
solvent	1:10	5	15.91	14.00	15.04	14.99	0.96
		10	45.70	42.33	44.15	44.06	1.68
		15	63.61	59.37	60.87	61.28	2.15
		20	71.21	66.64	69.86	69.24	2.35
		30	80.94	77.96	77.00	78.63	2.06
		45	86.46	85.47	85.24	85.73	0.65
		60	90.51	88.80	89.14	89.48	0.91
		90	94.79	93.95	92.12	93.62	1.36
		120	96.09	96.22	94.16	95.49	1.15
		180	97.42	97.00	95.80	96.74	0.84
		240	97.37	97.30	96.24	96.97	0.63
		300	97.72	96.51	95.54	96.59	1.09
		360	96.52	97.23	94.19	95.98	1.59
		420	95.96	96.11	95.60	95.89	0.26
		540	94.91	94.64	92.52	94.02	1.31
		660	93.17	92.96	91.39	92.51	0.98

Table 38 Percent dissolved of nifedipine-PEG6000 prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
kneading	1:1	5	24.50	25.48	26.26	25.41	0.88
		10	32.41	33.90	34.39	33.57	1.03
		15	39.90	40.05	41.32	40.42	0.78
		20	45.76	44.35	46.05	45.39	0.91
		30	55.55	53.36	53.09	54.00	1.35
		45	65.29	60.85	68.29	64.81	3.74
		60	68.35	66.08	65.92	66.78	1.36
		90	75.31	73.82	72.00	73.71	1.66
		120	80.75	78.57	75.89	78.40	2.43
		180	83.66	84.91	80.96	83.18	2.02
		240	86.91	85.65	82.47	85.01	2.29
		300	89.37	88.17	85.85	87.80	1.79
		360	89.05	89.45	84.74	87.75	2.61
		420	91.57	90.58	85.64	89.26	3.17
		540	91.59	93.41	87.20	90.74	3.19
660	91.80	95.04	87.64	91.49	3.71		
1200	98.00	99.49	91.79	96.43	4.08		
1440	95.50	98.87	91.82	95.40	3.53		
kneading	1:3	5	23.91	24.27	25.60	24.59	0.89
		10	34.42	35.41	34.51	34.78	0.55
		15	41.72	42.77	40.38	41.62	1.20
		20	48.21	48.29	45.67	47.39	1.49
		30	58.90	55.05	53.35	55.77	2.88
		45	70.47	63.22	60.92	64.87	4.94
		60	74.18	68.32	66.28	69.60	4.10
		90	82.77	74.31	70.73	75.94	6.19
		120	86.96	76.93	74.40	79.43	6.64
		180	92.52	81.31	78.00	83.94	7.61
		240	95.22	83.92	81.25	86.80	7.41
		300	97.83	86.34	82.18	88.78	8.11
		360	99.05	87.26	83.51	89.94	8.11
		420	98.85	86.57	82.90	89.44	8.35
		540	99.69	88.25	84.37	90.77	7.96
660	100.68	88.89	85.36	91.64	8.02		
1200	101.41	90.25	86.08	92.58	7.92		
1440	101.27	90.40	86.94	92.87	7.48		
kneading	1:5	5	28.37	28.54	28.55	28.48	0.10
		10	39.80	40.35	39.72	39.96	0.34
		15	47.92	49.12	47.29	48.11	0.93
		20	52.77	54.21	51.96	52.98	1.14
		30	58.83	60.63	57.74	59.07	1.46
		45	64.99	67.32	63.45	65.26	1.95
		60	68.67	71.30	67.42	69.13	1.98
		90	72.54	75.81	70.73	73.03	2.57
		120	76.24	79.83	74.18	76.75	2.86
		180	79.16	83.01	76.95	79.71	3.07
		240	81.76	85.20	79.97	82.31	2.65
		300	83.59	87.25	81.61	84.15	2.86
		360	84.85	88.67	82.74	85.42	3.00
		420	84.19	88.32	81.76	84.76	3.32
		540	86.24	90.35	83.86	86.82	3.29
660	86.64	90.79	84.24	87.22	3.31		
1200	89.89	93.20	88.39	90.49	2.46		
1440	90.08	93.85	88.13	90.69	2.91		
kneading	1:10	5	27.55	55.71	32.88	38.71	14.96
		10	43.98	70.05	46.60	53.54	14.35
		15	52.41	79.04	54.04	61.83	14.92
		20	58.07	84.64	59.14	67.28	15.04
		30	65.71	89.78	63.84	73.11	14.47
		45	70.14	95.99	70.77	78.96	14.74
		60	74.02	99.52	75.29	82.95	14.37
		90	79.94	105.37	80.64	88.65	14.49
		120	81.24	107.15	83.30	90.56	14.40
		180	84.62	110.19	84.28	93.03	14.86
		240	88.00	112.24	89.20	96.48	13.66
		300	89.29	112.81	90.14	97.42	13.34
		360	89.43	111.83	90.01	97.09	12.77
		420	90.49	114.29	90.07	98.28	13.86
		540	91.63	113.39	91.43	98.82	12.62
660	0.12	0.24	0.12	0.16	0.07		

Table 39 Percent dissolved of nifedipine-poloxamer 188 prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	18.80	18.66	20.31	19.26	0.92
		10	29.08	28.10	28.73	28.64	0.50
		15	35.66	33.77	35.12	34.85	0.98
		20	39.77	38.21	39.79	39.25	0.91
		30	47.86	45.54	46.56	46.65	1.17
		45	54.77	53.07	53.71	53.85	0.86
		60	60.64	58.39	60.12	59.72	1.18
		90	66.92	65.71	66.77	66.47	0.66
		120	71.64	71.09	69.60	70.78	1.05
		180	79.05	76.65	74.58	76.76	2.23
		240	83.50	80.96	77.86	80.78	2.83
		300	84.86	83.45	79.96	82.76	2.52
		360	86.76	86.13	81.31	84.74	2.98
		420	87.77	87.27	82.29	85.78	3.03
		540	90.00	89.09	83.47	87.52	3.54
		660	92.41	90.87	88.48	90.59	1.98
		1200	95.17	93.43	91.23	93.28	1.97
1440	97.09	95.61	89.80	94.50	4.07		
physical mixing	1:3	5	20.57	20.25	23.48	21.43	1.78
		10	32.20	30.40	32.86	31.82	1.27
		15	39.07	37.11	39.85	38.68	1.41
		20	44.45	42.34	44.44	43.74	1.21
		30	50.78	48.33	51.49	50.20	1.66
		45	58.96	54.68	57.50	57.04	2.18
		60	64.04	58.99	61.87	61.63	2.53
		90	72.70	65.39	69.18	69.09	3.66
		120	76.96	69.36	73.51	73.28	3.81
		180	83.24	74.36	78.52	78.71	4.44
		240	88.06	75.99	82.68	82.24	6.04
		300	89.18	78.04	84.60	83.94	5.60
		360	90.81	80.09	86.65	85.85	5.40
		420	92.78	81.37	87.85	87.33	5.72
		540	94.41	83.27	90.67	89.45	5.67
		660	96.25	85.40	91.75	91.13	5.45
		1200	98.17	87.41	94.73	93.77	5.94
1440	100.02	88.67	96.15	94.95	5.77		
physical mixing	1:10	5	21.90	24.64	24.70	23.75	1.60
		10	31.20	35.37	36.35	34.31	2.73
		15	37.30	42.09	39.91	39.77	2.40
		20	41.82	46.82	43.48	44.04	2.55
		30	46.61	52.74	53.15	50.84	3.66
		45	52.11	59.59	56.91	56.20	3.79
		60	57.41	63.27	60.37	60.35	2.93
		90	61.36	68.91	64.87	65.05	3.78
		120	65.08	73.77	69.26	69.37	4.34
		180	71.03	80.62	73.44	75.03	4.99
		240	73.30	85.23	76.89	78.47	6.12
		300	75.35	86.08	77.82	79.75	5.62
		360	76.27	88.04	80.01	81.44	6.02
		420	73.44	91.02	80.52	81.66	8.85
		540	79.09	93.50	81.13	84.57	7.80
		660	78.06	93.31	82.70	84.69	7.82
		1200	80.53	99.16	86.25	88.65	9.54

Table 40 Percent dissolved of nifedipine-poloxamer 188 by melting method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Melting	1:1	5	41.26	41.20	45.62	42.69	2.53
		10	62.19	61.49	61.16	61.61	0.53
		15	69.80	68.62	68.12	68.85	0.86
		20	73.77	72.86	70.38	72.34	1.75
		30	79.90	78.29	75.82	78.00	2.06
		45	85.27	82.16	79.84	82.42	2.72
		60	88.03	86.62	82.88	85.84	2.66
		90	92.41	91.49	84.51	89.47	4.32
		120	95.51	93.90	87.61	92.34	4.18
		180	97.55	96.02	89.80	94.46	4.11
		240	98.77	97.08	90.09	95.31	4.61
		300	99.42	97.93	92.14	96.49	3.85
		360	99.27	98.63	91.86	96.59	4.10
		420	99.00	99.14	92.29	96.81	3.91
		540	99.21	99.15	90.96	96.44	4.75
		660	98.73	98.32	89.84	95.63	5.02
1200	99.39	98.12	89.64	95.72	5.30		
1440	97.14	96.99	88.10	94.07	5.18		
Melting	1:3	5	55.22	58.11	61.31	58.21	3.05
		10	76.57	76.88	79.42	77.62	1.56
		15	85.10	83.79	83.16	84.02	0.99
		20	86.35	87.26	83.39	85.67	2.03
		30	87.54	87.91	84.58	86.68	1.82
		45	91.20	88.20	85.30	88.23	2.95
		60	93.47	91.22	87.97	90.89	2.76
		90	96.14	96.83	93.94	95.64	1.51
		120	99.53	98.41	97.20	98.38	1.16
		180	101.37	100.80	103.59	101.92	1.47
		240	101.87	101.93	101.66	101.82	0.14
		300	99.00	101.12	99.92	100.01	0.66
		360	98.01	99.50	99.35	98.95	0.82
		420	98.29	99.56	97.86	98.57	0.89
		540	98.01	99.85	99.42	99.09	0.96
		660	96.48	97.33	98.52	97.44	1.03
1200	97.91	93.50	93.56	94.99	2.53		
Melting	1:5	5	27.27	45.08	48.50	40.28	11.40
		10	70.48	76.47	76.49	74.48	3.46
		15	84.76	81.27	80.43	82.15	2.30
		20	88.20	85.24	93.03	88.82	3.94
		30	90.81	87.36	100.58	92.92	6.86
		45	93.00	88.98	101.32	94.43	6.30
		60	93.79	92.86	102.04	96.23	5.06
		90	101.44	98.14	101.65	100.41	1.97
		120	105.61	102.23	102.98	103.61	1.78
		180	108.81	104.14	108.95	107.30	2.74
		240	108.12	104.17	110.10	107.46	3.02
		300	108.96	104.09	111.23	108.10	3.65
		360	112.49	103.42	112.58	109.50	5.26
		420	111.46	102.43	113.94	109.28	6.06
		540	108.99	100.96	116.54	108.83	7.79
		660	108.51	99.40	116.30	108.07	8.46
1200	107.40	96.97	115.20	106.53	9.14		
1440	106.57	95.90	114.15	105.54	9.17		
Melting	1:10	5	60.94	77.66	62.48	67.03	9.24
		10	71.03	84.87	72.24	76.05	7.66
		15	77.76	90.54	75.65	81.31	8.06
		20	80.24	95.35	82.40	86.00	8.17
		30	85.52	99.93	82.37	89.28	9.36
		45	85.61	99.39	85.74	90.25	7.92
		60	90.17	100.30	87.02	92.50	6.94
		90	89.86	103.18	88.79	93.94	8.02
		120	91.54	103.76	89.34	94.88	7.76
		180	93.72	105.72	91.89	97.11	7.51
		240	93.04	109.76	91.56	98.12	10.11
		300	91.09	108.16	90.44	96.57	10.05
		360	92.48	115.26	90.29	99.34	13.82
		420	91.85	112.68	89.52	98.02	12.75
		540	91.57	112.19	88.12	97.30	13.01
		660	89.33	110.99	87.14	95.82	13.18
1200	88.20	109.41	85.95	94.52	12.94		
1440	88.06	109.68	85.10	94.28	13.42		

Table 41 Percent dissolved of nifedipine-poloxamer188 prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
solvent	1:1	5	20.26	20.89	45.62	28.92	14.46
		10	29.14	29.06	61.16	39.79	18.51
		15	35.57	35.57	68.12	46.42	18.79
		20	40.52	40.09	70.38	50.33	17.37
		30	47.34	46.99	75.82	56.72	16.54
		45	55.46	53.34	79.84	62.88	14.73
		60	61.89	59.91	82.88	68.23	12.73
		90	69.93	65.34	84.51	73.26	10.01
		120	73.26	67.75	87.61	76.21	10.25
		180	78.20	72.90	89.80	80.30	8.64
		240	81.94	75.80	90.09	82.61	7.17
		300	83.93	78.06	92.14	84.71	7.07
		360	85.61	79.12	91.86	85.53	6.37
		420	86.68	80.04	92.29	86.33	6.13
		540	88.01	81.09	90.96	86.69	5.06
		660	93.23	86.02	89.84	89.69	3.60
		1200	95.74	89.09	89.64	91.49	3.69
1440	93.66	88.28	88.10	90.01	3.16		
solvent	1:3	5	23.22	24.00	20.57	22.60	1.80
		10	32.15	32.98	29.31	31.48	1.93
		15	36.88	37.88	35.40	36.72	1.25
		20	39.87	40.64	40.06	40.19	0.40
		30	46.05	45.56	47.44	46.36	0.98
		45	49.45	50.01	54.93	51.46	3.01
		60	53.06	53.47	60.79	55.77	4.35
		90	57.13	57.76	68.20	61.03	6.22
		120	62.15	63.05	75.75	66.98	7.61
		180	65.88	67.84	82.24	71.99	8.93
		240	69.14	72.73	87.89	76.59	9.95
		300	71.54	74.22	91.93	79.23	11.08
		360	73.59	76.62	95.67	81.96	11.97
		420	77.32	79.72	99.75	85.60	12.32
		540	79.11	81.23	103.11	87.82	13.29
		660	80.79	84.11	104.58	89.83	12.88
		1200	86.80	90.53	105.16	94.16	9.71
1440	82.67	85.65	106.65	91.66	13.07		
solvent	1:5	5	55.43	55.52	55.16	55.37	0.18
		10	65.90	67.13	66.69	66.91	0.22
		15	73.57	73.71	74.12	73.93	0.21
		20	78.85	77.67	78.37	78.30	0.59
		30	83.24	81.96	82.67	82.62	0.64
		45	86.55	85.57	87.32	86.48	0.88
		60	90.35	87.98	89.89	89.41	1.26
		90	92.84	91.43	91.14	91.80	0.91
		120	94.19	92.69	93.97	93.61	0.81
		180	96.23	93.55	96.92	95.57	1.78
		240	96.96	94.47	97.44	96.29	1.59
		300	96.52	94.41	97.79	96.24	1.71
		360	96.03	94.83	97.86	96.24	1.53
		420	96.32	93.71	96.10	96.38	1.45
		540	95.68	93.23	96.32	95.07	1.63
		660	94.64	93.22	95.69	94.52	1.24
		1200	92.92	90.81	93.40	92.38	1.38
solvent	1:10	5	61.87	63.76	67.92	64.52	3.10
		10	75.81	77.47	75.09	76.12	1.22
		15	81.16	80.19	79.05	80.13	1.05
		20	83.15	82.59	81.74	82.50	0.71
		30	85.69	85.49	82.59	84.59	1.74
		45	87.02	87.94	85.41	86.79	1.28
		60	90.68	89.99	90.06	90.24	0.38
		90	97.58	97.58	91.13	95.43	3.72
		120	97.62	95.46	92.05	95.04	2.81
		180	99.44	99.56	97.59	98.86	1.10
		240	98.40	99.39	98.05	98.61	0.70
		300	100.65	100.30	99.04	100.00	0.85
		360	97.86	98.14	96.52	97.51	0.86
		420	96.17	97.50	96.30	96.66	0.73
		540	95.03	96.45	94.27	95.25	1.11
		660	93.69	94.28	92.79	93.59	0.75

Table 42 Percent dissolved of nifedipine-poloxamer 188 prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
kneading	1:1	5	21.39	32.76	21.81	25.32	6.44
		10	33.01	42.75	31.69	35.82	6.04
		15	41.35	48.91	39.03	43.10	5.16
		20	46.37	53.15	44.54	48.02	4.53
		30	54.26	60.54	51.24	55.35	4.75
		45	61.25	67.53	58.23	62.34	4.74
		60	64.45	71.76	62.82	66.35	4.76
		90	72.40	77.70	69.02	73.04	4.38
		120	76.58	81.30	74.67	77.51	3.41
		180	81.59	86.59	79.61	82.60	3.60
		240	84.84	89.08	83.64	85.85	2.85
		300	87.24	89.79	85.91	87.64	1.97
		360	89.15	92.67	87.81	89.88	2.51
		420	89.72	92.63	88.24	90.20	2.23
		540	91.98	93.19	89.66	91.61	1.80
		660	93.25	94.53	90.65	92.81	1.98
		1200	97.20	95.07	93.70	95.32	1.76
1440	96.18	96.34	95.04	95.85	0.71		
kneading	1:3	5	34.44	32.76	34.08	33.76	0.89
		10	44.17	42.75	43.17	43.36	0.73
		15	50.39	48.91	49.19	49.50	0.79
		20	54.92	53.15	53.43	53.83	0.95
		30	61.41	60.54	59.20	60.38	1.11
		45	68.65	67.53	65.76	67.31	1.46
		60	72.98	71.76	70.08	71.61	1.46
		90	77.91	77.70	75.92	77.18	1.09
		120	80.88	81.30	79.18	80.45	1.12
		180	85.61	86.59	83.27	85.16	1.71
		240	88.17	89.08	85.54	87.59	1.84
		300	88.53	89.79	86.19	88.17	1.82
		360	91.69	92.67	87.87	90.74	2.54
		420	91.64	92.63	87.82	90.69	2.54
		540	96.48	93.19	89.15	92.94	3.67
		660	96.79	94.53	90.71	94.01	3.07
		1200	99.06	95.07	91.52	95.22	3.77
1440	98.88	96.34	91.53	95.58	3.73		
kneading	1:5	5	33.84	33.36	36.02	34.40	1.42
		10	47.42	46.59	46.94	46.99	0.42
		15	54.17	52.84	54.24	53.75	0.79
		20	58.19	58.14	57.78	58.04	0.22
		30	63.48	68.75	63.20	65.14	3.13
		45	69.60	76.46	67.23	71.10	4.79
		60	73.79	77.98	70.69	74.15	3.66
		90	78.23	84.93	75.25	79.80	4.55
		120	82.88	88.40	80.21	83.83	4.18
		180	86.91	95.32	84.88	89.03	5.53
		240	91.64	99.56	88.82	93.34	5.57
		300	93.14	101.47	90.25	94.96	5.83
		360	93.92	104.59	91.95	96.82	6.80
		420	95.34	107.63	91.96	98.31	8.25
		540	96.89	108.56	92.88	99.44	8.15
		660	96.97	106.21	93.66	99.61	7.63
		1200	100.79	117.95	96.28	105.01	11.43
1440	100.75	117.44	96.79	104.99	10.96		
kneading	1:10	5	61.48	68.91	68.69	66.36	4.22
		10	75.77	78.28	78.20	77.42	1.43
		15	81.25	84.50	81.47	82.41	1.81
		20	83.38	88.60	83.45	85.15	2.99
		30	87.82	87.85	84.16	86.61	2.12
		45	80.82	80.61	80.03	80.49	0.41
		60	83.38	82.96	80.22	82.19	1.71
		90	86.41	86.90	84.16	85.82	1.46
		120	90.99	90.43	88.02	89.81	1.58
		180	96.41	95.02	95.14	95.52	0.77
		240	99.40	97.64	98.19	98.41	0.90
		300	98.28	98.71	98.01	98.33	0.35
		360	100.19	98.43	98.14	98.92	1.11
		420	96.96	96.12	97.38	96.82	0.64
		540	96.18	95.91	95.34	95.81	0.43
		660	96.66	95.32	96.60	96.26	0.82

Table 43 Percent dissolved of nifedipine-poloxamer288 prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	19.91	21.45	23.83	21.73	1.98
		10	35.80	33.99	35.69	35.16	1.01
		15	42.56	40.65	43.11	42.11	1.29
		20	47.64	45.89	48.58	47.37	1.37
		30	59.89	52.99	55.47	56.12	3.49
		45	63.18	61.11	62.60	62.29	1.07
		60	68.88	64.51	67.12	66.84	2.20
		90	74.10	74.79	72.13	73.68	1.38
		120	95.14	76.60	77.35	83.03	10.50
		180	87.03	84.26	81.87	84.39	2.58
		240	92.81	88.59	87.17	89.52	2.93
		300	95.71	92.47	89.71	92.63	3.00
		360	99.03	95.02	91.35	95.14	3.84
		420	101.16	94.96	92.19	96.10	4.59
540	103.20	98.97	93.83	98.67	4.69		
660	110.23	99.69	95.09	101.67	7.76		
1200	110.14	106.21	103.05	106.47	3.55		
1440	99.57	98.86	95.69	98.04	2.07		
physical mixing	1:3	5	16.98	24.75	20.20	20.64	3.90
		10	31.94	31.21	30.55	31.24	0.69
		15	39.60	39.25	37.00	38.61	1.41
		20	44.62	43.99	42.16	43.59	1.28
		30	52.37	51.39	50.25	51.34	1.06
		45	58.10	57.47	55.49	57.02	1.36
		60	62.41	61.85	59.80	61.35	1.37
		90	70.37	66.93	64.25	67.19	3.07
		120	74.27	71.17	67.42	70.95	3.43
		180	79.34	76.18	74.96	76.83	2.26
		240	83.09	79.78	79.08	80.65	2.14
		300	87.19	81.56	79.65	82.80	3.92
		360	90.50	83.89	82.19	85.53	4.39
		420	92.00	84.81	82.76	86.52	4.85
540	94.19	87.13	85.00	88.77	4.81		
660	93.92	95.98	106.22	98.70	6.59		
1200	105.92	93.03	90.55	96.50	8.25		
1440	100.37	92.65	90.39	94.47	5.24		
physical mixing	1:5	5	17.87	21.16	22.29	20.44	2.30
		10	32.63	35.10	33.91	33.88	1.24
		15	39.80	42.62	41.56	41.33	1.42
		20	44.12	47.43	45.04	45.53	1.71
		30	49.89	53.77	50.32	51.33	2.13
		45	59.89	62.44	58.56	60.29	1.97
		60	61.07	67.04	62.61	63.57	3.10
		90	65.28	71.49	66.77	67.85	3.24
		120	71.13	77.77	71.01	73.30	3.87
		180	75.37	83.41	74.53	77.77	4.90
		240	78.48	83.44	73.92	78.61	4.76
		300	79.55	85.69	76.45	80.56	4.70
		360	81.74	87.03	78.21	82.33	4.44
		420	84.13	88.09	78.66	83.63	4.74
540	85.41	90.07	79.49	84.99	5.30		
660	85.99	89.88	81.11	85.66	4.39		
1200	92.24	94.86	86.11	91.07	4.49		
1440	92.42	94.05	86.29	90.92	4.10		
physical mixing	1:10	5	21.47	24.28	24.90	23.55	1.83
		10	40.39	41.46	41.95	41.26	0.80
		15	47.64	48.56	49.34	48.51	0.85
		20	54.21	53.16	54.50	53.96	0.70
		30	59.44	59.85	64.72	61.34	2.94
		45	65.08	66.00	66.38	65.82	0.67
		60	68.90	69.55	70.17	69.54	0.64
		90	74.18	74.75	73.98	74.31	0.40
		120	77.73	78.99	78.42	78.38	0.63
		180	82.52	84.14	82.81	83.16	0.86
		240	85.20	86.35	85.57	85.71	0.58
		300	87.19	88.89	87.90	87.99	0.85
		360	88.04	89.60	90.06	89.24	1.06
		420	89.46	91.93	91.37	90.92	1.29
540	90.52	92.08	91.66	91.42	0.80		
660	90.54	93.36	92.16	92.02	1.42		
1200	94.70	97.46	96.47	96.21	1.40		
1440	94.65	96.42	95.92	95.66	0.91		

Table 44 Percent dissolved of nifedipine-poloxamer288 prepared by melting method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
melting	1:1	5	18.50	20.19	24.12	20.94	2.88
		10	31.85	33.53	33.44	32.21	1.07
		15	37.89	36.99	40.44	38.44	1.79
		20	42.29	41.30	44.26	42.62	1.51
		30	48.91	48.91	50.04	49.28	0.65
		45	54.06	55.26	58.14	55.82	2.09
		60	58.03	58.74	61.27	59.35	1.71
		90	68.16	65.21	67.74	67.04	1.59
		120	71.79	71.84	71.78	71.80	0.04
		180	76.79	75.95	77.34	76.69	0.70
		240	79.76	78.92	80.04	79.57	0.58
		300	82.30	81.74	82.44	82.16	0.37
		360	85.26	84.28	84.70	84.75	0.49
		420	85.20	85.98	85.48	85.55	0.39
		540	87.38	88.02	88.01	87.80	0.37
660	89.93	91.27	91.68	90.96	0.92		
1200	93.05	93.13	94.32	93.50	0.72		
1440	90.68	90.96	93.56	91.73	1.59		
melting	1:3	5	29.73	31.55	31.91	31.06	1.17
		10	41.96	43.16	41.83	42.32	0.73
		15	51.01	50.25	48.77	50.01	1.14
		20	54.28	54.49	52.87	53.88	0.88
		30	62.71	60.12	58.37	60.40	2.19
		45	68.17	65.56	63.66	65.79	2.27
		60	72.98	69.17	67.06	69.73	3.00
		90	75.95	75.01	71.70	74.22	2.23
		120	83.68	79.18	75.44	79.44	4.13
		180	87.66	82.64	78.34	82.88	4.66
		240	98.68	84.97	82.29	88.65	8.79
		300	98.20	80.43	83.65	87.42	9.47
		360	108.03	88.83	84.64	93.83	12.47
		420	106.95	89.37	85.77	94.03	11.34
		540	111.44	90.20	85.84	95.83	13.69
660	112.88	93.80	89.49	98.72	12.45		
1200	116.27	96.43	92.90	101.87	12.60		
1440	112.15	95.04	88.84	98.68	12.07		
melting	1:5	5	20.75	34.29	40.67	31.90	10.17
		10	65.63	67.18	66.29	66.36	0.78
		15	70.93	71.63	71.56	71.37	0.39
		20	74.89	71.80	72.91	73.20	1.56
		30	74.49	75.17	76.02	75.23	0.77
		45	76.59	79.20	79.40	78.40	1.57
		60	80.60	80.77	83.49	81.62	1.62
		90	85.75	85.68	87.02	86.15	0.75
		120	90.89	92.03	93.42	92.11	1.27
		180	91.00	92.55	95.99	93.18	2.55
		240	100.68	101.76	105.55	102.66	2.56
		300	99.47	100.04	103.36	100.96	2.10
		360	97.50	97.87	103.36	99.58	3.28
		420	99.66	100.52	103.76	101.32	2.16
		540	98.70	100.26	103.77	100.91	2.60
660	94.20	96.90	98.85	96.65	2.34		
1200	0.14	0.15	0.16	0.15	0.01		

Table 45 Percent dissolved of nifedipine-poloxamer288 prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
solvent	1:1	5	18.36	19.63	20.81	19.60	1.23
		10	29.62	30.68	30.75	30.35	0.63
		15	36.41	37.54	38.87	37.61	1.23
		20	43.33	42.21	44.25	43.26	1.02
		30	49.27	49.46	52.13	50.29	1.60
		45	59.06	56.16	58.92	58.05	1.63
		60	61.00	60.91	63.44	61.78	1.43
		90	71.68	65.77	69.08	68.84	2.96
		120	70.18	69.66	73.96	71.26	2.35
		180	74.59	75.71	79.81	76.71	2.74
		240	76.79	79.11	83.63	79.84	3.47
		300	82.49	82.43	85.47	83.46	1.74
		360	82.03	83.27	87.72	84.34	2.99
		420	83.85	85.47	89.14	86.16	2.71
		540	86.54	87.94	91.11	88.53	2.34
		660	88.81	90.76	93.73	91.10	2.48
		1200	94.16	93.60	97.54	95.10	2.13
1440	93.27	93.47	96.99	94.58	2.09		
solvent	1:3	5	21.33	26.93	30.02	26.09	4.40
		10	55.81	55.35	57.05	56.07	0.88
		15	64.63	63.29	64.71	64.21	0.80
		20	70.57	65.03	70.15	68.58	3.09
		30	77.13	75.35	76.43	76.30	0.90
		45	83.20	81.58	84.40	83.06	1.42
		60	88.72	84.08	90.16	87.65	3.18
		90	91.69	89.00	94.12	91.60	2.56
		120	96.56	91.49	96.45	94.83	2.90
		180	98.62	93.53	99.13	97.10	3.10
		240	99.76	96.01	104.23	100.00	4.12
		300	100.32	94.75	103.25	99.44	4.32
		360	99.97	95.17	102.89	99.35	3.90
		420	99.41	97.29	103.66	100.12	3.25
		540	100.05	96.03	105.16	100.41	4.57
		660	101.46	97.37	105.02	101.28	3.83
		1200	98.88	97.12	106.17	100.72	4.80
1440	98.88	95.71	105.12	99.90	4.79		
solvent	1:5	5	37.17	41.37	44.32	40.95	3.59
		10	57.52	58.86	59.37	58.58	0.96
		15	64.71	66.32	65.49	65.51	0.80
		20	71.76	71.42	70.22	71.13	0.81
		30	77.56	77.97	75.87	77.14	1.12
		45	86.81	83.91	81.37	84.03	2.72
		60	87.62	87.45	84.55	86.54	1.72
		90	94.37	90.91	89.49	91.59	2.51
		120	96.02	94.10	91.97	94.03	2.03
		180	100.02	96.72	99.58	98.77	1.79
		240	101.15	100.80	98.42	100.12	1.49
		300	102.58	100.82	98.47	100.63	2.06
		360	102.08	102.30	97.29	100.14	2.06
		420	102.94	101.19	97.57	100.56	2.83
		540	104.48	104.13	98.48	102.37	2.74
		660	103.89	104.17	99.15	102.40	2.82
		1440	102.76	104.45	97.60	101.61	3.57
solvent	1:10	5	26.52	30.93	36.68	31.38	5.09
		10	64.12	66.46	68.51	66.36	2.20
		15	73.58	73.24	75.66	74.16	1.31
		20	74.83	76.86	77.50	76.40	1.39
		30	81.64	80.66	81.23	81.18	0.49
		45	88.68	89.24	84.34	87.42	2.69
		60	93.01	92.94	89.46	91.81	2.03
		90	90.08	89.95	103.41	94.48	7.73
		120	96.52	96.75	95.82	96.37	0.48
		180	98.88	100.30	98.38	99.18	0.99
		240	101.00	102.56	100.16	101.24	1.22
		300	101.15	102.57	100.66	101.46	1.00
		360	100.53	102.50	101.08	101.37	1.02
		420	101.02	102.08	100.38	101.16	0.86
		540	101.09	102.37	100.38	101.28	1.01

Table 46 Percent dissolved of nifedipine-poloxamer288 prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
kneading	1:1	5	24.82	26.78	25.59	25.73	0.99
		10	37.65	37.38	35.62	36.88	1.10
		15	44.10	44.73	42.96	43.93	0.89
		20	52.14	50.25	47.50	49.96	2.33
		30	58.56	57.29	54.13	56.65	2.28
		45	64.98	64.21	60.32	63.17	2.50
		60	67.96	67.54	64.72	66.74	1.77
		90	73.45	73.17	69.29	71.97	2.32
		120	78.12	77.55	72.76	76.14	2.94
		180	82.00	82.98	77.69	80.89	2.81
		240	91.92	85.68	80.52	86.04	5.71
		300	96.12	87.72	84.49	89.44	6.00
		360	96.62	89.07	83.16	89.62	6.75
		420	98.24	90.48	84.77	91.16	6.76
		540	99.52	91.89	87.38	92.93	6.13
		660	106.06	94.72	91.18	97.32	7.77
		1200	107.65	97.47	93.51	99.54	7.29
1440	106.67	98.90	97.40	100.99	4.98		
kneading	1:3	5	23.85	24.96	24.54	24.45	0.56
		10	36.05	36.19	35.78	36.01	0.21
		15	43.13	43.55	42.50	43.06	0.53
		20	48.78	48.71	47.58	48.36	0.67
		30	55.27	55.83	54.21	55.10	0.82
		45	62.67	61.69	61.06	61.81	0.81
		60	68.05	67.63	69.60	68.42	1.04
		90	79.06	72.85	72.02	74.64	3.85
		120	78.53	76.73	76.10	77.12	1.26
		180	84.91	82.10	81.60	82.87	1.78
		240	90.70	85.56	83.73	86.67	3.61
		300	93.33	88.80	87.05	89.73	3.24
		360	98.05	89.59	88.53	92.06	5.22
		420	101.10	91.29	90.52	94.31	5.90
		540	102.23	93.19	91.17	95.53	5.89
		660	89.05	89.49	96.77	91.77	4.34
		1200	108.64	98.25	98.36	101.75	5.97
1440	108.60	99.64	96.81	101.68	6.15		
kneading	1:5	5	27.49	26.29	28.43	26.73	0.66
		10	39.21	36.53	37.52	37.75	1.35
		15	45.80	43.68	44.10	44.53	1.12
		20	51.03	48.91	49.26	49.73	1.14
		30	57.79	55.53	55.40	56.24	1.35
		45	67.30	65.25	64.70	65.75	1.37
		60	71.49	68.96	67.48	69.31	2.03
		90	74.18	71.57	72.97	72.91	1.31
		120	79.32	74.96	76.43	76.90	2.22
		180	82.01	79.33	78.63	79.99	1.78
		240	87.50	82.86	82.15	84.17	2.91
		300	88.24	85.13	83.78	85.71	2.28
		360	88.94	86.05	85.48	86.82	1.86
		420	99.75	87.53	85.42	90.90	7.74
		540	102.63	88.66	89.00	93.43	7.97
		660	105.28	89.59	88.18	94.35	9.49
		1200	102.75	93.67	92.81	96.41	5.60
1440	99.01	94.05	93.41	95.49	3.07		
kneading	1:10	5	65.74	43.20	46.91	51.95	12.09
		10	78.94	63.30	64.16	68.80	8.79
		15	85.75	71.41	71.12	76.09	8.36
		20	89.37	74.74	74.74	79.62	8.45
		30	93.17	79.53	79.53	84.08	7.87
		45	96.07	84.26	83.83	86.05	6.94
		60	101.62	89.06	86.65	92.45	8.04
		90	92.94	93.43	93.56	93.31	0.33
		120	105.41	92.26	91.56	96.41	7.80
		180	107.58	95.85	94.22	98.22	7.29
		240	108.99	96.20	95.15	100.11	7.70
		300	109.49	96.64	95.08	100.40	7.91
		360	109.21	97.36	94.59	100.38	7.76
		420	108.83	97.85	95.85	101.18	7.56
		540	110.20	97.85	95.93	101.32	7.75

Table 47 Percent dissolved of nifedipine-poloxamer407 prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	15.93	17.75	18.95	17.54	1.52
		10	28.30	28.80	29.85	28.98	0.79
		15	35.59	35.16	37.28	36.01	1.12
		20	42.37	40.97	42.15	41.83	0.75
		30	48.93	48.85	50.89	49.56	1.16
		45	56.96	56.40	59.36	57.57	1.57
		60	62.34	62.55	64.74	63.21	1.33
		90	69.39	69.38	72.43	70.40	1.76
		120	74.06	75.41	78.02	75.83	2.01
		180	80.67	83.08	83.79	82.51	1.63
		240	84.57	86.14	87.19	85.97	1.32
		300	87.69	88.33	89.74	88.59	1.05
		360	93.04	91.37	91.59	92.00	0.91
		420	93.22	92.93	92.57	92.91	0.33
		540	99.10	96.52	94.54	96.72	2.29
		660	98.93	97.11	97.02	97.68	1.08
		1200	101.68	101.13	99.99	100.93	0.86
1440	103.39	103.89	101.84	103.04	1.07		
physical mixing	1:3	5	16.91	18.81	20.82	18.85	1.96
		10	32.55	33.12	33.96	33.21	0.71
		15	40.91	41.34	44.42	42.22	1.91
		20	46.64	47.84	53.18	49.22	3.48
		30	54.31	56.23	71.97	60.83	9.69
		45	62.14	63.60	72.56	66.07	5.66
		60	64.79	68.59	75.15	69.51	5.24
		90	73.56	77.11	87.86	79.51	7.45
		120	79.00	81.71	94.81	85.17	8.45
		180	84.79	87.99	100.60	91.13	8.36
		240	89.60	91.32	107.87	96.26	10.09
		300	92.29	93.02	110.08	98.46	10.07
		360	92.52	94.92	114.31	100.58	11.95
		420	93.85	95.36	118.55	102.59	13.84
		540	96.11	98.18	122.43	105.58	14.54
		660	97.26	99.74	123.15	106.72	14.29
		1200	99.68	101.61	126.15	109.15	14.76
1440	100.46	102.74	127.01	110.07	14.71		
physical mixing	1:5	5	16.30	22.90	24.42	21.21	4.32
		10	34.91	34.66	33.74	34.44	0.62
		15	41.52	40.90	40.61	41.01	0.47
		20	46.40	46.12	45.77	46.10	0.31
		30	54.59	51.90	50.34	52.28	2.15
		45	59.58	58.19	57.18	58.32	1.38
		60	63.96	61.86	61.36	62.39	1.20
		90	70.09	70.08	67.22	69.13	1.66
		120	73.85	74.50	71.32	73.22	1.68
		180	79.41	79.71	75.75	78.29	2.20
		240	82.52	83.17	78.80	81.50	2.36
		300	84.56	87.07	80.56	84.00	3.27
		360	86.36	88.21	82.40	85.66	2.96
		420	86.16	88.37	83.68	86.07	2.34
		540	88.83	93.16	85.39	89.13	3.89
		660	88.99	91.26	86.59	88.95	2.34
		1200	94.56	94.79	91.32	93.56	1.94

Table 48 Percent dissolved of nifedipine-poloxamer407 prepared by melting method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Melting	1:1	5	20.58	20.64	27.23	22.82	3.82
		10	38.01	38.02	40.36	38.80	1.35
		15	44.98	44.64	46.25	45.29	0.85
		20	49.01	48.26	50.56	49.28	1.18
		30	53.81	53.40	55.78	54.33	1.27
		45	59.02	58.70	60.72	59.48	1.09
		60	63.48	62.60	64.67	63.58	1.04
		90	68.55	67.59	69.47	68.54	0.94
		120	72.59	71.20	73.85	72.55	1.32
		180	76.26	76.64	78.17	77.02	1.01
		240	80.56	79.12	81.69	80.46	1.29
		300	82.61	81.32	84.02	82.65	1.35
		360	85.43	83.31	86.01	84.92	1.42
		420	86.72	83.54	87.35	85.87	2.04
		540	87.29	85.24	88.62	87.05	1.70
660	88.27	85.00	89.54	87.60	2.35		
1200	92.31	88.93	94.28	91.84	2.70		
1440	90.50	85.86	92.89	89.75	3.58		
Melting	1:3	5	30.55	37.64	43.17	37.12	6.33
		10	68.79	69.47	69.77	69.35	0.50
		15	77.29	76.87	89.04	81.06	6.91
		20	82.18	80.91	83.57	82.22	1.33
		30	86.91	85.56	93.38	88.62	4.18
		45	91.42	88.55	95.45	91.81	3.47
		60	93.97	91.63	96.67	94.09	2.52
		90	91.46	94.74	101.86	96.02	5.31
		120	98.32	96.23	103.07	99.21	3.51
		180	102.79	99.89	106.24	102.97	3.18
		240	106.75	101.59	107.10	105.15	3.08
		300	101.26	99.99	106.55	102.60	3.48
		360	101.04	99.91	106.05	102.34	3.27
		420	100.06	99.28	104.94	101.43	3.06
		540	100.43	99.64	104.92	101.66	2.85
660	99.16	98.60	104.94	100.90	3.51		
1200	92.89	92.53	101.04	96.49	4.82		
Melting	1:5	5	44.63	62.45	61.59	56.22	10.05
		10	77.50	77.88	79.06	78.15	0.82
		15	86.72	84.06	85.69	85.49	1.34
		20	86.51	87.81	89.37	88.90	0.94
		30	93.33	91.41	93.96	92.90	1.32
		45	98.39	95.44	98.68	97.50	1.80
		60	99.40	96.93	99.40	98.58	1.43
		90	104.39	97.43	101.02	100.95	3.48
		120	107.71	102.14	102.43	104.10	3.14
		180	109.34	106.17	106.02	107.18	1.88
		240	114.56	106.19	109.76	110.17	4.20
		300	114.79	105.99	111.33	110.70	4.44
		360	115.64	106.19	112.54	111.46	4.81
		420	115.02	106.55	113.74	111.77	4.57
		540	113.55	104.03	111.86	109.81	5.08
660	111.80	103.33	113.60	109.58	5.48		
1200	110.89	102.14	119.34	110.79	8.60		
1440	107.66	98.50	107.71	104.62	5.30		
Melting	1:10	5	44.10	44.39	44.02	44.17	0.19
		10	72.36	74.82	73.22	73.47	1.25
		15	81.14	82.50	81.41	81.68	0.72
		20	85.83	84.42	84.70	84.98	0.74
		30	91.18	86.53	88.41	88.71	2.34
		45	90.86	91.54	90.74	91.05	0.43
		60	93.87	93.95	93.44	93.75	0.27
		90	96.28	96.13	95.72	96.04	0.29
		120	96.78	98.46	97.14	97.47	0.89
		180	102.19	103.33	102.25	102.59	0.64
		240	101.88	105.14	102.99	103.33	1.66
		300	99.56	103.47	101.01	101.35	1.97
		360	99.12	104.88	101.49	101.83	2.89
		420	100.35	104.17	101.75	102.09	1.93
		540	101.75	101.77	101.25	101.59	0.29
660	100.43	100.29	99.86	100.19	0.30		

Table 49 Percent dissolved of nifedipine-poloxamer407 prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Solvent	1:1	5	17.03	15.84	18.57	17.15	1.37
		10	26.73	25.75	30.27	27.58	2.38
		15	33.38	31.98	33.46	32.94	0.84
		20	37.98	36.99	38.62	37.86	0.82
		30	44.51	44.95	45.44	44.97	0.46
		45	53.05	52.77	53.69	53.17	0.47
		60	59.70	60.25	61.52	60.49	0.93
		90	66.05	66.33	69.15	67.17	1.71
		120	70.79	70.37	73.89	71.68	1.93
		180	76.08	76.77	79.68	77.51	1.91
		240	80.25	80.18	82.57	81.00	1.37
		300	83.21	82.86	85.82	83.96	1.62
		360	86.06	84.05	87.16	85.76	1.58
		420	85.64	85.20	88.73	86.52	1.92
		540	87.80	87.30	90.55	88.55	1.75
		660	91.62	92.32	95.84	93.26	2.26
		1200	82.37	94.89	97.57	91.61	8.12
1440	94.49	93.65	96.68	94.94	1.56		
Solvent	1:3	5	17.14	21.98	20.64	19.92	2.50
		10	33.50	34.86	33.45	33.94	0.80
		15	39.27	41.40	40.32	40.33	1.06
		20	44.43	45.28	44.43	44.71	0.49
		30	50.28	52.61	52.32	51.74	1.27
		45	56.01	57.48	59.08	57.52	1.54
		60	58.12	62.50	60.87	60.50	2.21
		90	63.19	65.89	70.93	66.67	3.93
		120	67.92	69.21	72.81	69.98	2.53
		180	72.51	73.93	78.44	74.96	3.09
		240	75.63	77.18	83.24	78.68	4.03
		300	79.51	80.09	84.33	81.31	2.63
		360	79.88	80.59	85.66	82.04	3.15
		420	82.12	82.64	88.42	84.40	3.50
		540	85.65	85.33	90.60	87.20	2.96
		660	87.16	87.16	92.58	88.97	3.13
		1200	95.25	92.95	98.44	95.55	2.76
1440	89.87	88.48	94.26	91.18	1.56		
Solvent	1:5	5	49.54	62.87	60.70	57.70	7.15
		10	62.11	66.60	66.45	65.05	2.55
		15	69.62	73.98	72.85	72.15	2.26
		20	75.75	78.16	76.61	76.84	1.22
		30	81.55	83.16	81.54	82.09	0.93
		45	86.00	87.68	86.41	86.70	0.88
		60	90.45	91.08	85.59	89.04	3.00
		90	92.28	91.58	91.20	91.69	0.55
		120	94.25	95.17	94.24	94.55	0.53
		180	97.01	97.79	96.23	97.01	0.78
		240	98.08	98.93	96.60	97.87	1.18
		300	98.36	99.22	96.68	98.09	1.29
		360	98.44	99.63	97.17	98.41	1.23
		420	97.39	98.46	95.69	97.18	1.40
		540	95.55	97.75	97.04	96.78	1.12
		660	95.84	96.49	94.44	95.59	1.04
		1200	92.71	93.71	91.37	92.60	1.17
Solvent	1:10	5	39.96	49.79	54.70	48.15	7.51
		10	70.05	75.18	71.04	72.09	2.72
		15	76.94	80.00	76.82	77.92	1.80
		20	81.94	83.25	79.29	81.48	2.01
		30	85.70	85.85	83.45	85.00	1.34
		45	89.66	89.44	87.11	88.74	1.41
		60	91.37	92.07	90.15	91.19	0.97
		90	94.03	95.79	93.97	94.60	1.04
		120	94.75	97.29	94.68	95.57	1.49
		180	96.53	100.18	95.46	97.39	2.48
		240	95.69	100.20	95.61	97.17	2.63
		300	94.63	98.50	94.71	95.95	2.21
		360	93.56	98.99	94.63	95.73	2.88

Table 50 Percent dissolved of nifedipine-poloxamer407 prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
Kneading	1:1	5	21.12	19.22	20.62	20.32	0.99
		10	32.60	31.25	33.50	32.45	1.13
		15	39.53	39.45	42.07	40.35	1.49
		20	45.11	45.46	46.74	45.77	0.86
		30	54.20	53.99	53.51	53.90	0.36
		45	59.85	61.05	61.54	60.81	0.87
		60	65.36	65.80	78.28	69.81	7.34
		90	73.32	73.32	86.87	77.84	7.82
		120	76.65	98.23	97.94	90.94	12.37
		180	82.64	96.37	108.17	95.73	12.78
		240	86.67	86.90	110.62	94.73	13.76
		300	89.72	88.19	112.39	96.77	13.55
		360	90.08	90.50	113.86	98.15	13.61
		420	90.93	91.49	114.15	98.86	13.25
		540	92.27	92.91	116.89	100.69	14.03
		660	94.03	93.48	116.98	101.50	13.41
		1200	98.05	97.78	120.58	105.47	13.09
1440	97.25	97.32	120.33	104.97	13.30		
Kneading	1:3	5	25.32	27.01	26.43	26.25	0.86
		10	34.02	33.81	34.26	34.03	0.23
		15	39.10	40.45	40.18	39.91	0.71
		20	43.63	46.65	45.60	45.29	1.54
		30	51.44	54.13	53.32	52.96	1.38
		45	58.98	61.96	61.09	60.68	1.53
		60	64.51	68.39	67.13	66.68	1.98
		90	71.55	74.81	73.92	73.43	1.68
		120	83.80	79.82	82.64	82.09	2.05
		180	83.80	85.61	85.56	84.99	1.03
		240	87.24	89.78	89.41	88.81	1.37
		300	90.56	90.02	91.21	90.60	0.59
		360	90.36	93.25	92.74	92.12	1.54
		420	91.56	93.97	93.71	93.08	1.32
		540	93.40	95.18	95.25	94.61	1.04
		660	95.80	96.87	97.31	96.66	0.78
		1200	97.25	98.45	98.84	98.18	0.83
1440	97.05	98.13	98.58	97.92	0.79		
Kneading	1:5	5.00	26.10	27.30	30.10	27.83	2.05
		10.00	35.64	35.02	36.94	35.87	0.98
		15.00	40.75	40.47	41.73	40.98	0.86
		20.00	44.56	45.76	46.68	45.67	1.06
		30.00	51.25	52.80	52.52	52.19	0.83
		45.00	58.58	59.50	58.45	58.84	0.57
		60.00	63.46	69.10	63.95	65.50	3.12
		90.00	70.84	76.23	69.46	72.18	3.58
		120.00	74.68	82.98	74.68	77.45	4.79
		180.00	81.79	91.26	81.94	85.00	5.42
		240.00	85.55	94.46	84.50	88.17	5.47
		300.00	88.24	97.28	88.59	91.37	5.12
		360.00	90.45	98.28	90.24	92.99	4.59
		420.00	90.93	99.34	91.94	94.07	4.59
		540.00	92.84	100.96	96.31	96.71	4.07
		660.00	94.97	105.39	95.34	98.57	5.91
		1200.00	98.23	105.10	100.69	101.34	3.48
1440.00	116.09	96.87	98.95	103.97	10.55		
Kneading	1:10	5.00	8.28	44.92	54.04	35.75	24.22
		10.00	66.71	71.27	73.43	70.47	3.43
		15.00	76.65	78.07	80.41	78.38	1.90
		20.00	81.19	82.19	83.60	82.32	1.21
		30.00	86.27	85.15	88.67	86.69	1.80
		45.00	90.34	85.65	87.43	87.81	2.37
		60.00	91.01	90.63	91.20	90.95	0.29
		90.00	95.72	94.32	95.93	95.32	0.88
		120.00	97.00	94.62	98.13	96.58	1.79
		180.00	98.20	96.79	100.45	98.48	1.85
		240.00	98.49	97.09	102.73	99.44	2.94
		300.00	99.05	97.01	102.59	99.55	2.82
		360.00	100.54	98.43	104.21	101.06	2.93
		420.00	98.94	96.12	104.65	99.90	4.35
		540.00	97.73	94.71	103.45	98.63	4.44
		660.00	99.63	96.81	105.20	100.55	4.27

Table 51 Percent dissolved of nifedipine- β -cyclodextrin prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	16.32	18.31	17.50	17.38	1.00
		10	18.97	18.70	18.92	18.86	0.14
		15	20.09	20.39	20.24	20.24	0.15
		20	22.40	22.24	22.90	22.51	0.34
		30	27.04	26.00	27.56	26.86	0.79
		45	27.72	32.57	33.97	31.42	3.28
		60	36.43	37.90	40.92	38.42	2.29
		90	38.16	46.38	51.04	45.19	6.52
		120	46.03	53.27	59.03	52.78	6.52
		180	56.96	61.91	69.75	62.87	6.45
		240	64.88	67.40	74.57	68.95	5.03
		300	72.95	72.07	79.24	74.75	3.91
		360	74.83	74.30	82.50	77.21	4.59
		420	76.89	75.71	83.47	78.69	4.18
		540	82.06	80.21	87.23	83.16	3.64
		660	83.78	82.80	89.68	85.42	3.72
		1200	88.45	90.25	96.69	91.80	4.33
1440	90.09	90.97	96.81	92.62	3.65		
physical mixing	1:3	5	16.41	16.83	17.25	16.83	0.42
		10	19.80	20.99	21.42	20.74	0.84
		15	21.99	23.54	24.46	23.33	1.25
		20	24.25	25.60	26.44	25.43	1.10
		30	28.48	31.29	31.58	30.45	1.71
		45	33.90	38.40	36.10	36.13	2.25
		60	37.93	44.06	41.52	41.17	3.08
		90	44.97	53.70	49.98	49.55	4.38
		120	49.84	60.63	55.14	55.21	5.40
		180	58.79	69.78	62.81	63.80	5.56
		240	62.84	73.77	72.49	69.70	5.98
		300	66.22	76.94	76.81	73.33	6.15
		360	68.70	79.29	81.68	76.56	6.91
		420	71.03	80.98	84.23	78.75	6.88
		540	74.21	84.01	87.69	81.97	6.97
		660	75.20	84.88	90.38	83.48	7.68
		1200	80.48	91.20	96.50	89.40	8.16
1440	78.77	88.64	94.65	87.35	8.02		
physical mixing	1:5	5	11.65	13.13	12.98	12.59	0.81
		10	17.53	19.09	19.72	18.78	1.13
		15	21.92	21.98	25.79	23.23	2.22
		20	25.87	25.81	29.25	26.98	1.97
		30	30.11	30.03	34.89	31.68	2.78
		45	35.31	35.88	41.31	37.50	3.31
		60	39.06	40.04	45.76	41.62	3.62
		90	44.28	46.45	51.47	47.40	3.68
		120	49.92	49.64	55.55	51.71	3.33
		180	55.00	56.96	63.39	58.45	4.59
		240	59.81	61.92	64.96	62.23	2.59
		300	62.21	64.54	67.85	64.87	2.83
		360	63.69	67.36	70.32	67.12	3.32
		420	66.58	68.92	70.68	68.73	2.06
		540	71.16	71.10	73.99	72.08	1.65
		660	72.17	72.24	74.79	73.07	1.49
		1200	79.00	77.45	80.00	78.81	1.28
1440	77.91	77.06	78.90	77.96	0.92		
physical mixing	1:10	5	18.87	21.27	22.74	20.96	1.96
		10	27.89	30.92	32.13	30.31	2.19
		15	32.57	35.81	36.53	34.97	2.11
		20	37.32	39.48	39.56	38.79	1.27
		30	42.16	42.94	45.75	43.62	1.89
		45	48.00	49.34	51.54	49.63	1.79
		60	51.96	53.24	55.78	53.66	1.94
		90	59.14	58.24	61.27	59.55	1.56
		120	63.74	62.76	66.36	64.28	1.86
		180	69.45	69.48	70.17	69.70	0.41
		240	73.27	70.46	73.50	72.41	1.69
		300	74.84	74.35	75.25	74.81	0.45
		360	77.16	76.97	77.10	77.08	0.10
		420	79.00	78.17	78.17	78.45	0.48
		540	80.84	80.29	79.86	80.33	0.49
		660	83.58	82.41	82.32	82.77	0.70
		1200	87.50	85.05	86.44	86.33	1.23
1440	88.51	85.77	88.36	87.55	1.54		

Table 52 Percent dissolved of nifedipine- β -cyclodextrin prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
kneading	1:1	5	17.38	16.18	16.39	16.65	0.64
		10	18.52	21.67	23.70	21.30	2.61
		15	24.28	26.68	29.43	26.80	2.58
		20	28.88	31.35	34.16	31.46	2.64
		30	36.21	37.69	41.84	38.58	2.92
		45	41.22	45.10	49.25	45.19	4.02
		60	47.22	49.34	55.61	50.72	4.36
		90	54.33	56.66	62.37	57.79	4.14
		120	60.13	63.51	67.46	63.70	3.67
		180	66.57	69.16	74.88	69.86	4.68
		240	69.31	74.52	78.20	74.01	4.46
		300	71.44	78.06	81.86	77.12	5.27
		360	74.40	80.40	83.43	79.41	4.60
		420	79.98	84.85	85.40	83.41	2.98
540	78.32	85.37	87.52	83.74	4.81		
660	84.50	87.33	90.71	87.51	3.11		
1200	90.01	94.23	95.93	93.39	3.05		
1440	88.35	94.26	94.20	92.27	3.40		
kneading	1:3	5	13.03	13.31	16.75	14.37	2.07
		10	23.83	25.45	27.08	25.46	1.62
		15	33.36	32.60	33.81	33.26	0.61
		20	37.07	38.33	40.01	38.47	1.47
		30	43.40	47.99	47.21	46.19	2.45
		45	49.05	55.11	53.70	52.62	3.17
		60	58.02	61.89	58.37	59.43	2.14
		90	58.54	67.04	63.79	63.13	4.29
		120	65.21	74.37	68.59	69.39	4.63
		180	66.85	78.13	72.83	72.61	5.64
		240	71.85	82.86	77.42	77.37	5.50
		300	73.14	84.15	78.15	78.48	5.51
		360	74.20	85.28	80.26	79.91	5.55
		420	76.31	87.67	81.81	81.93	5.68
540	78.07	89.37	84.00	83.81	5.65		
660	79.15	89.66	84.09	84.30	5.26		
1200	84.15	91.92	88.43	86.17	3.89		
1440	83.34	91.66	89.46	88.15	4.31		
kneading	1:5	5	17.39	17.81	19.28	18.16	0.99
		10	30.32	31.52	35.32	32.39	2.61
		15	38.46	39.17	40.31	39.31	0.93
		20	43.77	44.05	44.97	44.26	0.63
		30	50.17	51.24	50.52	50.65	0.54
		45	56.38	57.45	57.08	56.97	0.55
		60	62.81	60.50	62.24	61.85	1.20
		90	68.32	66.35	67.33	67.33	0.99
		120	71.99	69.32	72.47	71.26	1.70
		180	76.02	73.89	76.85	75.59	1.52
		240	81.16	77.22	84.04	80.81	3.42
		300	82.32	78.57	81.63	80.84	2.00
		360	82.88	80.90	83.79	82.52	1.48
		420	84.57	83.58	85.52	84.59	1.02
540	86.47	96.71	87.04	90.07	5.76		
660	87.19	86.34	88.11	87.21	0.88		
1200	92.21	92.61	92.91	92.58	0.35		
1440	91.74	94.41	94.89	93.68	1.70		
kneading	1:10	5	22.94	22.67	23.04	22.88	0.19
		10	39.13	38.63	39.28	39.02	0.34
		15	47.39	47.82	48.09	47.77	0.35
		20	52.34	51.28	52.33	51.98	0.61
		30	60.19	60.04	60.73	60.32	0.36
		45	63.50	66.63	65.73	65.29	1.61
		60	66.93	72.29	70.31	69.84	2.71
		90	71.36	77.57	75.22	74.72	3.14
		120	73.80	81.08	78.23	77.70	3.67
		180	76.87	85.30	81.91	81.36	4.24
		240	78.87	88.38	84.47	83.91	4.78
		300	81.45	92.02	87.61	87.03	5.31
		360	81.75	92.54	88.03	87.44	5.42
		420	82.25	93.32	88.68	88.08	5.66
540	83.34	94.70	89.92	89.32	5.70		
660	83.22	94.93	89.97	89.37	5.88		

Table 53 Percent dissolved of nifedipine-2-hydroxypropyl- β -cyclodextrin prepared by physical mixing.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
physical mixing	1:1	5	18.45	18.45	18.38	18.43	0.04
		10	20.16	22.62	21.28	21.36	1.23
		15	21.79	24.04	23.76	23.20	1.23
		20	25.94	27.06	26.22	26.41	0.59
		30	29.75	32.97	30.95	31.22	1.63
		45	35.87	39.53	34.83	36.74	2.47
		60	44.75	44.97	38.63	42.79	3.60
		90	48.38	53.07	45.24	48.90	3.94
		120	56.11	59.15	50.62	55.30	4.32
		180	60.85	66.34	56.89	61.36	4.74
		240	65.16	70.58	62.27	66.00	4.22
		300	67.92	74.33	65.02	69.09	4.76
		360	72.36	76.88	67.77	72.34	4.55
		420	74.84	77.52	68.71	73.69	4.52
		540	78.78	80.33	72.01	77.04	4.43
		660	81.05	82.11	74.13	79.10	4.33
		1200	88.02	89.08	80.60	85.90	4.62
1440	88.84	90.94	82.33	87.37	4.49		
physical mixing	1:3	5	20.55	20.27	20.89	20.57	0.31
		10	25.37	24.32	27.26	25.65	1.49
		15	28.55	26.79	30.95	28.76	2.09
		20	32.92	29.68	34.19	32.26	2.33
		30	39.96	35.72	39.83	38.50	2.41
		45	46.73	41.80	45.68	44.73	2.60
		60	52.67	48.50	48.94	50.03	2.29
		90	59.37	58.00	54.92	57.43	2.79
		120	66.00	62.91	60.43	63.11	2.79
		180	71.79	70.30	64.60	68.90	3.79
		240	75.61	73.91	66.87	72.13	4.64
		300	78.08	76.24	69.62	74.65	4.45
		360	81.40	78.92	71.74	77.35	5.02
		420	83.81	81.19	72.87	79.29	5.71
		540	86.21	84.00	74.99	81.73	5.94
		660	86.99	85.64	76.12	82.92	5.92
		1200	93.81	89.87	82.23	86.64	5.89
1440	91.24	89.20	79.62	86.69	6.20		
physical mixing	1:5	5	27.67	20.98	19.72	22.79	4.27
		10	33.29	26.00	24.46	27.92	4.72
		15	43.49	30.46	28.41	34.12	8.18
		20	45.79	34.97	29.70	36.82	8.20
		30	56.33	41.03	33.56	43.64	11.61
		45	61.08	48.57	39.90	49.85	10.65
		60	70.52	53.67	43.45	55.88	13.67
		90	85.16	61.69	47.96	64.94	18.82
		120	100.40	66.58	50.85	72.61	25.32
		180	96.98	73.27	55.57	75.27	20.78
		240	101.97	79.76	59.24	80.29	21.32
		300	111.92	82.32	61.23	84.66	24.99
		360	108.76	85.63	64.18	86.19	22.29
		420	109.66	86.91	65.39	87.32	22.13
		540	113.45	90.58	67.86	90.63	22.80
		660	114.81	92.29	70.13	92.41	22.34
		1200	119.90	109.72	77.80	102.47	21.97
1440	118.24	109.25	76.86	101.45	21.77		
physical mixing	1:10	5	20.76	22.04	21.74	21.51	0.67
		10	28.51	28.75	28.46	28.57	0.16
		15	34.11	33.42	33.27	33.60	0.45
		20	37.57	35.41	36.32	36.43	1.09
		30	43.21	40.47	42.72	42.13	1.46
		45	49.33	45.90	48.15	47.79	1.74
		60	53.93	48.88	54.14	52.32	2.98
		90	60.42	63.56	61.34	61.77	1.62
		120	65.36	59.43	66.35	63.71	3.74
		180	70.93	66.07	72.42	69.81	3.32
		240	75.31	71.16	77.00	74.49	3.01
		300	77.09	73.37	79.71	76.72	3.19
		360	79.42	74.84	81.47	78.56	3.39
		420	80.41	89.53	82.76	84.23	4.74
		540	82.32	81.61	85.36	83.10	1.99
		660	83.53	85.07	86.85	85.15	1.66
		1200	87.75	89.04	92.63	89.81	2.53
1440	87.42	88.64	92.59	89.55	2.70		

Table 54 Percent dissolved of nifedipine-2-hydroxypropyl- β -cyclodextrin prepared by solvent method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.		
			# 1	# 2	# 3				
solvent	1:1	5	16.84	17.82	17.89	17.51	0.59		
		10	19.67	22.27	22.55	21.49	1.59		
		15	25.09	27.34	27.69	26.71	1.41		
		20	28.70	32.50	32.43	31.21	2.18		
		30	37.43	40.96	39.33	39.24	1.76		
		45	42.59	47.67	47.09	45.79	2.78		
		60	47.18	59.10	54.93	53.74	6.05		
		90	57.54	65.15	65.38	62.69	4.46		
		120	62.94	69.47	72.67	68.36	4.96		
		180	69.90	79.91	80.22	76.68	5.87		
		240	79.73	85.51	84.76	83.33	3.15		
		300	81.09	90.61	88.92	86.88	5.08		
		360	84.13	92.10	91.20	89.14	4.37		
		420	83.50	97.75	92.54	91.26	7.21		
		540	88.86	94.12	98.17	93.72	4.67		
		660	87.46	101.53	98.21	95.73	7.35		
		1200	94.48	107.26	103.75	101.83	6.60		
		1440	96.22	106.11	102.88	101.74	5.05		
		solvent	1:3	5	18.94	20.20	19.84	19.66	0.65
				10	24.16	27.11	25.28	25.52	1.49
15	29.16			33.32	30.86	31.11	2.09		
20	33.55			38.62	34.82	35.66	2.64		
30	42.71			45.51	40.52	43.25	3.03		
45	55.46			54.48	47.71	52.55	4.22		
60	62.34			60.35	52.66	58.45	5.11		
90	70.73			70.56	61.18	67.49	5.47		
120	77.93			76.85	69.30	74.70	4.70		
180	88.64			85.32	76.58	83.51	6.23		
240	96.14			88.81	82.15	89.03	7.00		
300	102.43			93.60	85.90	93.98	8.27		
360	104.57			95.59	89.37	96.51	7.64		
420	107.81			96.72	91.42	98.65	8.37		
540	115.29			98.92	93.07	102.42	11.52		
660	117.57			100.62	97.58	105.26	10.77		
1200	122.92			104.98	105.89	111.27	10.10		
1440	121.70			104.52	105.53	110.58	9.64		
solvent	1:5			5	14.72	15.57	15.99	15.91	1.32
				10	18.39	20.76	20.57	23.52	2.25
		15	21.07	25.51	23.96	26.88	2.59		
		20	24.04	29.11	27.49	31.76	2.99		
		30	28.48	34.32	32.49	37.41	2.93		
		45	34.05	39.41	38.77	42.19	2.05		
		60	39.84	43.58	43.15	48.01	1.08		
		90	46.81	48.92	48.31	54.19	1.50		
		120	52.61	54.37	55.58	62.69	1.83		
		180	60.99	62.47	64.62	73.69	4.63		
		240	74.03	68.90	78.14	77.02	4.48		
		300	75.50	73.49	82.06	80.73	4.90		
		360	78.52	77.32	86.35	84.28	4.54		
		420	83.25	80.35	89.25	88.95	4.92		
		540	87.41	84.99	94.46	93.92	5.54		
		660	91.58	89.94	100.25	102.83	6.71		
		1200	100.58	97.54	110.37	100.53	7.67		
		1440	96.30	95.92	109.38	100.53	7.67		
		solvent	1:10	5	28.12	29.24	28.97	28.78	0.58
				10	44.42	42.59	42.53	43.18	1.07
15	53.13			50.11	51.37	51.54	1.52		
20	57.88			57.09	58.22	57.73	0.58		
30	69.07			64.92	65.84	66.61	2.18		
45	76.36			72.12	72.27	73.58	2.41		
60	83.55			76.51	76.30	78.79	4.13		
90	97.32			82.64	80.74	86.90	9.08		
120	99.47			85.20	85.89	90.19	8.05		
180	104.96			90.97	89.36	95.10	8.58		
240	109.42			93.96	92.81	98.73	9.28		
300	115.78			96.49	93.88	102.05	11.96		
360	117.10			98.70	95.86	103.89	11.53		
420	117.43			99.20	96.08	104.24	11.53		
540	116.60			100.47	96.93	104.73	10.60		
660	119.47			101.89	100.72	107.36	10.50		
1200	117.66			100.51	100.48	106.21	9.91		
1440	115.70			99.44	97.61	104.25	9.96		

Table 55 Percent dissolved of nifedipine-2-hydroxypropyl- β -cyclodextrin prepared by kneading method.

Method	Drug : Carrier ratio	Time (min)	% Drug dissolved			Mean	SD.
			# 1	# 2	# 3		
kneading	1:1	5	20.25	20.10	19.47	19.94	0.41
		10	30.89	30.45	29.39	30.24	0.77
		15	40.40	37.71	36.15	38.09	2.15
		20	45.11	43.06	40.85	43.01	2.13
		30	54.61	50.14	47.45	50.73	3.62
		45	64.55	57.11	53.49	58.38	5.64
		60	69.12	62.02	58.75	63.30	5.30
		90	79.54	69.11	63.23	70.63	8.26
		120	83.41	73.95	67.70	75.02	7.91
		180	87.32	78.29	72.39	79.33	7.52
		240	96.60	83.05	76.02	85.22	10.46
		300	97.92	86.83	78.15	87.63	9.91
		360	103.93	88.69	80.15	90.92	12.05
		420	107.87	91.54	81.01	93.47	13.53
		540	107.47	91.84	79.62	92.98	13.96
		660	108.74	92.91	82.16	94.60	13.37
		1320	117.39	99.77	86.48	101.21	15.51
1440	115.88	97.34	85.09	99.43	15.50		
kneading	1:3	5	19.53	21.24	21.60	20.79	1.11
		10	32.62	32.70	33.63	32.98	0.56
		15	42.89	41.25	41.97	42.04	0.82
		20	48.58	47.58	47.15	47.77	0.73
		30	60.89	55.03	54.67	56.86	3.49
		45	67.02	61.63	60.14	62.93	3.62
		60	69.76	66.52	63.88	66.72	2.95
		90	80.64	73.04	68.25	73.98	6.25
		120	83.04	78.15	72.56	77.91	5.25
		180	86.52	81.02	74.80	80.81	5.92
		240	90.99	86.04	79.51	85.51	5.76
		300	94.16	85.71	79.04	86.30	7.58
		360	96.90	87.49	80.54	88.98	9.27
		420	96.77	88.21	81.75	88.91	7.54
		540	97.48	88.65	83.04	89.72	7.28
		660	99.64	90.66	83.50	91.27	8.08
		1200	102.52	94.11	87.22	94.62	7.66
1440	101.68	95.55	87.60	94.94	7.06		
kneading	1:5	5	18.49	31.92	32.77	27.73	8.01
		10	47.04	47.20	47.77	47.34	0.39
		15	55.29	54.65	54.93	54.96	0.32
		20	59.63	58.92	59.42	59.32	0.37
		30	67.10	65.23	67.74	66.69	1.30
		45	73.03	69.71	72.66	71.80	1.82
		60	77.62	72.67	76.26	75.52	2.56
		90	83.17	82.14	82.22	82.51	0.57
		120	86.20	84.85	86.91	85.98	1.05
		180	89.37	86.58	89.59	88.51	1.68
		240	92.10	90.39	91.68	91.39	0.89
		300	94.48	90.26	94.34	93.03	2.40
		360	95.43	91.86	96.23	94.51	2.33
		420	96.30	91.31	95.95	94.52	2.78
		540	96.83	92.44	95.53	94.93	2.26
		660	96.69	93.37	95.52	95.19	1.68
		1440	0.14	0.13	0.14	0.14	0.01
kneading	1:10	5	100.01	101.96	88.55	96.84	7.24
		10	100.01	101.96	88.55	96.84	7.24
		15	100.01	101.96	88.55	96.84	7.24
		20	100.01	101.96	88.55	96.84	7.24
		30	100.01	101.96	88.55	96.84	7.24
		45	100.01	101.96	88.55	96.84	7.24
		60	100.01	101.96	88.55	96.84	7.24
		90	100.01	101.96	88.55	96.84	7.24
		120	100.01	101.96	88.55	96.84	7.24
		180	100.01	101.96	88.55	96.84	7.24
		240	100.01	101.96	88.55	96.84	7.24
		300	100.01	101.96	88.55	96.84	7.24
		360	100.01	101.96	88.55	96.84	7.24
		420	100.01	101.96	88.55	96.84	7.24
		540	100.01	101.96	88.55	96.84	7.24
		660	100.01	101.96	88.55	96.84	7.24
		1440	100.01	101.96	88.55	96.84	7.24

Appendix D
Two-way ANOVA
of dissolution rate constant

Table 56 Two way analysis of variance for nifedipine-PEG4000 system.

Analysis of Variance (Two way)
PEG 4000

PEG 4000 Ratio (B)	Dissolution rate constant				Grand Total	Mean total
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	0.0829	0.0681	0.0906	0.0735	0.3151	0.0788
Chamber 2	0.0886	0.0763	0.0804	0.0658	0.3111	0.0778
Chamber 3	0.0859	0.0863	0.0854	0.0804	0.3380	0.0845
Total	0.2574	0.2307	0.2564	0.2197	0.9642	
Mean	0.0858	0.0769	0.0855	0.0732		0.0804
1:3						
Chamber 1	0.0790	0.1011	0.0841	0.0497	0.3139	0.0785
Chamber 2	0.0812	0.0991	0.0872	0.0467	0.3142	0.0786
Chamber 3	0.0843	0.0958	0.0784	0.0674	0.3259	0.0815
Total	0.2445	0.2960	0.2497	0.1638	0.9540	
Mean	0.0815	0.0987	0.0832	0.0546		0.0795
1:5						
Chamber 1	0.1089	0.1055	0.1166	0.0757	0.4067	0.1017
Chamber 2	0.1169	0.1052	0.0986	0.0731	0.3938	0.0985
Chamber 3	0.1073	0.1008	0.1059	0.0792	0.3932	0.0983
Total	0.3331	0.3115	0.3211	0.2280	1.1937	
Mean	0.1110	0.1038	0.1070	0.0760		0.0995
1:10						
Chamber 1	0.1259	0.1122	0.1140	0.0996	0.4517	0.1129
Chamber 2	0.1268	0.1237	0.1147	0.0938	0.4590	0.1148
Chamber 3	0.1145	0.1137	0.0871	0.1030	0.4183	0.1046
Total	0.3672	0.3496	0.3158	0.2964	1.3290	
Mean	0.1224	0.1165	0.1053	0.0988		0.1107
Grand total	1.2022	1.1878	1.1430	0.9079	4.4409	
Mean total	0.1002	0.0990	0.0953	0.0757		

ANOVA Table

Source	df	SS	Mean Square	F cal	F critical value	Significance
Between method	3	4.71E-03	1.57E-03	30.99	9.28	Yes
Between ratio	3	8.38E-03	2.79E-03	55.17	3.86	Yes
Method-ratio interaction	9	1.97E-03	2.19E-04	4.33	2.27	Yes
Error	32	1.62E-03	5.06E-05			
Total	47	0.0167	3.55E-04		$\alpha = 0.05$	

Table 57 LSR test of PEG4000

Test between method

Duncan's test

Dissolution rate constant

Melt	Solvent	Knead	Phys
0.1002	0.0990	0.0953	0.0757

Sorted; least to most value

Phys	Knead	Solvent	Melt
0.0757	0.0953	0.0990	0.1002

Difference with next values

Phys	0.0196	0.0233	0.0245
	Knead	0.0037	0.0049
		Solvent	0.0012

LSR = $SSR_{table} \times S_x$

LSR =	0.0058	0.0061	0.0063
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Difference vs LSR test

Phys	Knead	Solvent	Melt
0.0757	0.0953	0.0990	0.1002

	0.0196	0.0233	0.0245
Phys	<u>0.0138</u>	<u>0.0172</u>	<u>0.0182</u>
		0.0037	0.0049
	Knead	-0.0021	-0.0012
			0.0012
		Solvent	-0.0046

Test between ratio

Duncan's test

Dissolution rate constant

1:1	1:3	1:5	1:10
0.0804	0.0795	0.0995	0.1107

Sorted; least to most value

1:3	1:1	1:5	1:10
0.0795	0.0804	0.0995	0.1107

Difference with next values

1:3	0.0009	0.0200	0.0312
	1:1	0.0191	0.0303
		1:5	0.0112

LSR = $SSR_{table} \times S_x$

LSR = 0.0058 0.0061 0.0063

Difference vs LSR test

1:3	1:1	1:5	1:10
0.0795	0.0804	0.0995	0.1107

	0.0009	0.0200	0.0312
1:3	-0.0049	<u>0.0139</u>	<u>0.0249</u>
		0.0191	0.0303
	1:1	<u>0.0133</u>	<u>0.0242</u>
			0.0112
		1:5	<u>0.0054</u>

* Underlined positive values show statistical significance where the difference between its next value is greater than LSR

Table 59 Two way analysis of variance for nifedipine-PEG6000 system.

Analysis of Variance (Two way)
PEG 6000

PEG 6000 Ratio (B)	Dissolution rate constant Method (A)				Grand Total	Mean total
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	0.0934	0.0697	0.0771	0.0672	0.3074	0.0769
Chamber 2	0.1010	0.0823	0.0754	0.0608	0.3195	0.0799
Chamber 3	0.0980	0.0863	0.0896	0.0633	0.3372	0.0843
Total	0.2924	0.2383	0.2421	0.1913	0.9641	
Mean	0.0975	0.0794	0.0807	0.0638		0.0803
1:3						
Chamber 1	0.0959	0.1079	0.0782	0.0844	0.3664	0.0916
Chamber 2	0.0909	0.1190	0.1003	0.0846	0.3948	0.0987
Chamber 3	0.0894	0.1141	0.0846	0.0843	0.3724	0.0931
Total	0.2762	0.3410	0.2631	0.2533	1.1336	
Mean	0.0921	0.1137	0.0877	0.0844		0.0945
1:5						
Chamber 1	0.1009	0.1145	0.1080	0.0895	0.4129	0.1032
Chamber 2	0.1169	0.1011	0.1079	0.0910	0.4169	0.1042
Chamber 3	0.1137	0.1300	0.1081	0.0829	0.4347	0.1087
Total	0.3315	0.3456	0.3240	0.2634	1.2645	
Mean	0.1105	0.1152	0.1080	0.0878		0.1054
1:10						
Chamber 1	0.1343	0.1282	0.1064	0.0816	0.4505	0.1126
Chamber 2	0.1224	0.1169	0.1256	0.0909	0.4558	0.1140
Chamber 3	0.1207	0.1439	0.1243	0.0861	0.4750	0.1188
Total	0.3774	0.3890	0.3563	0.2586	1.3813	
Mean	0.1258	0.1297	0.1188	0.0862		0.1151
Grand total	1.2775	1.3139	1.1855	0.9666	4.7435	
Mean total	0.1065	0.1095	0.0988	0.0806		

ANOVA table

Source	df	SS	Mean Square	F cal	F critical value	Significance
Between method	3	6.07E-03	2.02E-03	32.16	9.28	Yes
Between ratio	3	8.02E-03	2.67E-03	42.50	3.86	Yes
Method-ratio interaction	9	2.04E-03	2.27E-04	3.60	2.27	Yes
Error	32	2.01E-03	6.29E-05			
Total	47	0.0181	3.86E-04		$\alpha = 0.05$	

Table 60 LSR test of PEG6000

Test between method

Duncan's test

Dissolution rate constant

Melt	Solvent	Knead	Phys
0.1065	0.1096	0.0988	0.0806

Sorted; least to most value

Phys	Knead	Melt	Solvent
0.0806	0.0988	0.1065	0.1096

Difference with next values

Phys	0.0182	0.0259	0.0290
	Knead	0.0077	0.0108
		Melt	0.0031

LSR = $SSR_{table} \times S_x$

LSR =	0.0065	0.0068	0.0071
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Difference vs LSR test

Phys	Knead	Melt	Solvent
0.0806	0.0988	0.1065	0.1096

Phys	0.0182	0.0259	0.0290
	0.0117	0.0191	0.0219
		0.0077	0.0108
	Knead	0.0012	0.0040
			0.0031
		Melt	-0.0034

Test between ratio

Duncan's test

Dissolution rate constant

1:1	1:3	1:5	1:10
0.0803	0.0945	0.1054	0.1151

Sorted; least to most values

1:1	1:3	1:5	1:10
0.0803	0.0945	0.1054	0.1151

Different with next values

1:1	0.0142	0.0251	0.0348
	1:3	0.0109	0.0206
		1:5	0.0097

LSR = $SSR_{table} \times S_x$

LSR =	0.0065	0.0068	0.0071
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Difference vs LSR test

1:1	1:3	1:5	1:10
0.0803	0.0945	0.1054	0.1151

	0.0142	0.0251	0.0348
1:1	0.0077	0.0183	0.0277
		0.0109	0.0206
	1:3	0.0044	0.0138
			0.0097
		1:5	0.0032

Table 62 Two way analysis of variance for nifedipine-poloxamer188 system.

Analysis of Variance (Two way)

Poloxamer188

Poloxamer188 Ratio (B)	Dissolution rate constant				Grand Total	Mean total
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	0.1217	0.0914	0.0956	0.0853	0.3940	0.0985
Chamber 2	0.1264	0.0888	0.0959	0.0858	0.3969	0.0992
Chamber 3	0.1158	0.0938	0.0983	0.0939	0.4018	0.1005
Total	0.3639	0.2740	0.2898	0.2650	1.1927	
Mean	0.1213	0.0913	0.0966	0.0883		0.0994
1:3						
Chamber 1	0.2280	0.0867	0.0944	0.1029	0.5120	0.1280
Chamber 2	0.1974	0.0985	0.0878	0.1021	0.4858	0.1215
Chamber 3	0.2030	0.0857	0.0976	0.0922	0.4785	0.1196
Total	0.6284	0.2709	0.2798	0.2972	1.4763	
Mean	0.2095	0.0903	0.0933	0.0991		0.1230
1:5						
Chamber 1	0.2156	0.1221	0.1144	0.1068	0.5589	0.1397
Chamber 2	0.1911	0.1208	0.0789	0.1059	0.4967	0.1242
Chamber 3	0.1194	0.1239	0.1086	0.1060	0.4579	0.1145
Total	0.5261	0.3668	0.3019	0.3187	1.5135	
Mean	0.1754	0.1223	0.1006	0.1062		0.1261
1:10						
Chamber 1	0.1047	0.1499	0.1190	0.1004	0.4740	0.1185
Chamber 2	0.1044	0.1292	0.1732	0.1032	0.5100	0.1275
Chamber 3	0.1085	0.1658	0.1600	0.0695	0.5038	0.1260
Total	0.3176	0.4449	0.4522	0.2731	1.4878	
Mean	0.1059	0.1483	0.1507	0.0910		0.1240
Grand total	1.8360	1.3566	1.3237	1.1540	5.6703	
Mean total	0.1530	0.1131	0.1103	0.0962		

ANOVA table

Source	df	SS	Mean Square	F cal	F table	Significance
Between method	3	2.14E-02	7.14E-03	23.84	9.28	Yes
Between ratio	3	5.68E-03	1.89E-03	6.32	3.86	Yes
Method-ratio interaction	9	2.92E-02	3.25E-03	10.84	2.27	Yes
Error	32	9.58E-03	2.99E-04			
Total	47	0.0659	1.40E-03		$\alpha = 0.05$	

Table 63 LSR test of poloxamer188

Test between method**Duncan's test**

Dissolution rate constant

Melt	Solvent	Knead	Phys
0.1530	0.1131	0.1103	0.0962

Sorted; least to most value

Phys	Knead	Solvent	Melt
0.0962	0.1103	0.1131	0.1530

$$LSR = SSR_{table} \times S_x$$

LSR =	0.0141	0.0149	0.0154
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Difference vs LSR test

Phys	Knead	Solvent	Melt
0.0962	0.1103	0.1131	0.1530
	0.0141	0.0169	0.0568
Phys	-0.0000	<u>0.0020</u>	<u>0.0414</u>
		0.0028	0.0427
	Knead	-0.0113	<u>0.0278</u>
			0.0399
		Solvent	<u>0.0258</u>

Test between ratio**Duncan's test**

Dissolution rate constant

1:1	1:3	1:5	1:10
0.0994	0.1230	0.1261	0.1240

Sorted; least to most value

1:1	1:3	1:10	1:5
0.0994	0.1230	0.1240	0.1261

Difference with next value

1:1	0.0236	0.0246	0.0267
	1:3	0.0010	0.0031
		1:10	0.0021

$$LSR = SSR_{table} \times S_x$$

LSR =	0.0141	0.0149	0.0154
-------	--------	--------	--------

Difference vs LSR test

1:1	1:3	1:10	1:5
0.0994	0.1230	0.1240	0.1261
	0.0236	0.0246	0.0267
1:1	<u>0.0095</u>	<u>0.0097</u>	<u>0.0113</u>
		0.0010	0.0031
	1:3	-0.0131	-0.0118
			0.0021
		1:10	-0.0120

* Underlined positive values show statistical significance where the difference between its next value is greater than LSR

Table 65 Two way analysis of variance for nifedipine-poloxamer288 system

Analysis of Variance (Two way)

Poloxamer288

Poloxamer288 Ratio (B)	Dissolution rate constant				Grand Total	Mean total
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	0.1004	0.1075	0.1069	0.0776	0.3924	0.0981
Chamber 2	0.0873	0.0939	0.0971	0.0980	0.3763	0.0941
Chamber 3	0.1010	0.0923	0.0977	0.1008	0.3918	0.0980
Total	0.2887	0.2937	0.3017	0.2764	1.1605	
Mean	0.0962	0.0979	0.1006	0.0921		0.0967
1:3						
Chamber 1	0.0933	0.1392	0.1038	0.1005	0.4368	0.1092
Chamber 2	0.1082	0.1029	0.0974	0.0871	0.3956	0.0989
Chamber 3	0.1051	0.1301	0.0990	0.0866	0.4208	0.1052
Total	0.3066	0.3722	0.3002	0.2742	1.2532	
Mean	0.1022	0.1241	0.1001	0.0914		0.1044
1:5						
Chamber 1	0.1551	0.1253	0.0988	0.1135	0.4927	0.1232
Chamber 2	0.1565	0.1131	0.0985	0.1086	0.4767	0.1192
Chamber 3	0.1998	0.1124	0.1024	0.1127	0.5273	0.1318
Total	0.5114	0.3508	0.2997	0.3348	1.4967	
Mean	0.1705	0.1169	0.0999	0.1116		0.1247
1:10						
Chamber 1	0.2714	0.1411	0.1316	0.1286	0.6727	0.1682
Chamber 2	0.1660	0.1673	0.1354	0.1100	0.5787	0.1447
Chamber 3	0.1614	0.1653	0.1272	0.0894	0.5433	0.1358
Total	0.5988	0.4737	0.3942	0.3280	1.7947	
Mean	0.1996	0.1579	0.1314	0.1093		0.1496
Grand total	1.7055	1.4904	1.2958	1.2134	5.7051	
Mean total	0.1421	0.1242	0.1080	0.1011		

ANOVA Table

Source	df	SS	Mean Square	F cal	F table	Significance
Between method	3	1.20E-02	4.01E-03	10.68	9.28	Yes
Between ratio	3	2.01E-02	6.70E-03	17.85	3.86	Yes
Method-ratio interaction	9	1.22E-02	1.36E-03	3.61	2.27	Yes
Error	32	1.20E-02	3.75E-04			
Total	47	0.0564	1.20E-03			$\alpha = 0.05$

Table 66 LSR test of poloxamer288

Test between method**Duncan's test**

Dissolution rate constant

Melt	Solvent	Knead	Phys
0.1421	0.1242	0.1080	0.1011

Sorte; Least to most value

Phys	Knead	Solvent	Melt
0.1011	0.1080	0.1242	0.1421

Difference with next values

Phys	0.0069	0.0231	0.0410
	Knead	0.0162	0.0341
		Solvent	0.0179

LSR = $SSR_{table} \times S_x$

LSR =	0.0158	0.0167	0.0172
-------	--------	--------	--------

Difference vs LSR test

Phys	Knead	Solvent	Melt
0.1011	0.1080	0.1242	0.1421

	0.0069	0.0231	0.0410
Phys	-0.0089	<u>0.0064</u>	<u>0.0238</u>
		0.0162	0.0341
	Knead	<u>0.0004</u>	<u>0.0174</u>
			0.0179
		Solvent	<u>0.0021</u>

Test between ratio**Duncan's test**

Dissolution rate constant

1:1	1:3	1:5	1:10
0.0967	0.1044	0.1247	0.1496

Sorted; least to most value

1:1	1:3	1:5	1:10
0.0967	0.1044	0.1247	0.1496

Difference with next values

1:1	0.0077	0.0280	0.0529
	1:3	0.0203	0.0452
		1:5	0.0249

LSR = $SSR_{table} \times S_x$

LSR =	0.0158	0.0167	0.0172
-------	--------	--------	--------

Difference vs LSR test

1:1	1:3	1:5	1:10
0.0967	0.1044	0.1247	0.1496

	0.0077	0.0280	0.0529
1:1	-0.0081	<u>0.0113</u>	<u>0.0357</u>
		0.0203	0.0452
	1:3	<u>0.0045</u>	<u>0.0285</u>
			0.0249
		1:5	<u>0.0091</u>

Table 68 Two way analysis of variance for nifedipine-poloxamer407 system.
Analysis of Variance (Two way)
Poloxamer407

Poloxamer407 Ratio (B)	Dissolution rate constant				Grand Total	Mean total
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	0.1270	0.0956	0.0853	0.1056	0.4135	0.1034
Chamber 2	0.1223	0.0857	0.0932	0.0900	0.3912	0.0978
Chamber 3	0.1116	0.0870	0.1061	0.0865	0.3912	0.0978
Total	0.3609	0.2683	0.2846	0.2821	1.1959	
Mean	0.1203	0.0894	0.0949	0.0940		0.0997
1:3						
Chamber 1	0.1614	0.1124	0.0793	0.1048	0.4579	0.1145
Chamber 2	0.1079	0.0950	0.0852	0.0985	0.3866	0.0967
Chamber 3	0.1641	0.0925	0.0803	0.0665	0.4034	0.1009
Total	0.4334	0.2999	0.2448	0.2698	1.2479	
Mean	0.1445	0.1000	0.0816	0.0899		0.1040
1:5						
Chamber 1	0.1703	0.1123	0.0874	0.1091	0.4791	0.1198
Chamber 2	0.1373	0.0958	0.0845	0.1028	0.4204	0.1051
Chamber 3	0.1290	0.0976	0.0880	0.1051	0.4197	0.1049
Total	0.4366	0.3057	0.2599	0.3170	1.3192	
Mean	0.1455	0.1019	0.0866	0.1057		0.1099
1:10						
Chamber 1	0.1430	0.1608	0.1781	0.1008	0.5827	0.1457
Chamber 2	0.2010	0.1699	0.1700	0.1058	0.6467	0.1617
Chamber 3	0.1644	0.1285	0.1275	0.1148	0.5352	0.1338
Total	0.5084	0.4592	0.4756	0.3214	1.7646	
Mean	0.1695	0.1531	0.1585	0.1071		0.1471
Grand total	1.7393	1.3331	1.2649	1.1903	5.5276	
Mean total	0.1449	0.1111	0.1054	0.0992		

ANOVA table

Source	df	SS	Mean Square	F cal	F table	Significance
Between method	3	1.50E-02	5.01E-03	17.62	9.28	Yes
Between ratio	3	1.69E-02	5.64E-03	19.80	3.86	Yes
Method-ratio interaction	9	6.24E-03	6.94E-04	2.44	2.27	Yes
Error	32	9.11E-03	2.85E-04			
Total	47	0.0473	1.01E-03			$\alpha = 0.05$

Table 69 LSR test of poloxamer407

Test between method**Duncan's test**

Dissolution rate constant

Melt	Solvent	Knead	Phys
0.1449	0.1111	0.1054	0.0992

Sorted; least to most values

Phys	Knead	Solvent	Melt
0.0992	0.1054	0.1111	0.1449

Difference with next value

Phys	0.0062	0.0119	0.0457
	Knead	0.0057	0.0395
		Solvent	0.0338

LSR = $SSR_{table} \times S_x$

LSR =	0.0138	0.0145	0.0150
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Difference vs LSR test

Phys	Knead	Solvent	Melt
0.0992	0.1054	0.1111	0.1449
	0.0062	0.0119	0.0457
Phys	<u>-0.0076</u>	<u>-0.0026</u>	<u>0.0307</u>
		0.0057	0.0395
	Knead	<u>-0.0081</u>	<u>0.0250</u>
			0.0338
		Solvent	<u>0.0200</u>

Test between ratio**Duncan's test**

Disssolution rate constant

1:1	1:3	1:5	1:10
0.0997	0.1040	0.1099	0.1471

Sorted; least to most value

1:1	1:3	1:5	1:10
0.0997	0.1040	0.1099	0.1471

Difference with next values

1:1	0.0043	0.0102	0.0474
	1:3	0.0059	0.0431
		1:5	0.0372

LSR = $SSR_{table} \times S_x$

LSR =	0.0138	0.0145	0.0150
-------	--------	--------	--------

Difference vs LSR test

1:1	1:3	1:5	1:10
0.0997	0.1040	0.1099	0.1471
	0.0043	0.0102	0.0474
1:1	<u>-0.0095</u>	<u>-0.0043</u>	<u>0.0324</u>
		0.0059	0.0431
	1:3	<u>-0.0079</u>	<u>0.0286</u>
			0.0372
		1:5	<u>0.0234</u>

* Underlined positive values show statistical significance where the difference between its next value is greater than LSR

Table 71 Two way analysis of variance for nifedipine- β -cyclodextrin
Analysis of Variance (Two way)
Beta-CD

Beta-CD Ratio (B)	Dissolution rate constant				Grand Total	Mean total
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1	-	-	0.0645	0.0532	0.1177	0.0589
Chamber 2	-	-	0.0808	0.0482	0.1290	0.0645
Chamber 3	-	-	0.0795	0.0495	0.1290	0.0645
Total	-	-	0.2248	0.1509	0.3757	
Mean	-	-	0.0749	0.0503		0.0626
1:3						
Chamber 1	-	-	0.1075	0.0687	0.1762	0.0881
Chamber 2	-	-	0.0843	0.0617	0.1460	0.0730
Chamber 3	-	-	0.0947	0.0686	0.1633	0.0817
Total	-	-	0.2865	0.1990	0.4855	
Mean	-	-	0.0955	0.0663		0.0809
1:5						
Chamber 1	-	-	0.1029	0.0969	0.1998	0.0999
Chamber 2	-	-	0.1021	0.0893	0.1914	0.0957
Chamber 3	-	-	0.1116	0.0917	0.2033	0.1017
Total	-	-	0.3166	0.2779	0.5945	
Mean	-	-	0.1055	0.0926		0.0991
1:10						
Chamber 1	-	-	0.1034	0.1022	0.2056	0.1028
Chamber 2	-	-	0.0982	0.1205	0.2187	0.1094
Chamber 3	-	-	0.1097	0.0866	0.1963	0.0982
Total	-	-	0.3113	0.3093	0.6206	
Mean	-	-	0.1038	0.1031		0.1034
Grand total	-	-	1.1392	0.9371	2.0763	
Mean total	-	-	0.0949	0.0781		

ANOVA Table

Source	df	SS	Mean Square	F cal	F critical value	Significance
Between method	1	1.70E-03	1.70E-03	22.55	4.54	yes
Between ratio	3	6.28E-03	2.09E-03	27.73	3.29	yes
Method-ratio interaction	3	7.35E-04	2.45E-04	3.24	3.29	No
Error	16	1.21E-03	7.55E-05			
Total	23	0.0099	4.31E-04		$\alpha = 0.05$	

Table 72 LSR test of β -cyclodextrin

Test between method

Duncan's test

Dissolution rate constant	Melt	Solvent
	0.0949	0.0781

Sorted; least to most value	Solvent	Melt
	0.0781	0.0949

Difference with next values	Solvent	0.0168
		Melt

LSR = $SSR_{table} \times S_x$	LSR =	0.0073
--------------------------------	-------	--------

Difference vs LSR test	Solvent	Melt
	0.0781	0.0949
		0.0168
	Solvent	<u>0.0095</u>
		Melt

Test between ratio

Duncan's test

Dissolution rate constant	1:1	1:3	1:5	1:10
	0.0626	0.0809	0.0991	0.1013

Sorted; least to most value	1:1	1:3	1:5	1:10
	0.0626	0.0809	0.0991	0.1013

Difference with next values	1:1	0.0183	0.0365	0.0387
		1:3	0.0182	0.0204
			1:5	0.0022

LSR = $SSR_{table} \times S_x$	LSR =	0.0105	0.0110	0.0113
--------------------------------	-------	--------	--------	--------

Difference vs LSR test	1:1	1:3	1:5	1:10
	0.0626	0.0809	0.0991	0.1013
		<u>0.0183</u>	<u>0.0365</u>	<u>0.0387</u>
	1:1	<u>0.0078</u>	<u>0.0255</u>	<u>0.0274</u>
			0.0182	0.0204
		1:3	<u>0.0077</u>	<u>0.0094</u>
				0.0022
			1:5	-0.0083

* Underlined positive values show statistical significance where the difference between its next value is greater than LSR

Table 73 Two way analysis of variance for nifedipine-2-hydroxypropyl- β -cyclodextrin system.

Analysis of Variance (Two way)

2-HBCD

2-HBCD Ratio (B)	Dissolution rate constant				Total	Mean
	Method (A)					
	Melt	Solvent	Knead	Phys		
1:1						
Chamber 1		0.0587	0.0874	0.0689	0.2150	0.0717
Chamber 2		0.0668	0.0959	0.0569	0.2196	0.0732
Chamber 3		0.0753	0.0961	0.0646	0.2360	0.0787
Total		0.2008	0.2794	0.1904	0.6706	
Mean		0.0669	0.0931	0.0635		0.0745
1:3						
Chamber 1		0.0635	0.0817	0.0657	0.2109	0.0703
Chamber 2		0.0800	0.1004	0.0612	0.2416	0.0805
Chamber 3		0.0865	0.0990	0.0796	0.2651	0.0884
Total		0.2300	0.2811	0.2065	0.7176	
Mean		0.0767	0.0937	0.0688		0.0797
1:5						
Chamber 1		0.0741	0.0806	0.0717	0.2264	0.0755
Chamber 2		0.0854	0.1046	0.0789	0.2689	0.0896
Chamber 3		0.0783	0.0955	0.0880	0.2618	0.0873
Total		0.2378	0.2807	0.2386	0.7571	
Mean		0.0793	0.0936	0.0795		0.0841
1:10						
Chamber 1		0.0866	0.1230	0.0925	0.3021	0.1007
Chamber 2		0.0992	0.1104	0.0877	0.2973	0.0991
Chamber 3		0.1042	0.0950	0.0794	0.2786	0.0929
Total		0.2900	0.3284	0.2596	0.8780	
Mean		0.0967	0.1095	0.0865		0.0976
Grand total		0.9586	1.1696	0.8951	3.0233	
Mean total		0.0799	0.0975	0.0746		

ANOVA Table

Source	df	SS	Mean Square	F cal	F critical value	Significance
Between method	2	3.44E-03	1.72E-03	19.85	3.38	Yes
Between ratio	3	2.63E-03	8.76E-04	10.10	2.99	Yes
Method-ratio interaction	6	3.01E-04	5.01E-05	0.58	2.49	no
Error	24	2.08E-03	8.67E-05			
Total	35	0.0085	2.41E-04		$\alpha = 0.05$	

Table 74 LSR test of 2-hydroxypropyl- β -cyclodextrin.

Test between method

Duncan's test

Dissolution rate constant

Solvent	Knead	Phys
0.0799	0.0975	0.0746

Sorted; least to most value

Phys	Solvent	Knead
0.0746	0.0799	0.0975

Difference with next values

Phys	0.0053	0.0229
	Solvent	0.0176
		Knead

LSR = $SSR_{table} \times S_x$

LSR =	0.0077	0.0081
-------	--------	--------

Difference vs LSR test

Phys	Solvent	Knead
0.0746	0.0799	0.0975
	0.0053	0.0229
Phys	-0.0024	<u>0.0148</u>
		0.0176
	Solvent	<u>0.0099</u>
		Knead

Test between ratio

Duncan's test

Dissolution rate constant

1:1	1:3	1:5	1:10
0.0745	0.0797	0.0841	0.0976

Sorted; least to most value

1:1	1:3	1:5	1:10
0.0745	0.0797	0.0841	0.0976

Difference with next values

1:1	0.0052	0.0096	0.0231
	1:3	0.0044	0.0179
		1:5	0.0135

LSR = $SSR_{table} \times S_x$

LSR =	0.0089	0.0093	0.0096
-------	--------	--------	--------

Difference vs LSR test

1:1	1:3	1:5	1:10
0.0745	0.0797	0.0841	0.0976
	0.0052	0.0096	0.0231
1:1	-0.0037	<u>0.0003</u>	<u>0.0135</u>
		0.0044	0.0179
	1:3	-0.0045	<u>0.0086</u>
			0.0135
		1:5	<u>0.0046</u>

*Underlined positive values show statistical significance where the difference between its next value is greater than LSR

Appendix E

Summary of dissolution rate of all treatments.

Table 75 Dissolution rate summary of all treatments.

Carrier	Ratio (drug: carrier)	Dissolution rate (min ⁻¹)				
		Method				
		Melting	Solvent	Kneading	Physical	Nontreated
(Pure drug)	1:0	0.0492	0.0552	0.0287	0.0314	0.0524
PEG4000	1:1	0.0858	0.0769	0.0855	0.0732	-
	1:3	0.0815	0.0987	0.0832	0.0546	-
	1:5	0.111	0.1038	0.107	0.076	-
	1:10	0.1224	0.1165	0.1053	0.0988	-
PEG6000	1:1	0.0975	0.0794	0.0807	0.0638	-
	1:3	0.0921	0.1137	0.0877	0.0844	-
	1:5	0.1105	0.1152	0.108	0.0878	-
	1:10	0.1258	0.1297	0.1188	0.0862	-
polox188	1:1	0.1213	0.0913	0.0966	0.0883	-
	1:3	0.2095	0.0903	0.0933	0.0991	-
	1:5	0.1754	0.1223	0.1006	0.1062	-
	1:10	0.1059	0.1483	0.1507	0.091	-
polox288	1:1	0.0962	0.0979	0.1006	0.0921	-
	1:3	0.1022	0.1241	0.1001	0.0914	-
	1:5	0.1705	0.1169	0.0999	0.1116	-
	1:10	0.1996	0.1579	0.1314	0.1093	-
polox407	1:1	0.1203	0.0894	0.0949	0.094	-
	1:3	0.1445	0.1000	0.0818	0.0899	-
	1:5	0.1455	0.1019	0.0866	0.1057	-
	1:10	0.1695	0.1531	0.1585	0.1071	-
β-cyclo	1:1	-	-	0.0749	0.0503	-
	1:3	-	-	0.0955	0.0663	-
	1:5	-	-	0.1055	0.0926	-
	1:10	-	-	0.1038	0.1031	-
2-HBCD	1:1	-	0.0669	0.0931	0.0635	-
	1:3	-	0.0767	0.0937	0.0688	-
	1:5	-	0.0793	0.0936	0.0795	-
	1:10	-	0.0967	0.1095	0.0865	-

- No dissolution profiles

Appendix F

**Fitness of dissolution plot
First order and Higuchi plots.**

Determination of dissolution plot

In order to determine the fitness of dissolution plot, first order and Higuchi plot was determined.

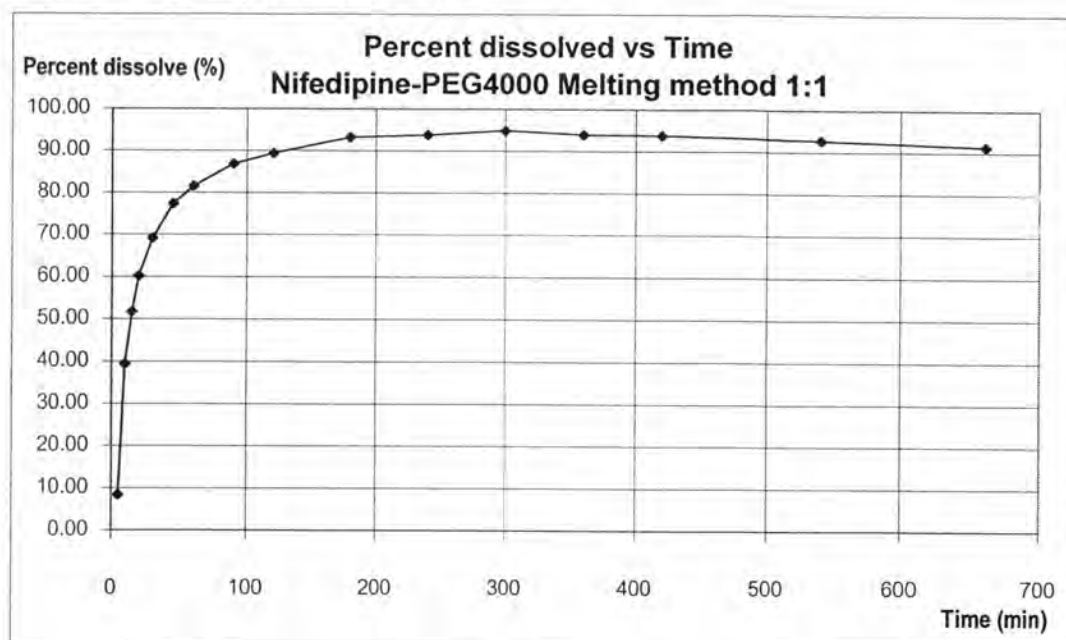


Figure 167 Percent dissolved plot of nifedipine from nifedipine-PEG4000 prepared by melting method ratio 1:10

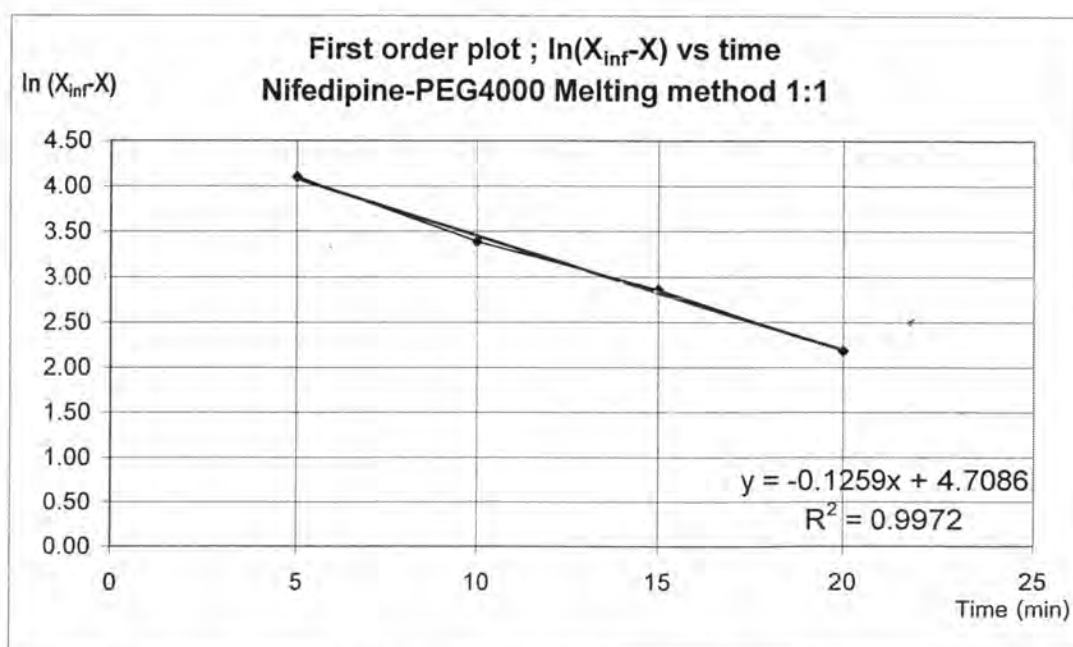


Figure 168 First order plot of nifedipine from nifedipine-PEG4000 prepared by melting method ratio 1:10

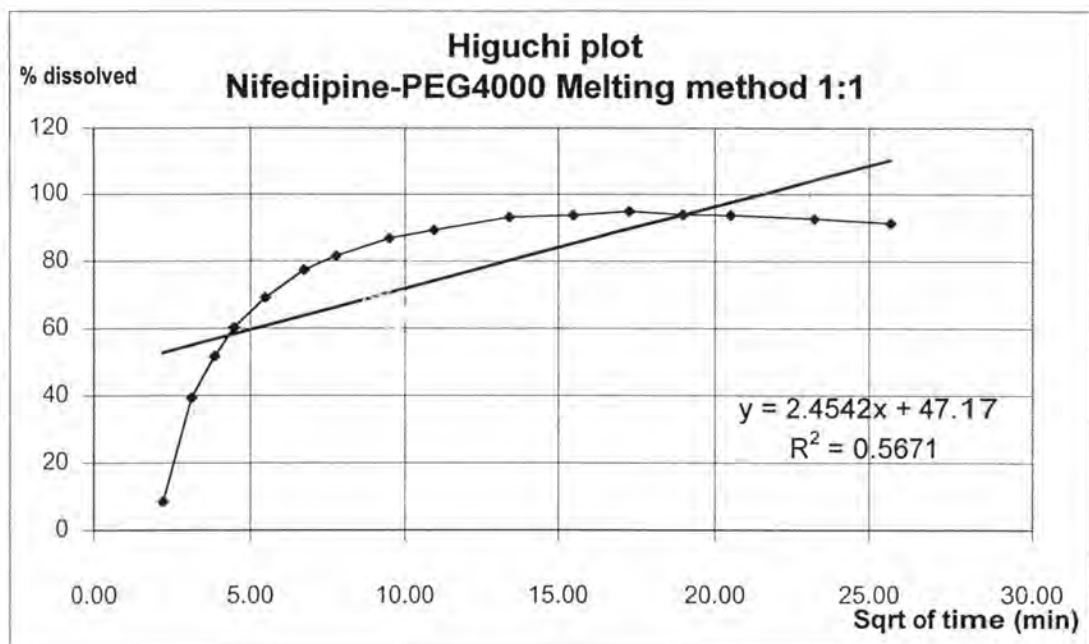


Figure 169 Higuchi plot of nifedipine from nifedipine-PEG4000 prepared by melting method ratio 1:10

Appendix G

Measurement of contact angle.

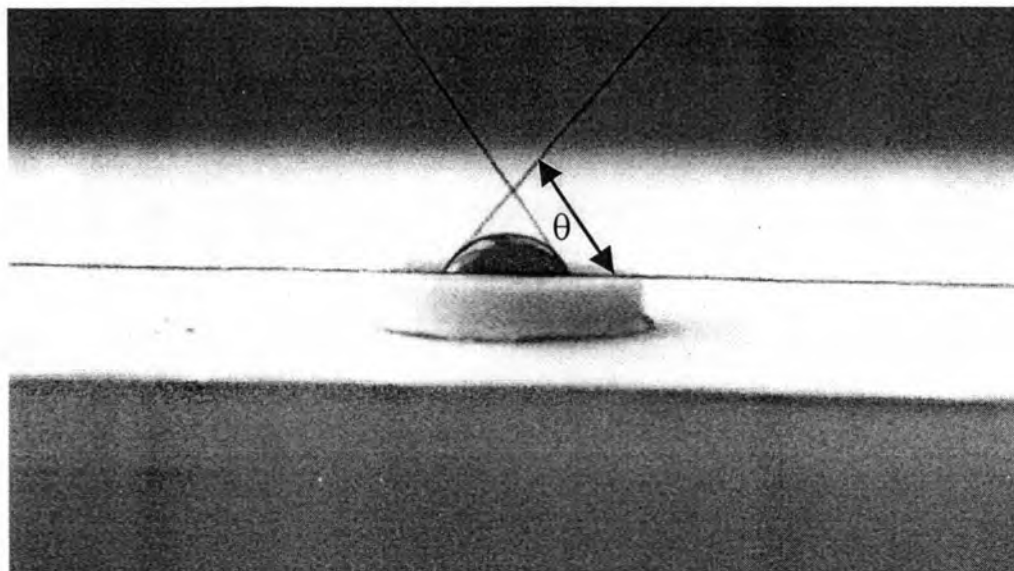


Figure170 Contact angle of nifedipine-poloxamer407 prepared by melting method, 1:3 ratio

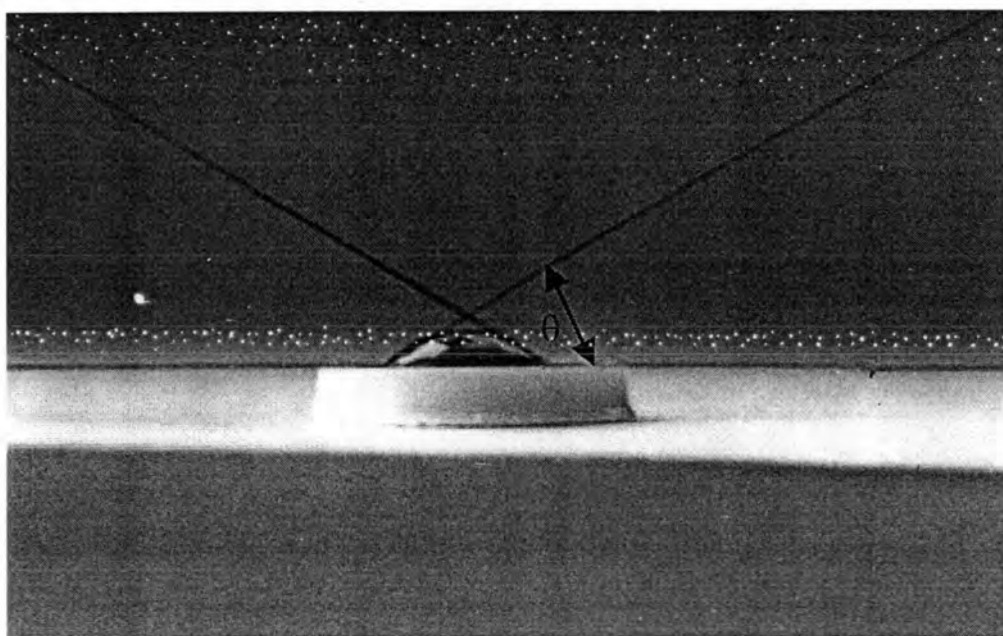


Figure171 Contact angle of nifedipine-poloxamer188 prepared by melting method, 1:5 ratio

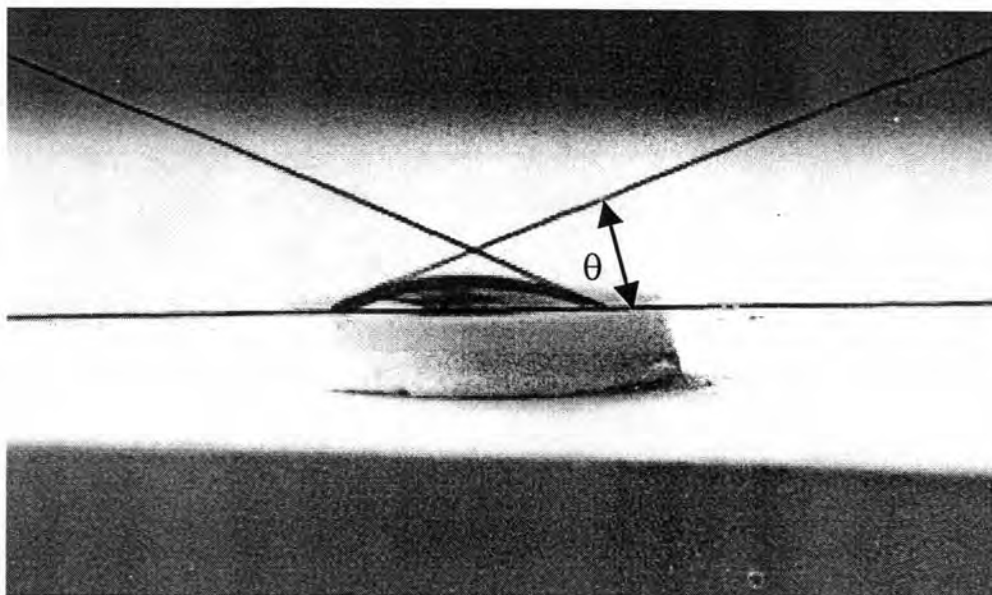


Figure172 Contact angle of nifedipine-PEG6000 prepared by melting method, 1:3 ratio

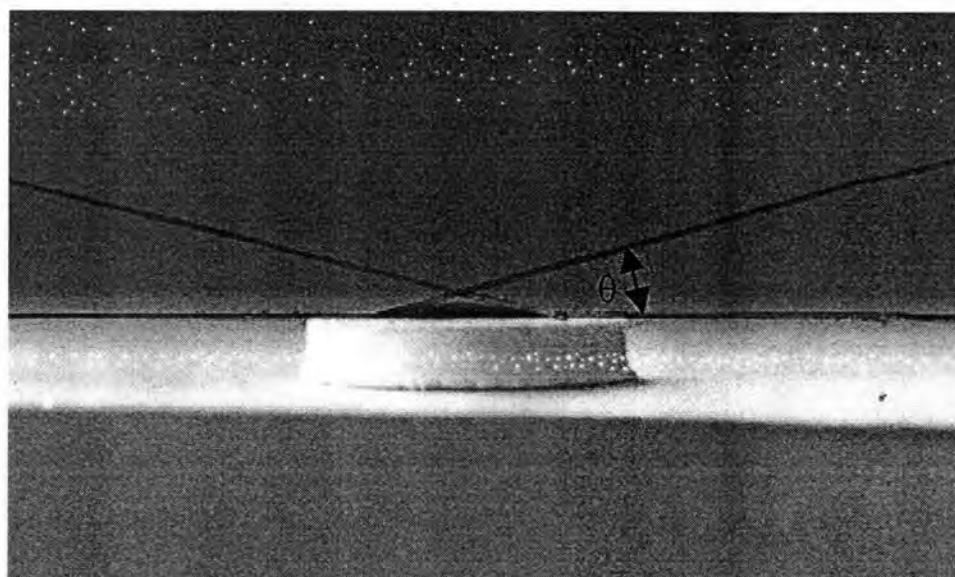


Figure173 Contact angle of nifedipine- β -cyclodextrin prepared by kneading method, 1:5 ratio

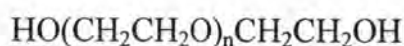
Appendix H

Properties of carriers used.

Polyethylene glycols (PEGs)

PEGs are high-molecular-weight polymers, obtained by the reaction of ethylene oxide with ethylene glycol or water.

Their generalized structure may be written as:



-PEG4000, 6000 are white waxy solids that are supplied in flake or powder form.

-PEG4000, MW 2600-3800, freezing point 53-57°C, white flake appearance.

-PEG6000, MW 7300-9300, freezing point 56-61°C, white powder appearance.

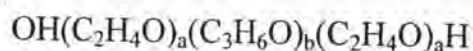
-Highly soluble in water and soluble in many organic solvents except aliphatic hydrocarbons.

-Low toxicity and negligible skin irritation.

-The oral LD₅₀ test for PEG4000, 6000 is 50g/kg (Wade, and Weller, 1990).

Poloxamers

The poloxamer polyols are a series of closely related block copolymer of ethylene oxide and propylene oxide conforming to the general formula



Poloxamer	physical form	a	b	average molecular weight
188	solid	80	27	7680-9516
288	solid	-	-	-
407	solid	101	56	9840-14600

-Poloxamers are nonionic polyoxyethylene-polyoxypropylene copolymers used primarily in pharmaceutical formulations as emulsifying or solubilizing agent.

-The polyoxyethylene segment is hydrophilic, polyoxypropylene segment is hydrophobic.

-Generally occur as white-colored, waxy, freeflowing granules

-Melting point 52°C for poloxamer188, 56°C for poloxamer407

-Freely soluble in ethanol 95% and water.

-Poloxamer188 is administered orally as a wetting agent and stool lubricant in the treatment of constipation.

-Poloxamer may also used therapeutically as wetting agents in eye-drop formulation, in the treatment of kidney stones and as wound cleansers.

-LD_{50(rat,oral)} of poloxamer188 is 9.4g/kg (Wade, and Weller, 1990).

Cyclodextrins

Cyclodextrins are crystalline, nonhygroscopic, cyclic oligosaccharides derived from starch. β -Cyclodextrin has 7 glucose units. In shape, cyclodextrins are 'bucket-like' or 'cone-like', toroid molecules. They have a rigid structure with a central cavity whose size varies according to the cyclodextrin type.

- β -Cyclodextrin is the most commonly used cyclodextrin although it is the least soluble. It should not be used in parenteral formulations since it is nephrotoxic but nontoxic when administered orally.

-Melting point of β -cyclodextrin is 255-265°C.

- β -Cyclodextrin: soluble 1 in 200 parts of propylene glycol, 1 in 50 of water at 20°C, 1 in 20 at 50°C, practically insoluble in acetone and ethanol 95%.

-2-Hydroxypropyl- β -cyclodextrin soluble greater than 1 in 2 parts of water at 25°C.

- β -Cyclodextrins are stable in the solid state if protected from high humidity.

-Cyclodextrin administered orally is metabolized by microflora in the colon forming the metabolites maltodextrin, maltose and glucose, which are themselves further metabolized before being finally excreted as carbon dioxide and water.

-Cyclodextrins are now approved for use in food products and orally administered pharmaceutical in a number of countries.

-Cyclodextrins are not irritant to the skin and eyes, or upon inhalation and no evidence to suggest that cyclodextrins are mutagenic or teratogenic, LD50_(rat,oral): 18.8 g/kg (Wede and Weller, 1990).

VITA

Miss Nicha Khusakul was born on 15th October 1972, in Bangkok Thailand. She received her Bachelor degree of Science of Pharmacy in 1994 from Faculty of Pharmaceutical Sciences, Prince of Songkla University, Songkla, Thailand. After graduation, she worked in the department of medical supply at Chulalongkorn Hospital, Bangkok from 1994-1997 before entering the Master degree program in Pharmacy at Chulalongkorn University.