CHAPTER III

RESULTS

Particle size Distribution

The particle size distribution data of Starch 1500, Elcema G.250 and Tablettose are presented in Table 2, 3 and 4 respectively. For Starch 1500, the maximum in the size-frequency occured at the size that was less than 149 µm. (passed through sieve no.100) to which the percent in the size group was 90.76 and the next frequent-size group was 149-177 µm. and 177-250 µm., having the percent particles of 5.85 and 2.54 respectively. The average diameter of the particle size of Starch 1500 as calculated is 86 µm. Comparing to Elcema G.250 having the maximum in the size frequency of 250-420 µm. to which the percent particles in this size group was 55.72 and the next frequent-size group was 177-250 µm. having the percent particles of 31.69. The percent particles of 56.32 is fallen in the size frequency over 250 µm. sieve opening size, and the percent particles of 43.68 is fallen in the size frequency under 250 µm. sieve opening size. The average diameter of the particle size of Elcema G.250 as calculated is 275 µm.

The percent particles corresponding to size frequency showed that Elcema G.250 possess a narrow size distribution range than tablettose.

Table 2 Particle size distribution data of Starch 1500

Sieve Number (Passed/Retained)	Sieve Opening (μm)	Arithmetic Mean Size of Opening(μm)	Wt. Retained (Frequency)(g)	Percent Frequency(%)	Weight Size
(1)	(2)	(3)	(4)	(5)	(3) × (5)
0/20	>840	420	0.07	0.07	29
20/40	420-840	630	0.30	0.30	189
40/60	250-420	335	0.47	0.47	157
60/80	177-250	213	2.52	2.54	542
80/100	149-177	163	5.81	5.85	954
100/Pan	<149	75	90.10	90.76	6,762
			99.27	100.00	8,633

$$d_{ave} = \frac{8,633}{100} = 86\ \mu m$$

Table 3 Particle size distribution data of Elcema G.250

Sieve Number (Passed/Retained)	Sieve Opening (μm)	Arithmetic Mean Size of Opening(μm)	Wt. Retained (Frequency)(g)	Percent Frequency(%)	Weight Size
(1)	(2)	(3)	(4)	(5)	(3) × (5)
0/20	>840	420	-	-	-
20/40	420-840	630	0.60	0.60	378
40/60	250-420	335	55.59	55.72	18,666
60/80	177-250	213	31.61	31.69	6,750
80/100	149-177	163	9.40	9.42	1,535
100/Pan	<149	75	2.57	2.57	193
			99.77	100.00	27,522

$$d_{ave} = \frac{27,522}{100} = 275\ \mu m$$

Table 4 Particle size distribution data of Tablettose

Sieve Number (Passed/Retained)	Sieve Opening (μm)	Arithmetic Mean Size of Opening(μm)	Wt. Retained (Frequency)(g)	Percent Frequency(%)	Weight Size
(1)	(2)	(3)	(4)	(5)	(3) × (5)
0/20	>840	420	-	-	-
20/40	420-840	630	4.28	4.30	2,709
40/60	250-420	335	13.51	13.57	4,546
60/80	177-250	213	15.21	15.28	3,255
80/100	149-177	163	18.42	18.5	3,015
100/Pan	<149	75	48.14	48.35	3,626
			99.56	100.00	17,151

$$d_{ave} = \frac{17,151}{100} = 171\ \mu m$$

For Tablettose, the maximum in the size-frequency occured at the size that was less than 149 µm., having the percent particles in the size group of 48.35. The next frequent size-group was 149-177 µm., 177-250 µm. and 250-420 µm. corresponding to the percent particles of 18.5, 15.28 and 13.57 respectively. So the percent particles of 51.65 is fallen in the size frequency over 149 µm. sieve opening size, and the percent particles of 48.35 is fallen in the size-frequency under 149 µm. sieve opening size. The average diameter of the particle size of Tablettose as calculated is 171 µm. The percent particles corresponding to size frequency showed that Tablettose possess a wider size distribution range than Elcema G.250.

Among these three drug carriers, Elcema G.250 has the largest particle size and followed by Tablettose and Starch 1500 respectively.

Scanning Electron Micrographs

A scanning electron microscope was used to study the surface characteristic and particle size of drug and drug carriers used. For micronized prednisolone, the photomicrographs is shown in Figure 6, showing the agglomeration of the drug particles to which this occurances of drug agglomeration may be due to the small size of the particle. For as the particle size approaches 10 µm. and below, weak polarizing electrical forces begin to cause particle agglomeration. The size of the micronized prednisolone as seen in the photomicrograph is approximately

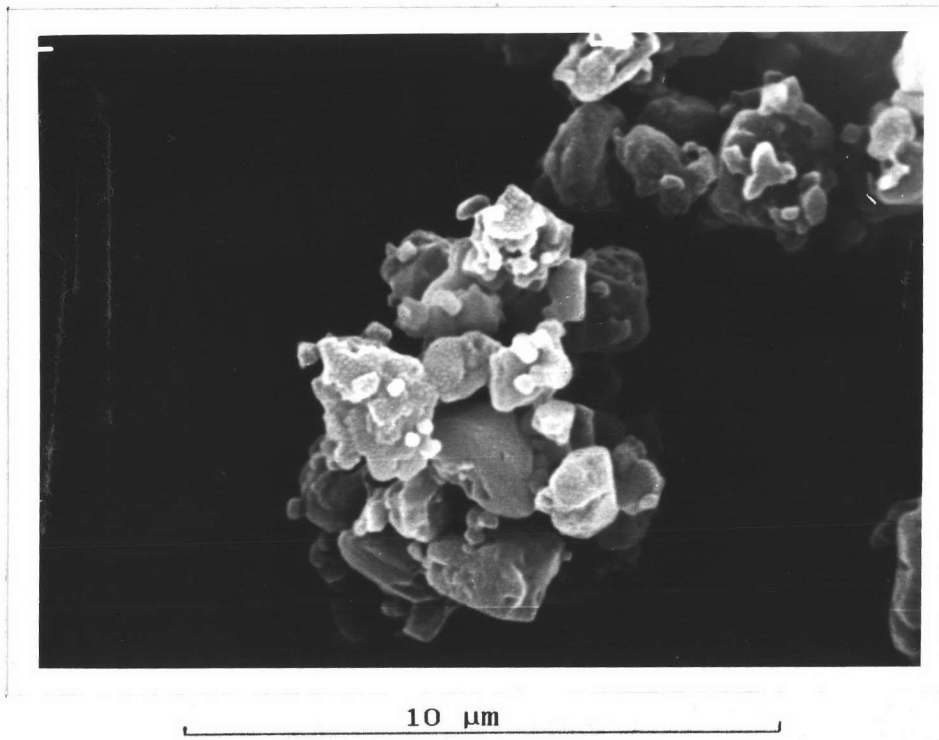

Figure 6 Scanning electron micrograph of micronized Prednisolone. (×7,500 magnification)

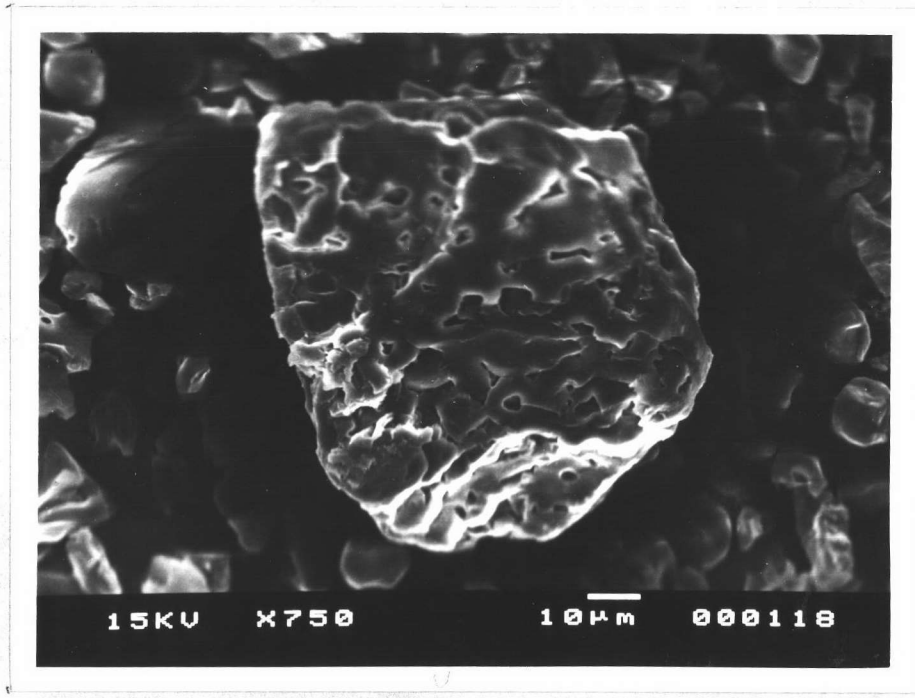

Figure 7 Scanning electron micrograph of Starch 1500 (×750 magnification)

1-3 µm. and the size of the agglomeration is approximately 7 µm. For Starch 1500, the photomicrographs are shown in Figure 7 and 10 indicated that most of the particle size is less than 100 µm. The surface characteristic of Starch 1500 is quite smooth and possess some indents. The photomicrographs of Elcema G.250 are shown in Figure 8 and 11. The particle characteristic of Elcema G.250 is a fibrous powder and a lot of indents on the surface. For Tablettose the photomicrographs are shown in Figure 9, 12 and 13. The surface of Tablettose is quite smooth with some indents.

Mixing Homogeneity Studies

Prednisolone content (%) in samples from ordered mixture of prednisolone with Starch 1500, with Elcema G.250 and Starch 1500 and with Tablettose and Starch 1500 at various mixing time are shown in Table 5, 6 and 7 respectively and the mixing profile is illustrated in Figure 14.

The degree of homogeneity of the ordered mixture was determined by the coefficient of variation. The homogeneity standard chosen for effective mixing was the coefficient of variation for 95% of samples falling within ±10% of the mean, that is the value of 5% (20).

Figure 14 shows the change in coefficient of variation with time of a mix of 2.5% prednisolone in various drug carriers. Mixing of prednisolone with Starch 1500 (Formulation 1) resulted in unsatisfactory degree of homogeneity. Sampling between 2 and 50 minutes all the

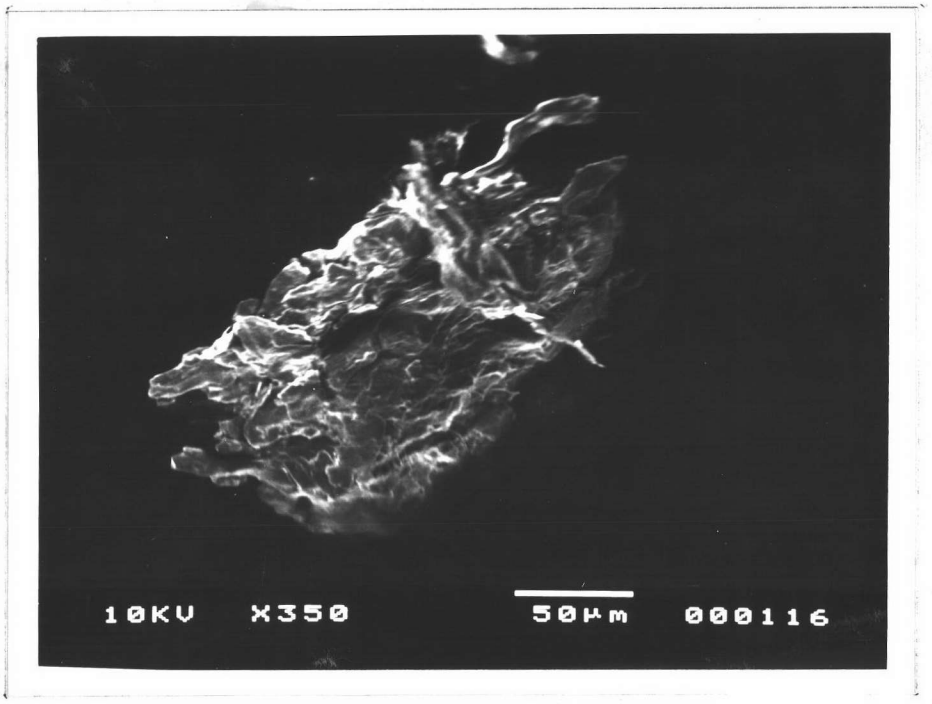

Figure 8 Scanning electron micrograph of Elcema G.250 (×350 magnification)

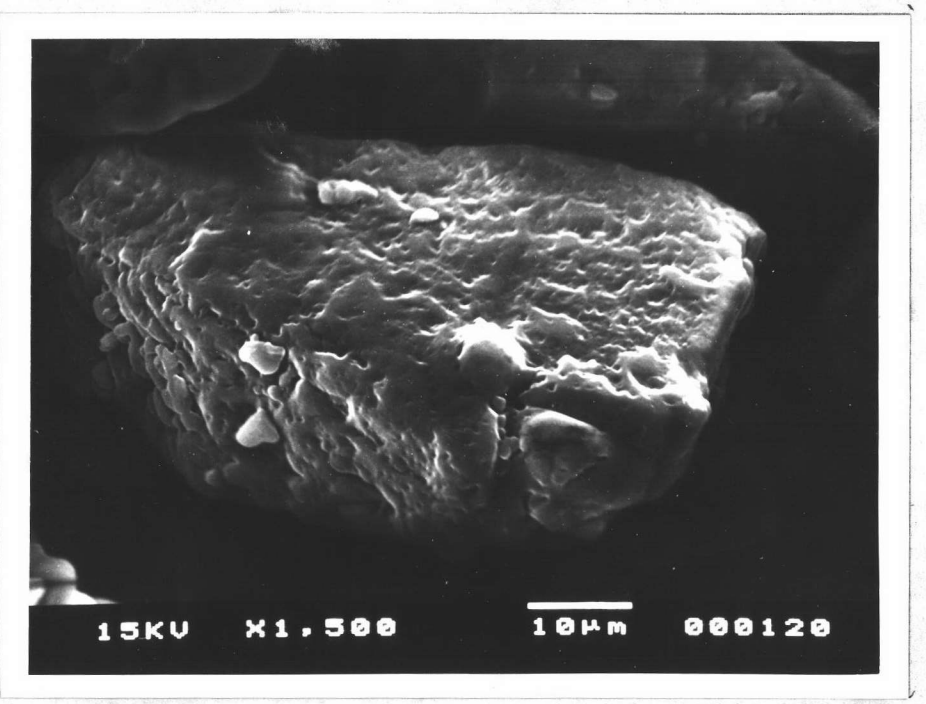

Figure 9 Scanning electron micrographs of Tablettose (×1,500 magnification)

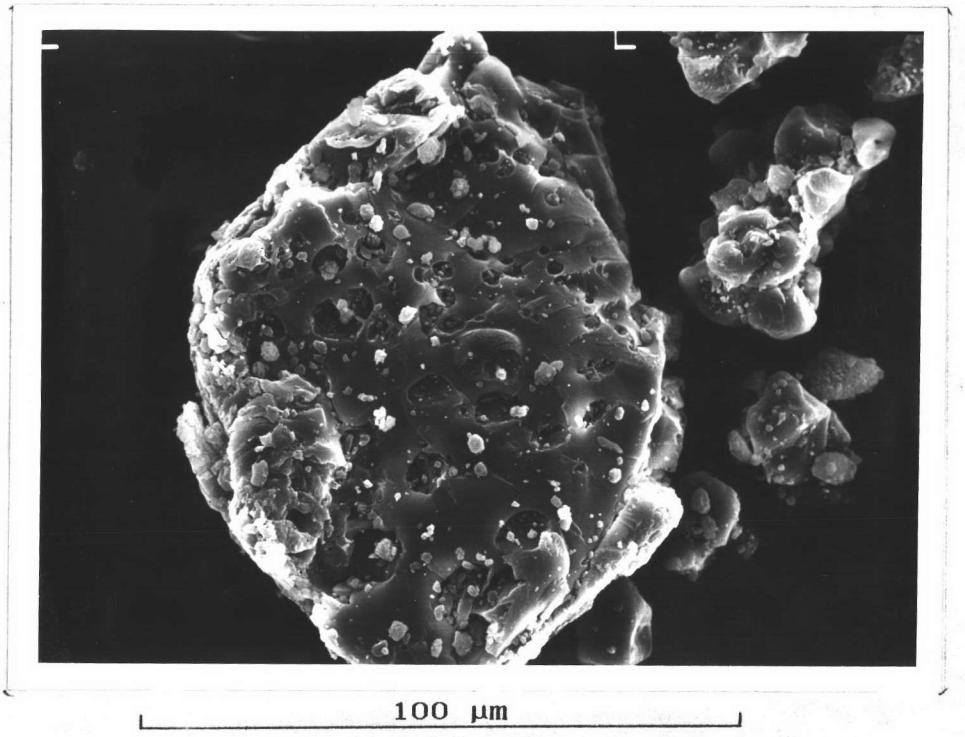

Figure 10 Scanning electron micrograph of Starch 1500 after mixed for 50 min. with 2.5% Prednisolone. (×750 magnification)

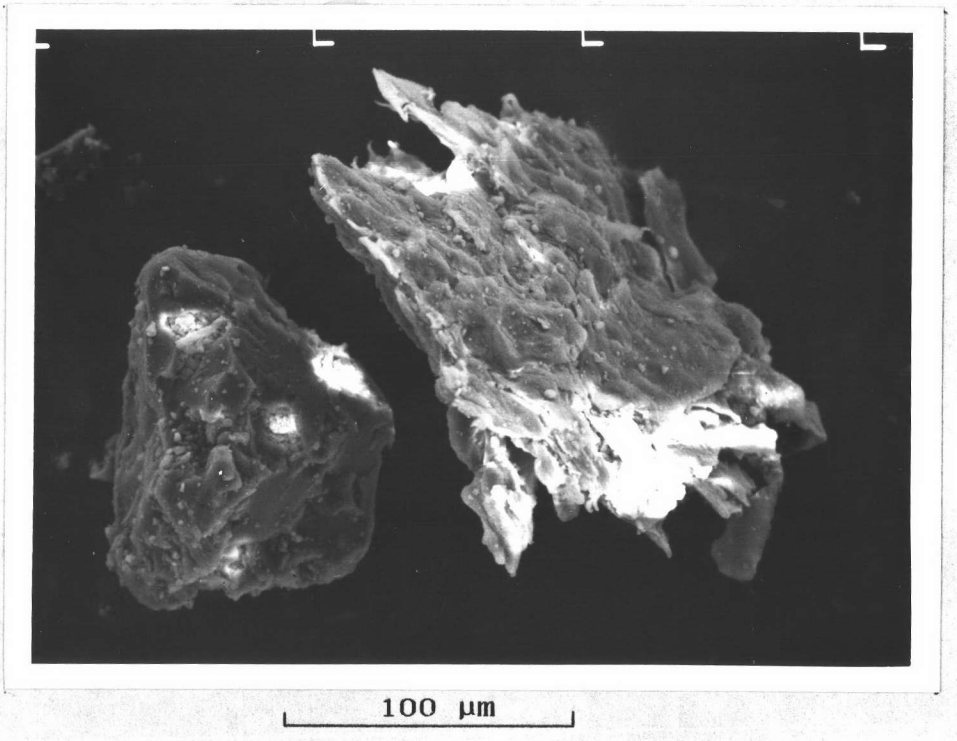

Figure 11 Scanning electron micrograph of Elcema G.250 after mixed for 50 min. with 2.5% Prednisolone. (×350 magnification)

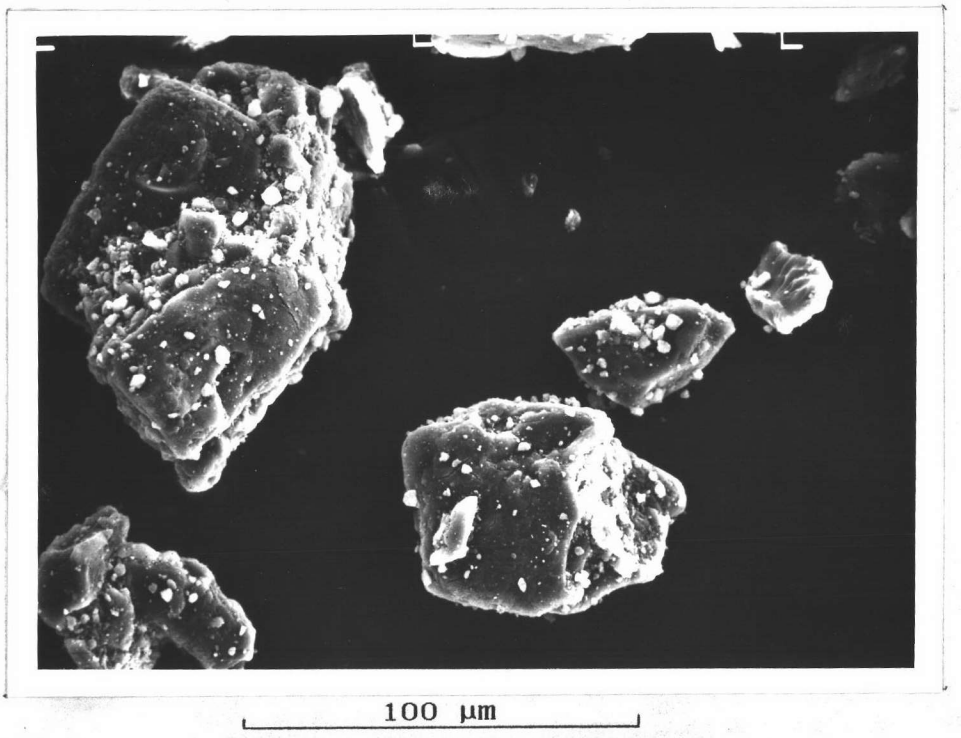

Figure 12 Scanning electron micrograph of Tablettose after mixed for 50 min. with 2.5% Prednisolone. (×500 magnification)

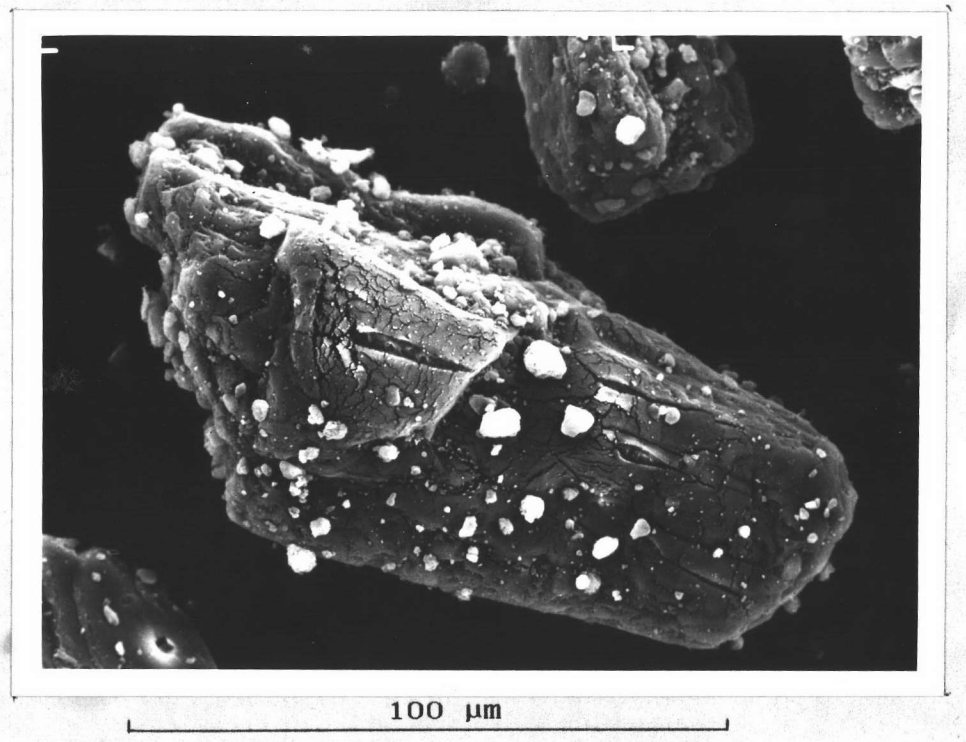

Figure 13 Scanning electron micrograph of Tablettose after mixed for 50 min. with 2.5% Prednisolone. (×750 magnification)

Table 5 Prednisolone content (%) in samples from ordered mixture of prednisolone with Starch 1500 (Formulation 1) at various mixing time.

Sample No.	Mixing Time (min) *						
	2	5	10	20	30	50	60
1	175.83	94.39	93.56	83.47	94.65	94.16	92.60
2	106.30	82.66	102.65	92.39	87.69	96.15	95.74
3	87.93	96.64	88.73	83.04	90.86	98.52	102.56
4	96.20	61.21	84.06	87.04	86.18	111.39	98.08
5	101.69	81.48	82.21	80.39	102.66	92.88	96.95
6	83.90	97.87	69.91	91.64	91.64	134.24	96.59
7	86.21	123.12	96.62	89.11	92.07	94.22	98.04
8	96.61	88.96	83.39	86.47	142.80	92.16	97.70
9	86.55	92.77	81.50	103.44	95.59	96.89	102.58
10	81.34	72.13	84.30	101.86	98.55	97.76	97.32
Average ± S.D.	100.26 ±27.77	89.12 ±16.66	86.69 ±9.17	89.88 ±7.71	98.27 ±16.39	100.84 ±12.94	97.61 ±3.02
C.V.(%)	27.70	18.69	10.58	8.58	16.68	12.83	3.10

* After 50 minutes mixing time, magnesium stearate and aerosil L.200 were incorporated into the mixture.

Table 6 Prednisolone content (%) in samples from ordered mixture of prednisolone with Elcema G.250 and Starch 1500 (77:20) (Formulation 2) at various mixing time.

Sample No.	Mixing Time (min) *						
	2	5	10	20	30	50	60
1	80.82	93.50	94.81	99.44	104.82	102.33	99.96
2	124.40	90.94	111.25	102.27	102.27	103.77	98.74
3	85.40	87.60	92.87	111.64	111.64	97.19	100.43
4	86.66	90.65	94.37	102.46	102.46	99.06	94.16
5	92.31	95.15	96.45	101.06	101.06	102.73	100.25
6	114.81	93.60	97.09	102.01	102.01	99.12	98.53
7	86.51	88.22	96.48	101.16	101.16	98.40	97.28
8	80.84	90.09	94.20	102.47	102.47	98.80	98.06
9	85.05	91.37	95.60	101.92	101.92	99.36	95.27
10	85.06	90.12	94.95	100.16	100.16	97.61	93.27
Average ± S.D.	92.19 ±14.97	91.12 ±2.38	96.81 ± 5.40	101.47 ±1.69	102.98 ±3.17	99.84 ±2.27	97.59 ±2.62
C.V.(%)	16.24	2.61	5.40	1.69	3.17	2.27	2.62

* After 50 minutes mixing time, magnesium stearate and aerosil L.200 were incorporated into the mixture.

Table 7 Prednisolone content (%) in samples from ordered mixture of prednisolone with Tablettose and Starch 1500 (77:20) (Formulation 3) at various mixing time.

Sample No.	Mixing Time (min) *						
	2	5	10	20	30	50	60
1	94.96	98.39	96.39	97.51	102.27	98.75	94.00
2	90.89	98.70	97.68	102.93	102.15	104.14	95.24
3	107.05	93.36	96.45	99.82	100.34	100.25	96.81
4	91.07	89.15	103.97	103.30	103.10	98.94	92.57
5	86.74	146.38	98.40	100.54	101.52	96.75	94.05
6	87.71	92.85	100.59	96.70	100.57	99.05	96.55
7	86.07	94.55	98.51	96.89	101.65	95.93	99.82
8	87.70	96.94	94.74	97.65	101.50	99.72	92.96
9	83.29	89.62	97.45	97.59	100.90	97.37	95.97
10	87.17	94.97	97.03	97.65	103.42	96.52	94.49
Average ± S.D.	90.26 ±6.72	99.49 ±16.79	98.12 ±2.57	99.05 ±2.46	101.74 ±1.01	98.74 ±2.38	95.25 ±2.15
C.V.(%)	7.44	16.87	2.62	2.48	1.00	2.41	2.26

* After 50 minutes mixing time, magnesium stearate and aerosil L.200 were incorporated into the mixture.

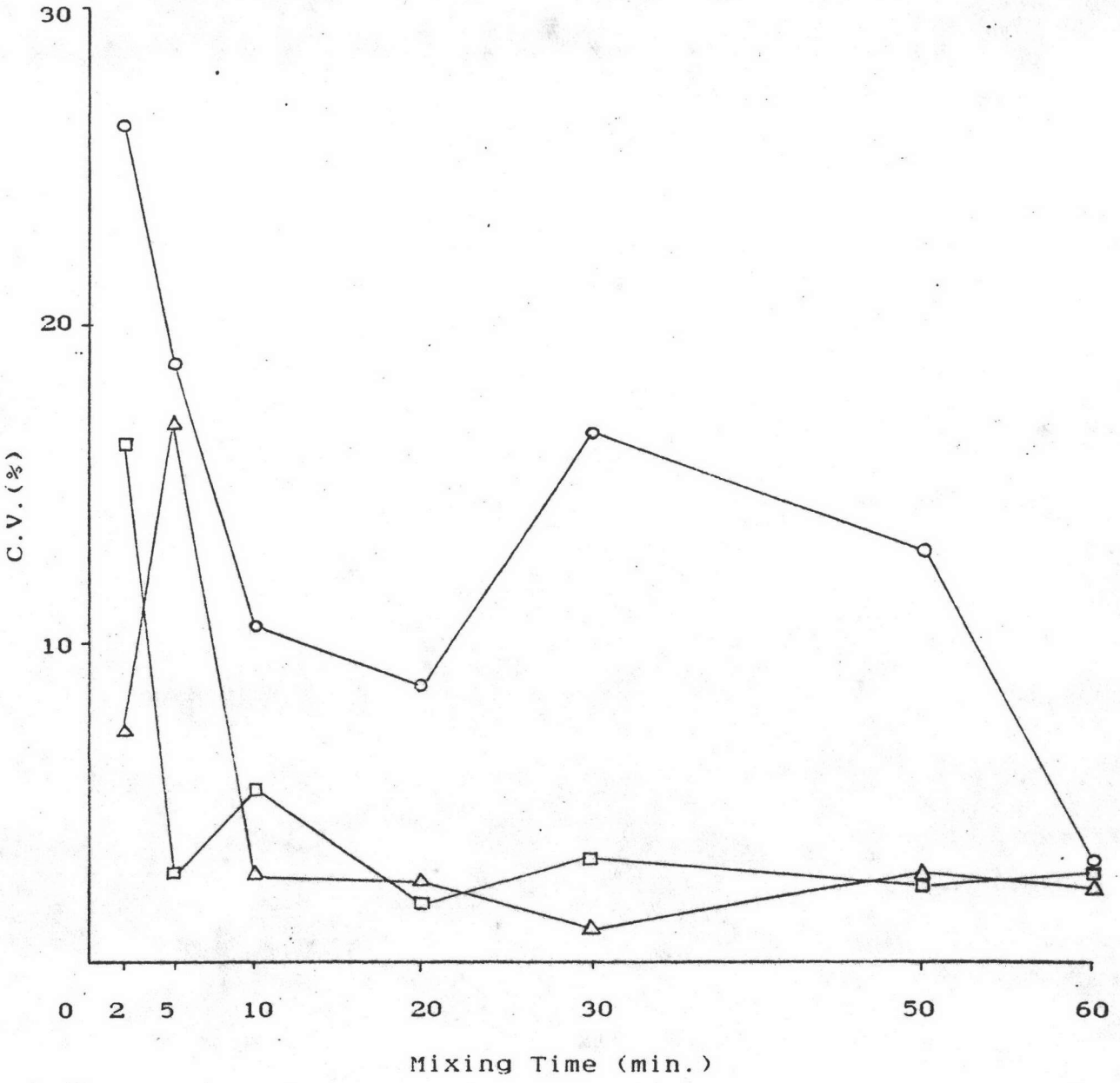

Figure 14 The mixing profile of prednisolone (2.5%) with various drug carriers.

Key: o, Starch 1500 (Formulation 1)

□, Elcema G.250 with Starch 1500 (77:20) (Formulation 2)

Δ, Tablettose with Starch 1500 (77:20) (Formulation 3)

samples had not achieved the coefficient of variation below 5%. Until the lubricants were incorporated and further mixing for 10 minutes, the coefficient of variation decreased to 3.15%.

Mixing of prednisolone with Elcema G.250 and Starch 1500 at ratio 77:20 (Formulation 2), the satisfactory degree of homogeneity was obtained after 5 minutes of mixing time, although a little high value in the coefficient of variation at 10 minutes (C.V.=5.40%). The lowest coefficient of variation of 1.69% was obtained at 20 minutes mixing time.

Mixing of prednisolone with Tablettose and Starch 1500 at ratio 77:20 (Formulation 3), the satisfactory degree of homogeneity was obtained after 10 minutes of mixing time. The lowest coefficient of variation of 1.0 % was obtained at 30 minutes mixing time.

Ordered Unit Segregation Studies

The ordered unit segregation was studied from drug content uniformity of the first and last interval sampling of the tablets during compression, the results are shown in Table 8, 9 and 10. The content uniformity of prednisolone tablets of the three formulations are within the requirement of USP XX which requires for the content of each of the 10 tablets within the limit of not less than 85% and not more than 115%.

Formulation 1 has the average content of prednisolone for the first interval sampling of 98.7% and the last

Table 8 Content uniformity of prednisolone tablets, using Starch 1500 as drug carrier. (Formulation 1)

Sample tablet No.	Prednisolone content (%)	
	First interval sampling	Last interval sampling
1	95.25	99.76
2	94.64	99.44
3	111.63	101.25
4	96.56	96.87
5	93.68	98.07
6	101.25	100.53
7	97.36	99.89
8	98.81	98.83
9	98.88	107.41
10	98.98	99.00
Average ± S.D.	98.70 ± 5.10	100.10 ± 2.85
C.V.(%)	5.17	2.85

Table 9 Content uniformity of prednisolone tablets, using Elcema G.250 and Starch 1500 (77:20) as drug carriers. (Formulation 2)

Sample tablet No.	Prednisolone content (%)	
	First interval sampling	Last interval sampling
1	104.47	93.73
2	104.56	93.11
3	102.08	93.05
4	101.79	92.26
5	100.15	91.67
6	101.31	92.90
7	100.62	93.48
8	100.81	92.68
9	101.31	91.46
10	99.76	94.39
Average ±S.D.	101.69 ± 1.65	92.87 ± 0.90
C.V.(%)	1.62	0.97

Table 10 Content uniformity of prednisolone tablets, using Tablettose and Starch 1500 (77:20) as drug carriers. (Formulation 3)

Sample tablet No.	Prednisolone content (%)	
	First interval sampling	Last interval sampling
1	99.05	98.16
2	100.95	97.16
3	99.55	99.49
4	100.65	98.12
5	100.81	97.63
6	98.42	100.60
7	100.64	99.64
8	102.88	99.94
9	101.87	100.98
10	101.86	100.50
Average ±S.D.	100.67 ± 1.36	99.22 ± 1.35
C.V.(%)	1.35	1.36

interval sampling of 100.1%, a slightly increasing in the average content of 1.14% was obtained.

Formulation 2 has the average content for the first and the last sampling of 101.69% and 92.87% respectively, a decreasing in average content of 8.82% was obtained.

Formulation 3 has the average content for the first and the last interval sampling of 100.67% and 99.22% respectively, a slightly decreasing in average content of 1.45% was obtained.

Among the three formulations, formulation 2 gave the highest variation of the prednisolone content during compression. It also noted that, formulation 1 has highest value of coefficient of variation than the other two formulations, both in the first and last interval of sampling.

Evaluation of Prednisolone Direct Compressed Tablet

The three formulations of prednisolone direct compressed tablet were evaluated, and the results are shown in Table 11.

Weight Variation

The weight variation of the tablets from all of the three formulations are in the limit of ±10%, since USP XX requires for the limit of the weight variation of ±10% for tablet weighs 100 mg. and below.

Table 11 Evaluation of prednisolone direct compressed tablets for three differences formulations.

	Formulation 1	Formulation 2	Formulation 3	n
Average weight (mg.) ± S.D	101.49 ± 1.15	102.70 ± 1.31	102.44 ± 1.59	20
Weight variation (%)	+2.08, -1.45	+2.63, -2.63	+2.21, -2.38	
Hardness (kp)	3.6 ± 0.52	4.42 ± 0.17	3.02 ± 0.28	6
Friability (%)	0.15	0.19	0.10	20
Disintegration time (min)	16.5 ± 0.9	1.31 ± 0.11	0.15 ± 0.01	6

Hardness

The average hardness of the tablet are 3.6, 4.2 and 3.02 kp. for formulation 1, 2 and 3 respectively. Formulation 2 has the higest hardness and formulation 3 has the lowest hardness.

Friability

The friability of the tablets from each formulation are all less than 1% and formulation 3 gives the minimum percent friability.

Disintegration Time

The disintegration time of the tablets from each formulation are all in the limit of USP., since USP XX requires 30 minutes for the disintegration time of prednisolone tablet. Formulation 3 gave the fastest disintegration time of 0.15 minutes, formulation 2 gave the disintegration time of 1.31 minutes and formulation 1 gave the slowest disintegration time of 16.50 minutes.

Dissolution Rate Studies

Dissolution rate of prednisolone direct compression tablets formulation 1, 2 and 3 are shown in Table 12, 13 and 14 respectively. The dissolution rate profile of the three formulations is presented in Figure 15. Dissolution requirement of prednisolone tablets in USP XX, using apparatus type I, specifies that not less than 60% of the labeled amount of prednisolone is dissolved in 20 minutes.

Table 12 Dissolution rate of prednisolone tablets prepared by direct compression containing Starch 1500 as drug carrier. (Formulation 1)

Time (min.)	Percent of Prednisolone dissolved		
	Tablet #1	Tablet #2	Average ± S.D.
5	21.11	29.79	25.45 ± 6.14
10	28.67	30.74	29.70 ± 1.46
15	40.95	49.76	45.35 ± 6.23
20	48.52	45.00	46.76 ± 2.49
30	88.21	92.54	90.37 ± 3.06

Table 13 Dissolution rate of prednisolone tablets prepared by direct compression containing Elcema G.250 and Starch 1500 (77:20) as drug carriers. (Formulation 2)

Time (min.)	Percent of Prednisolone dissolved		
	Tablet #1	Tablet #2	Average ± S.D.
5	73.01	80.48	76.74 ± 5.28
10	73.96	81.43	77.69 ± 5.28
15	81.51	80.48	80.99 ± 0.73
20	84.34	86.15	85.24 ± 1.28
30	83.40	99.35	91.37 ± 11.28

Table 14 Dissolution rate of prednisolone tablets prepared by direct compression containing Tablettose and Starch 1500 (77:20) as drug carriers. (Formulation 3)

Time (min.)	Percent of Prednisolone dissolved		
	Tablet #1	Tablet #2	Average ± S.D.
5	93.97	96.81	95.39 ± 2.01
10	94.92	97.37	96.14 ± 1.73
15	97.04	102.48	99.76 ± 3.85
20	93.97	101.14	97.55 ± 5.07
30	99.65	102.48	101.10 ± 2.00

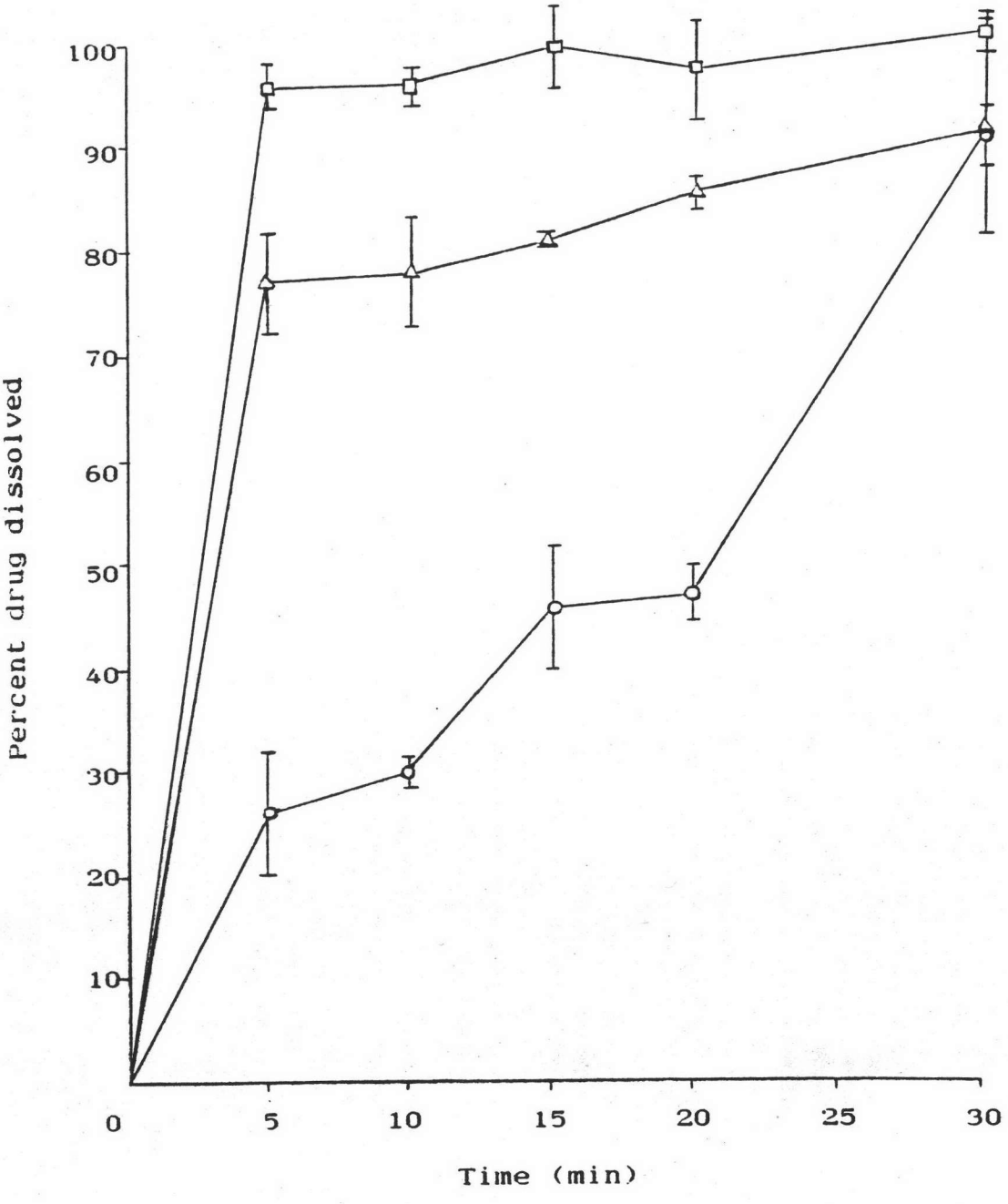

Figure 15 Dissolution rate profiles of prednisolone tablets prepared by direct compression containing various drug carriers.

Key: o, Starch 1500 (77:20)

△, Elcema G.250 and Starch 1500 (77:20)

□, Tablettose and Starch 1500 (77:20)

Percent of prednisolone dissolved from prednisolone tablets formulation 1 at 20 minutes is only 46.76%, which is not conformed in the limit of USP XX requirement. Prednisolone tablets formulation 2 and 3 give 85.24 and 97.55% of prednisolone dissolved at 20 minutes respectively.

The dissolution profiles of three formulations as shown in Figure 15, it is clearly showed that the formulation 3 give the fastest dissolution rate and the highest percent of prednisolone dissolved at every time intervals.

For prednisolone tablets prepared by wet granulation method, formulation 1 which containing Starch 1500 was not able to prepare, due to the formation of sticky mass when purified water was incorporated, thus granulation could not be done. The dissolution rate of prednisolone tablets prepared by wet granulation method formulation 2 and 3 are shown in Table 15 and 16 respectively and the dissolution rate profile of the two formulation is presented in Figure 16. The dissolution rate of prednisolone tablets formulation 3 gave faster prednisolone dissolved than formulation 2. Comparison of dissolution rate of prednisolone tablets prepared by direct compression and by wet granulation method is shown by dissolution rate profile in Figure 17. The results show that prednisolone tablets containing Tablettose and Starch 1500 prepared by both method gave faster dissolution rate than tablets containing Elcema G.250 and Starch 1500.

Table 15 Dissolution rate of prednisolone tablets prepared by wet granulation containing Elcema G.250 and Starch 1500 (77:20) as drug carriers. (Formulation 2)

Time (min.)	Percent of Prednisolone dissolved		
	Tablet #1	Tablet #2	Average ± S.D.
5	75.77	74.03	74.90 ± 1.23
10	75.77	74.98	75.37 ± 0.56
15	74.83	73.09	73.96 ± 1.23
20	76.71	80.65	78.68 ± 2.79
30	82.37	88.21	85.29 ± 4.13

Table 16 Dissolution rate of prednisolone tablets prepared by wet granulation containing Tablettose and Starch 1500 (77:20) as drug carriers. (Formulation 3)

Time (min.)	Percent of Prednisolone dissolved		
	Tablet #1	Tablet #2	Average ± S.D.
5	74.27	89.69	81.98 ± 10.90
10	80.99	94.44	87.71 ± 9.51
15	82.91	97.29	90.10 ± 10.17
20	87.71	94.44	91.10 ± 4.76
30	87.71	99.19	93.45 ± 8.12

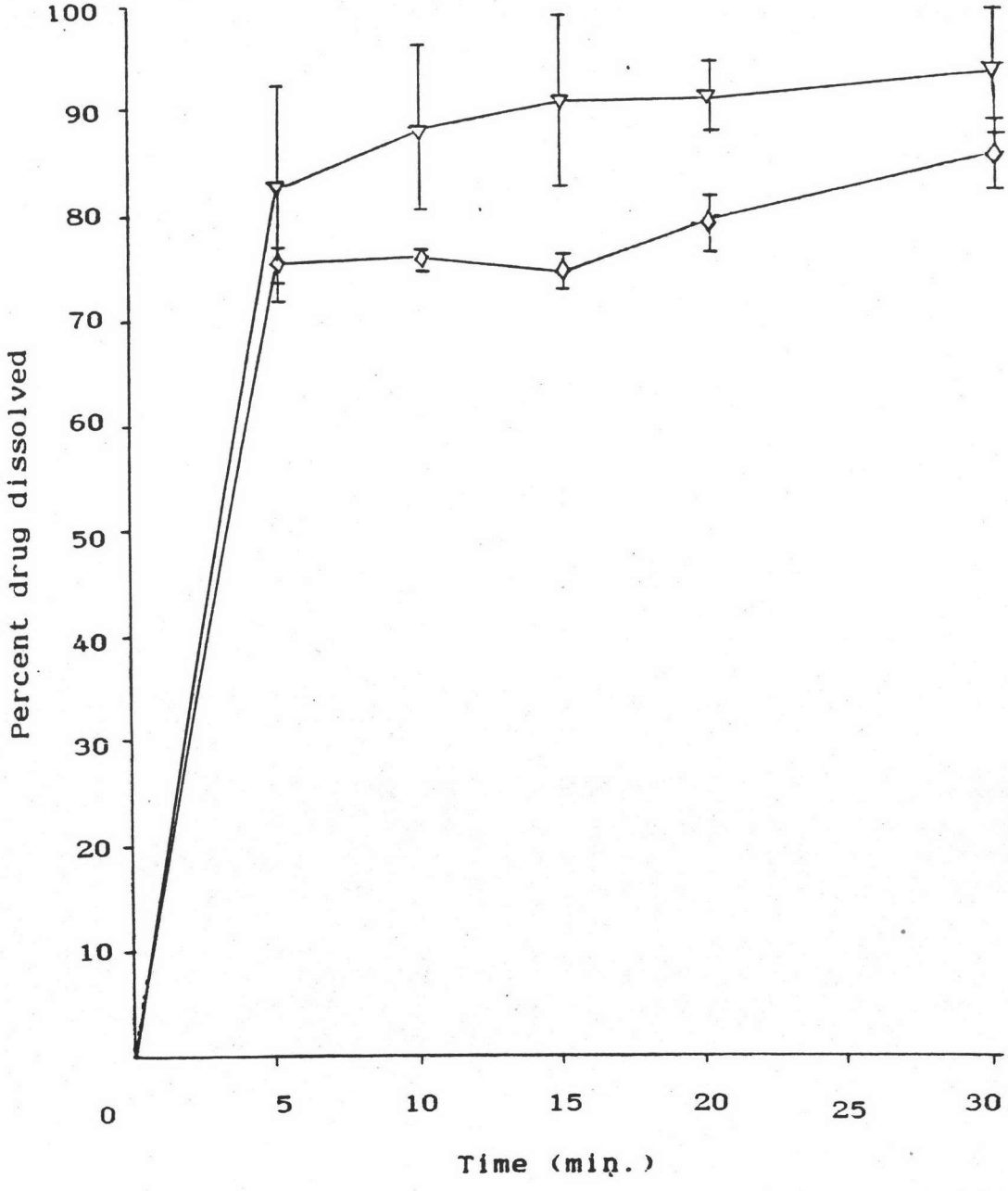

Figure 16 Dissolution rate profiles of prednisolone tablets prepared by wet granulation containing various drug carriers.

Key: ◊, Elcema G.250 and Starch 1500 (77:20)

▽, Tablettose and Starch 1500 (77:20)

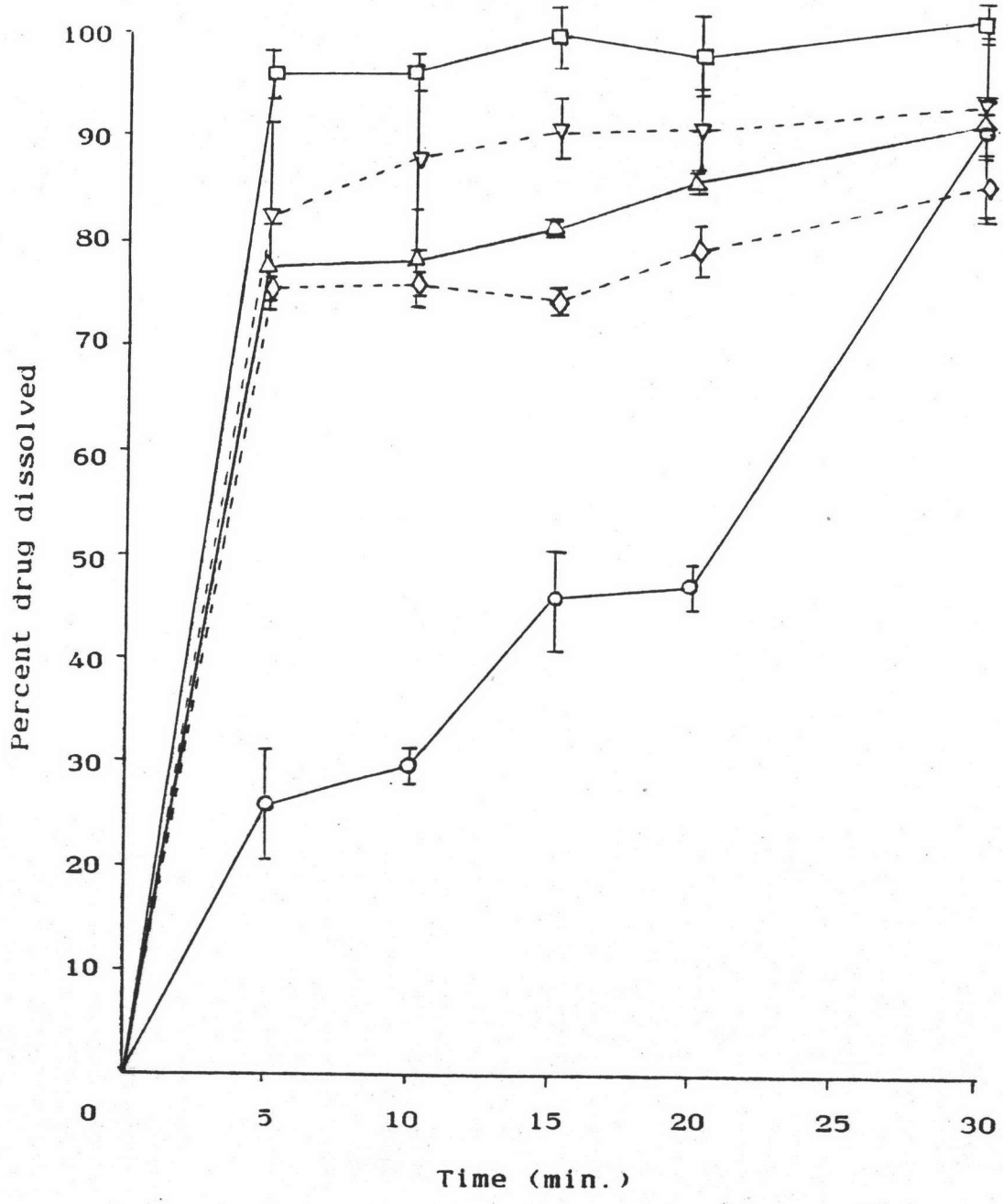

Figure 17 Comparison of the dissolution rate profiles of prednisolone tablets prepared by direct compression and by wet granulation with various drug carriers.

Key:

- o, Starch 1500 (direct compression)
- △, Elcema G.250 and Starch 1500 (77:20) (direct compression)
- ◊, Elcema G.250 and Starch 1500 (77:20) (wet granulation)
- □, Tablettose and Starch 1500 (77:20) (direct compression)
- ▽, Tablettose and Starch 1500 (77:20) (wet granulation)

Prednisolone tablets prepared by direct compression gave faster dissolution rate than those prepared by wet granulation method in both formulation 2 and 3.

Physical Stability of Prednisolone Direct Compressed Tablets

The results for the stability of prednisolone direct compressed tablets regarding to disintegration time and hardness are shown in Table 17 and 18 respectively and regarding to dissolution rate are shown in Table 19, 20 and 21. The dissolution profiles are shown in Figure 18, 19 and 20. There was no significanty change in the disintegration time, hardness and dissolution rates of prednisolone direct compressed tablets, only a slightly decreased in disintegration time of prednisolone tablets in formulation 2 at 12 weeks of storage and a slightly decreased in hardness of prednisolone tablets in formulation 3. So the prednisolone direct compressed tablets were physically stable within the storage time of 12 weeks.

Table 17 Disintegration time of Prednisolone direct compressed tablets, after stored in polystyrene jar at room temperature for a period of time.

	Disintegration time (min.) (Average ± S.D.)			
	0 week	4 weeks	8 weeks	12 weeks
Formulation 1	16.50 ± 0.90	13.82 ± 0.92	17.83 ± 1.00	15.36 ± 0.73
Formulation 2	1.31 ± 0.11	1.13 ± 0.12	1.18 ± 0.10	0.48 ± 0.05
Formulation 3	0.15 ± 0.01	0.16 ± 0.01	0.16 ± 0.02	0.14 ± 0.01

Table 18 Hardness of Prednisolone direct compressed tablets, after stored in polystyrene jar at room temperature for a period of time.

	Hardness (Kp) (Average ± S.D.)			
	0 week	4 weeks	8 weeks	12 weeks
Formulation 1	3.60 ± 0.52	3.52 ± 0.42	3.87 ± 0.30	3.62 ± 0.36
Formulation 2	4.42 ± 0.17	3.93 ± 0.15	4.28 ± 0.07	4.28 ± 0.16
Formulation 3	3.02 ± 0.28	2.22 ± 0.19	2.87 ± 0.14	2.25 ± 0.22

Table 19 Percent of Prednisolone dissolved from tablets prepared by direct compression containing Starch 1500 as drug carrier (Formulation 1), after stored in polystyrene jar at room temperature for a period of time.

Time (min.)	Percent of prednisolone dissolved (Average ± S.D.)			
	0 week	4 weeks	8 weeks	12 weeks
5	25.45 ± 6.14	24.56 ± 8.74	16.86 ± 5.34	18.71 ± 4.5
10	29.70 ± 1.46	30.74 ± 1.34	28.20 ± 6.19	26.26 ± 8.44
15	45.35 ± 6.23	44.05 ± 4.04	44.71 ± 2.39	27.25 ± 2.25
20	46.76± 2.49	54.51 ± 8.07	56.48 ±10.99	46.12 ± 1.58
30	90.37 ± 3.06	85.88 ± 5.38	81.55 ± 0.82	90.54 ± 4.16

Table 20 Percent of prednisolone dissolved from tablets prepared by direct compression containing Elcema G.250 and Starch 1500 (77:20) as drug carriers (Formulation 2), after stored in polystyrene jar at room temperature for a period of time.

Time (min.)	Percent of prednisolone dissolved (Average ± S.D.)			
	0 week	4 weeks	8 weeks	12 weeks
5	76.74 ± 5.28	75.29 ± 4.50	75.98 ± 4.40	75.02 ± 1.63
10	77.69 ± 5.28	79.38 ± 2.57	76.40 ± 2.83	76.85 ± 4.22
15	81.00 ± 0.73	80.74 ± 3.22	81.08 ± 2.40	79.61 ± 2.27
20	85.24 ± 1.28	83.47 ± 3.21	87.58 ± 5.01	83.73 ± 2.25
30	91.37 ±11.28	88.92 ± 3.22	90.82 ± 3.22	91.98 ± 3.51

Table 21 Percent of prednisolone dissolved from tablets prepared by direct compression containing Tablettose and Starch 1500 (77:20) as drug carriers (Formulation 3), after stored in polystyrene jar at room temperature for a period of time.

Time (min.)	Percent of prednisolone dissolved (Average ± S.D.)			
	0 week	4 weeks	8 weeks	12 weeks
5	95.39 ± 2.01	90.74 ± 7.22	95.44 ± 2.62	93.33 ± 1.74
10	96.14 ± 1.73	89.82 ± 4.60	99.22 ± 3.98	95.61 ± 3.68
15	99.76 ± 3.85	94.03 ± 1.26	100.16 ± 2.66	97.43 ± 1.74
20	97.95 ± 5.07	95.44 ± 3.36	100.64 ± 4.67	97.89 ± 1.75
30	101.10 ± 2.00	98.24 ± 3.39	100.64 ± 3.34	99.03 ± 2.08

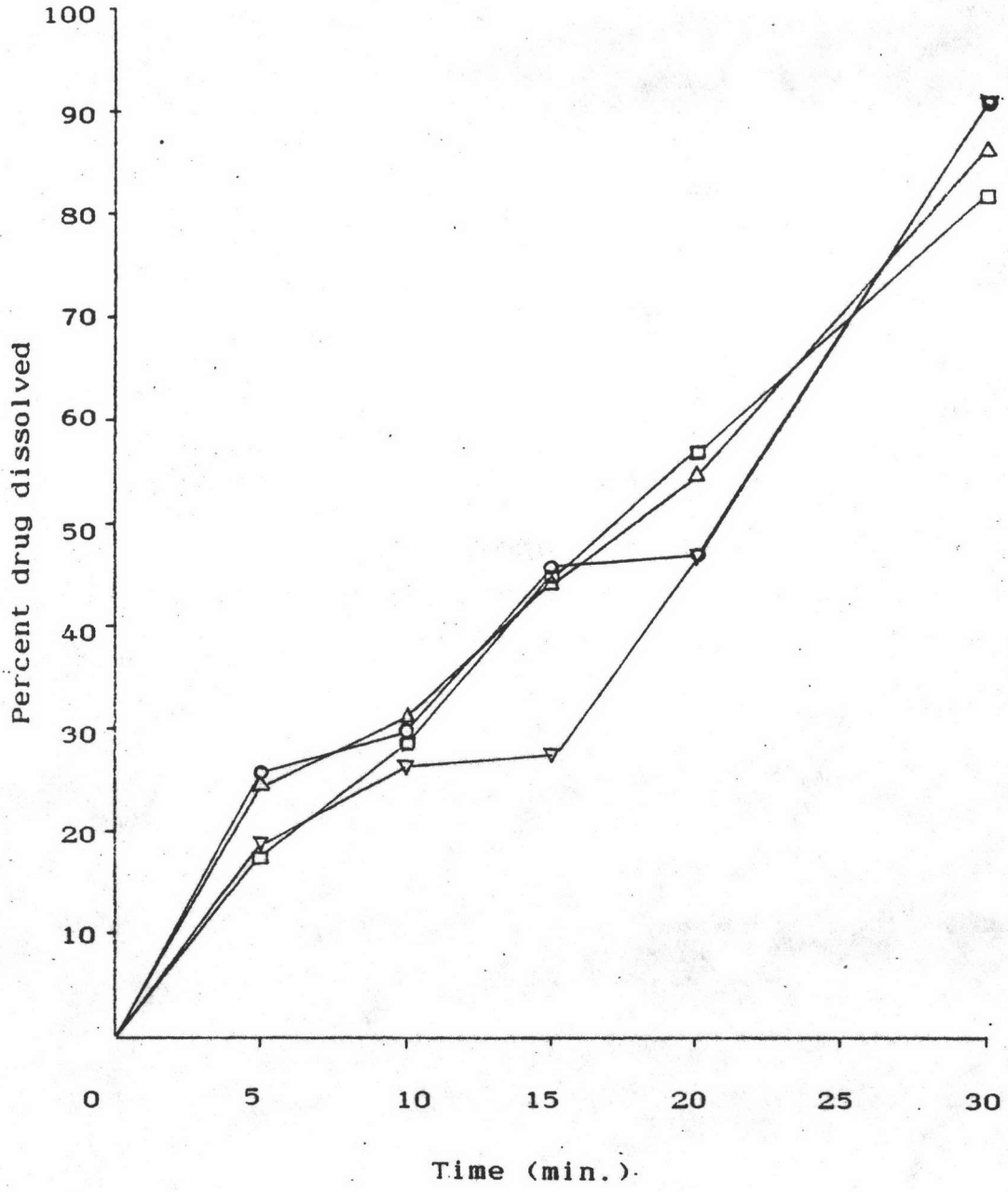

Figure 18 Dissolution rate profiles of prednisolone tablets prepared by direct compression containing Starch 1500 as drug carrier (Formulation 1), after stored at room temperature for a period of time.

Key: ○, 0 week △, 4 weeks

□, 8 weeks ▽, 12 weeks

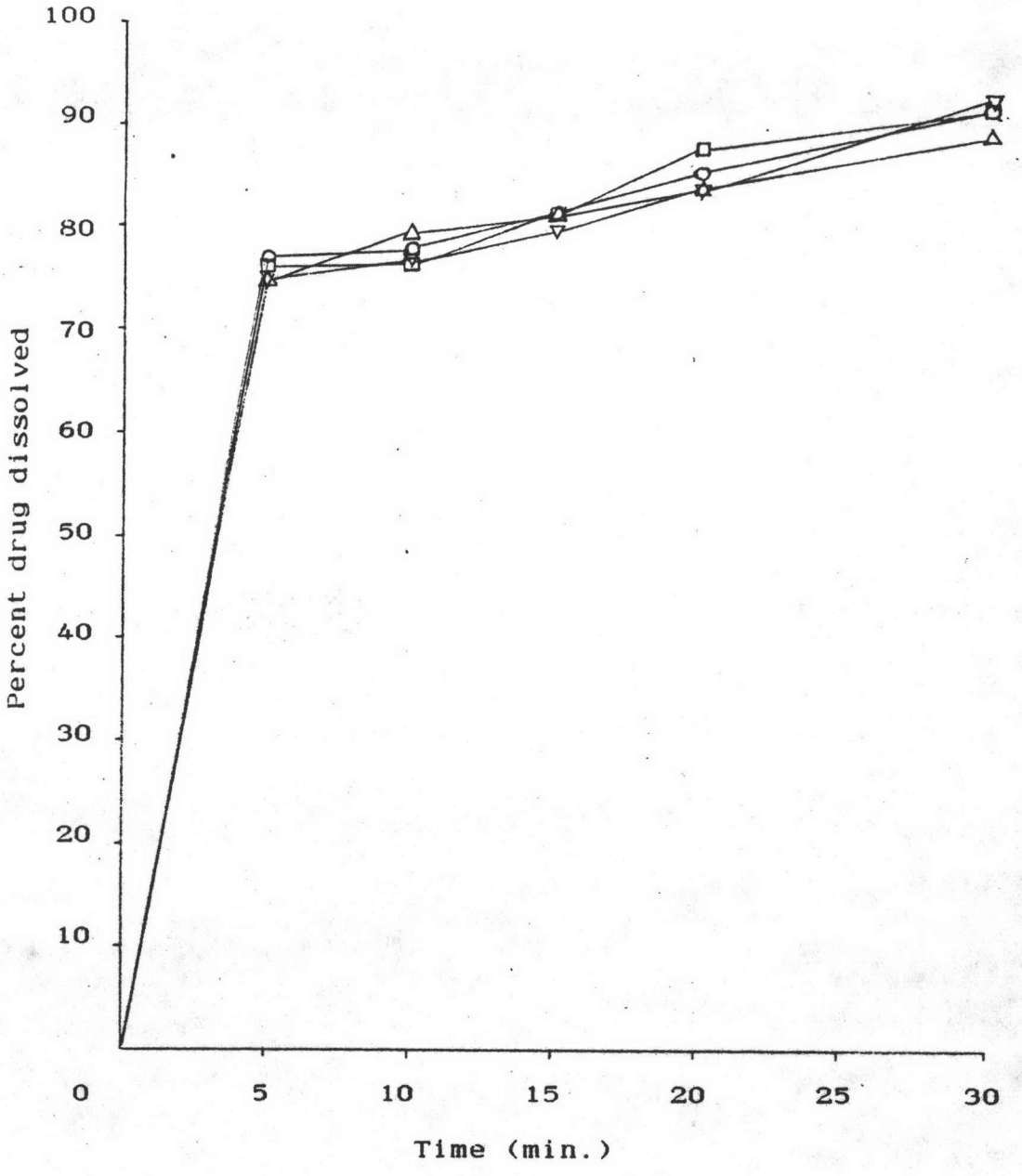

Figure 19 Dissolution rate profiles of prednisolone tablets prepared by direct compression containing Elcema G.250 and Starch 1500 (77:20) as drug carriers (Formulation 2), after stored at room temperature for a period of time.

Key: o, 0 week △, 4 weeks

□, 8 weeks ▽, 12 weeks

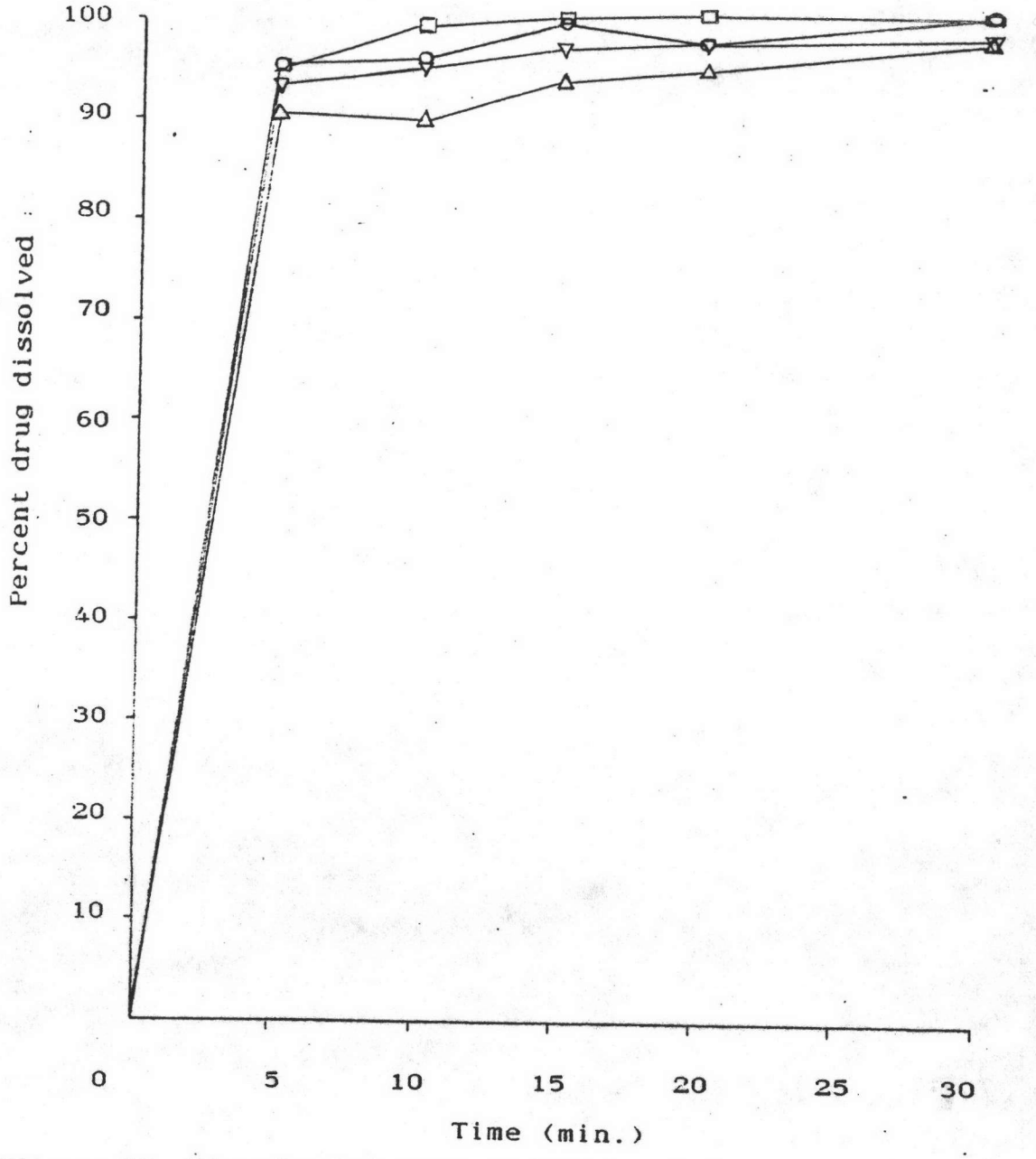

Figure 20 Dissolution rate profiles of prednisolone tablets prepared by direct compression containing Tablettose and Starch 1500 (77:20) as drug carriers (Formulation 3), after stored at room temperature for a period of time.

Key: o, 0 week △, 4 weeks

□, 8 weeks ▽, 12 weeks