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## APPENDICES



## Appendix I

### Calibration Data of Standard Curves

Table 11 Calibration Data between Strain and Applied Forces of Strain Guages Bound on Upper Punch

Force (pounds )	Strain (microstrain)	
	Experimental	Predicted
0	0	0
440	35.17	33.61
880	68.83	67.23
1320	103.17	100.84
1760	136.50	134.45
2200	169.67	168.07
2640	204.17	201.68
3080	236.17	235.29
3520	268.50	268.90
3960	300.17	302.52
4400	333.67	336.13

#### SUMMARY OUTPUT

##### Regression Statistics

Multiple R	0.9999
R Square	0.9997
Adjusted R Squar	0.8997
Standard Error	1.8945
Observations	11.0000

$$Y = 0.0764 X + 0.0002 ; R \text{ square} = 0.9997$$

Table 12 Absorbance of Paracetamol Standard Solution in Phosphate Buffer pH 5.8

Concentration ( $\mu\text{g} / \text{ml}$ )	Absorbance at 249 nm.	Predicted Value
0.0	0.000	0.002
2.5	0.172	0.173
5.0	0.350	0.345
7.5	0.514	0.517
10.0	0.695	0.689
12.5	0.856	0.861

#### SUMMARY OUTPUT

##### Regression Statistics

Multiple R	0.99991
R Square	0.99981
Adjusted R Squar	0.99977
Standard Error	0.00490
Observations	6

$$Y = 0.0687 X + 0.00167 ; R \text{ square} = 0.9998$$

Table 13 Absorbance of Nicotinamide Standard Solution in Purified water

Concentration ( $\mu\text{g} / \text{ml}$ )	Absorbance at 262 nm.	Predicted Value
0.0	0.000	0.0016
10.0	0.242	0.2356
15.0	0.351	0.3525
20.0	0.464	0.4695
25.0	0.586	0.5864
30.0	0.706	0.7034

#### SUMMARY OUTPUT

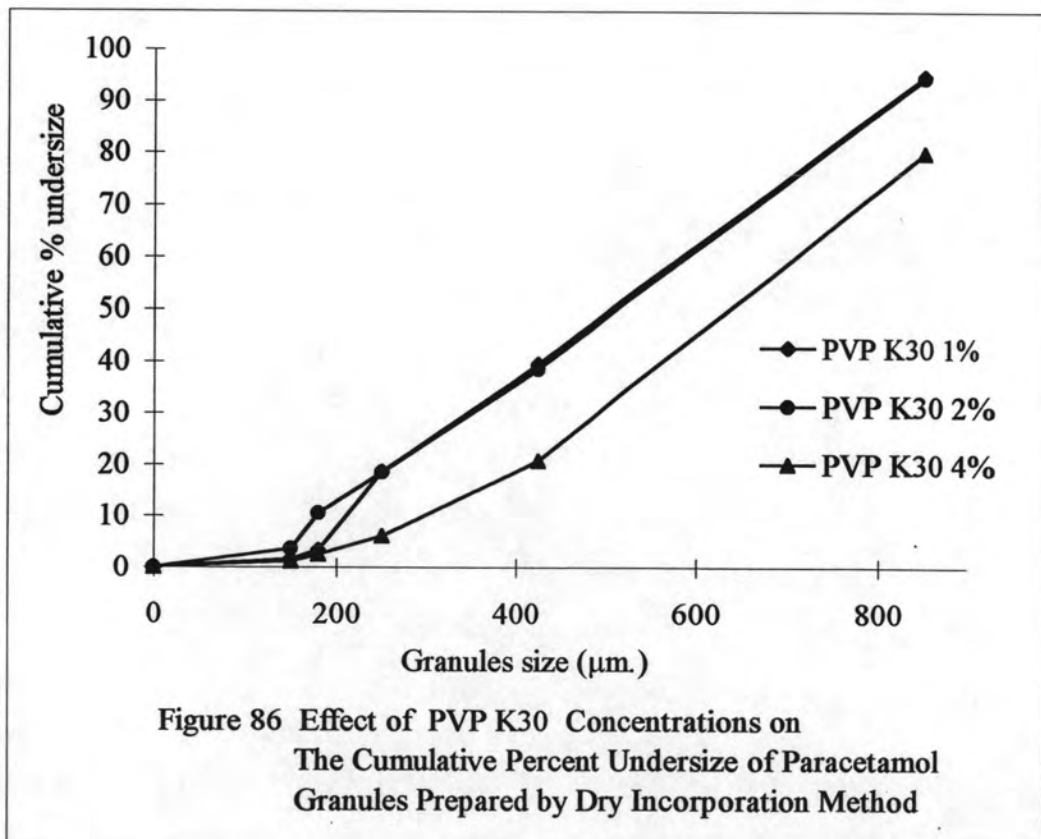
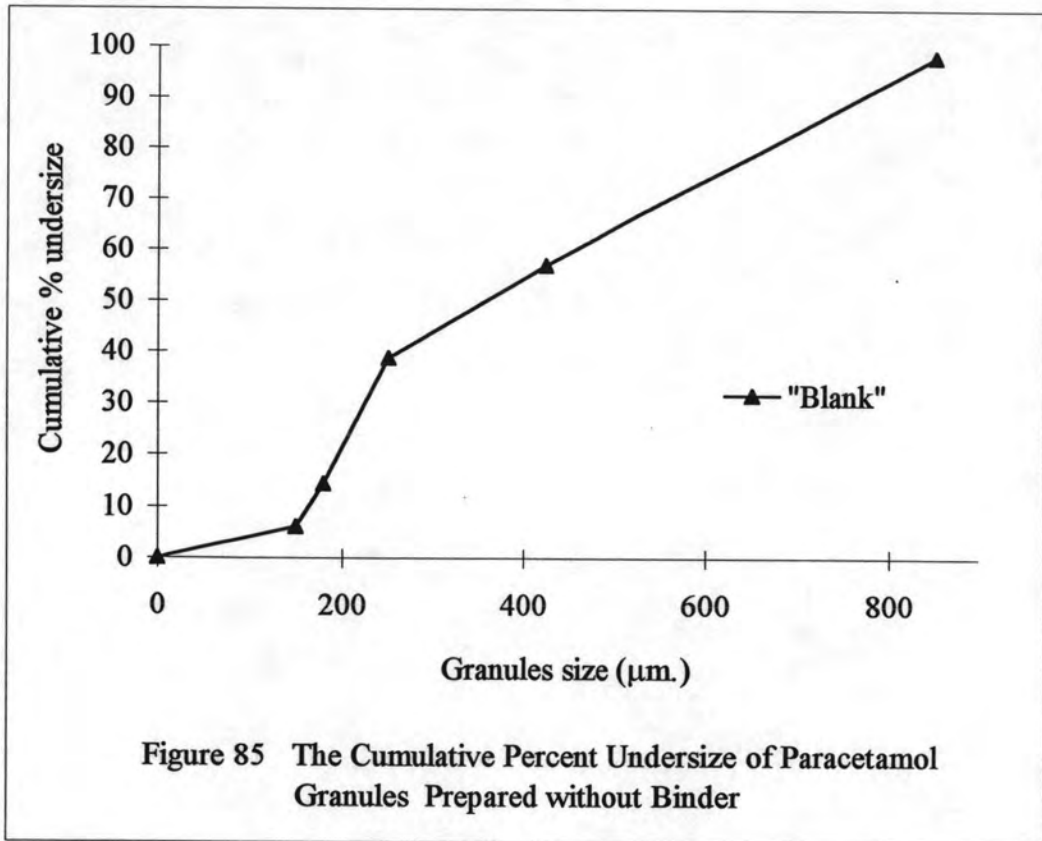
##### Regression Statistics

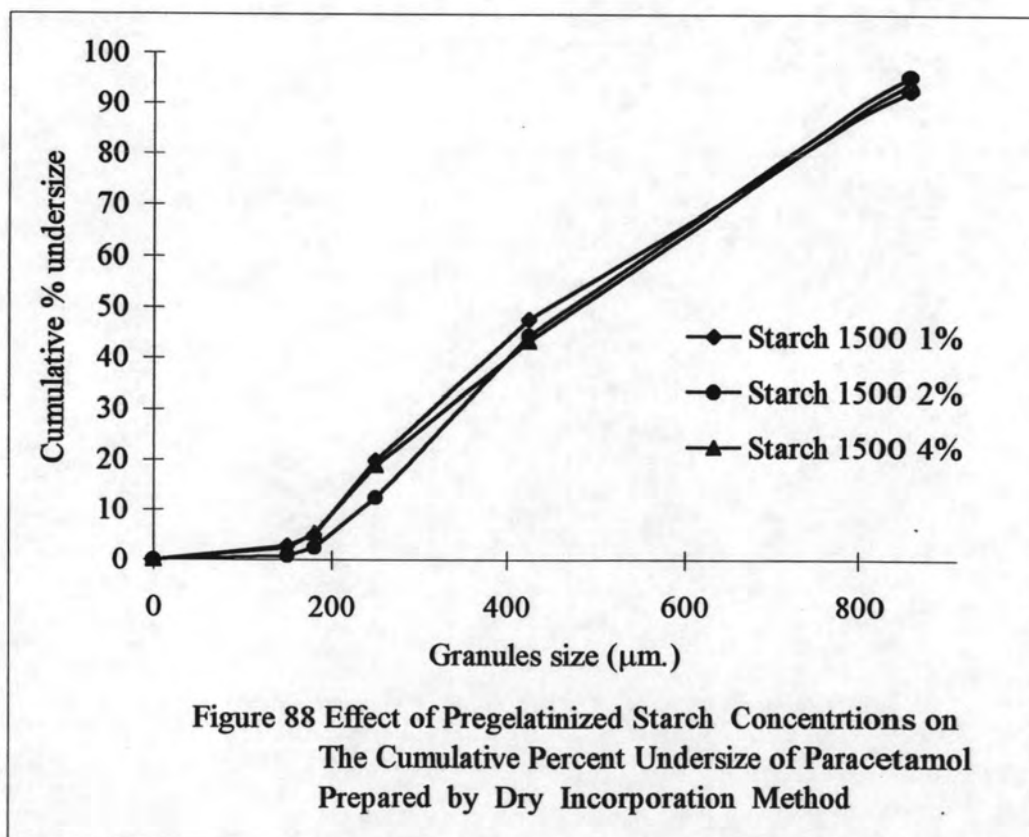
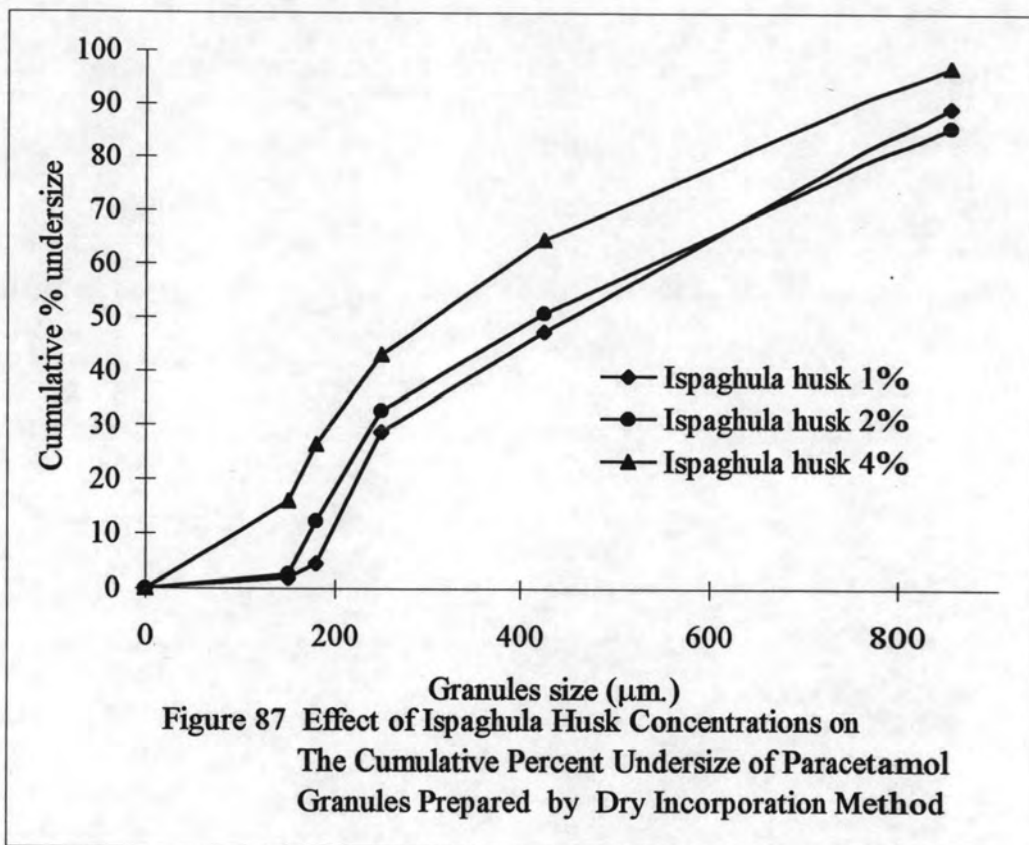
Multiple R	0.99987
R Square	0.99974
Adjusted R Squar	0.99967
Standard Error	0.00457
Observations	6

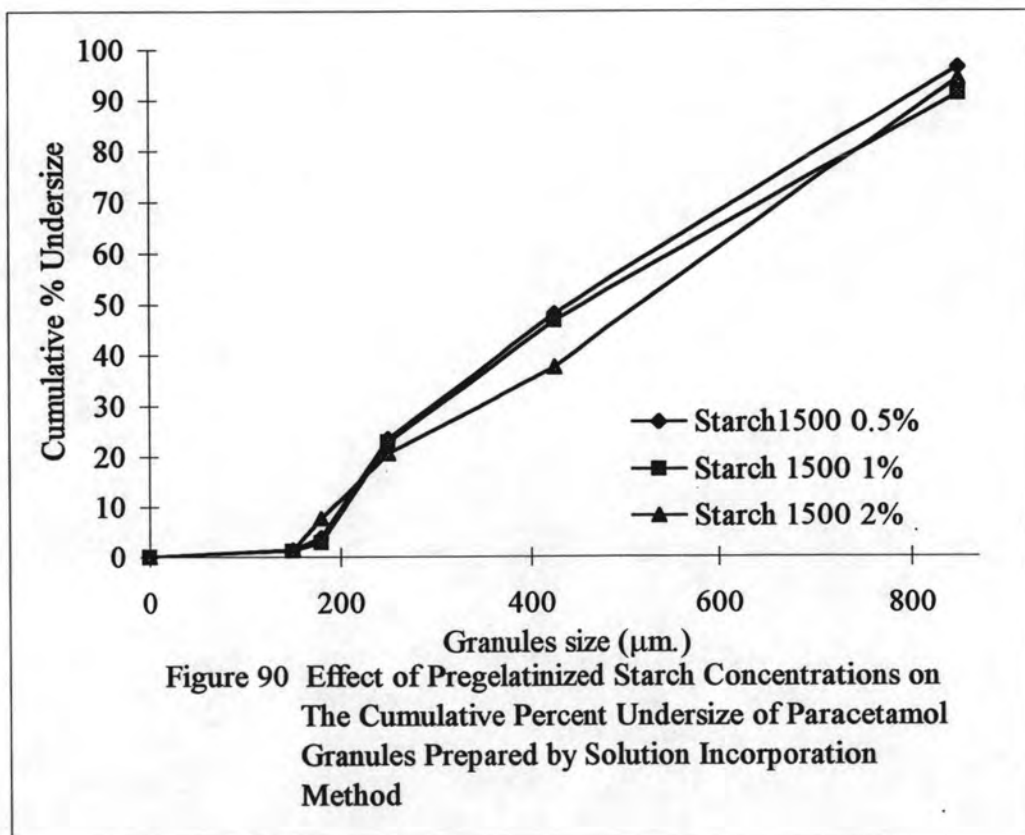
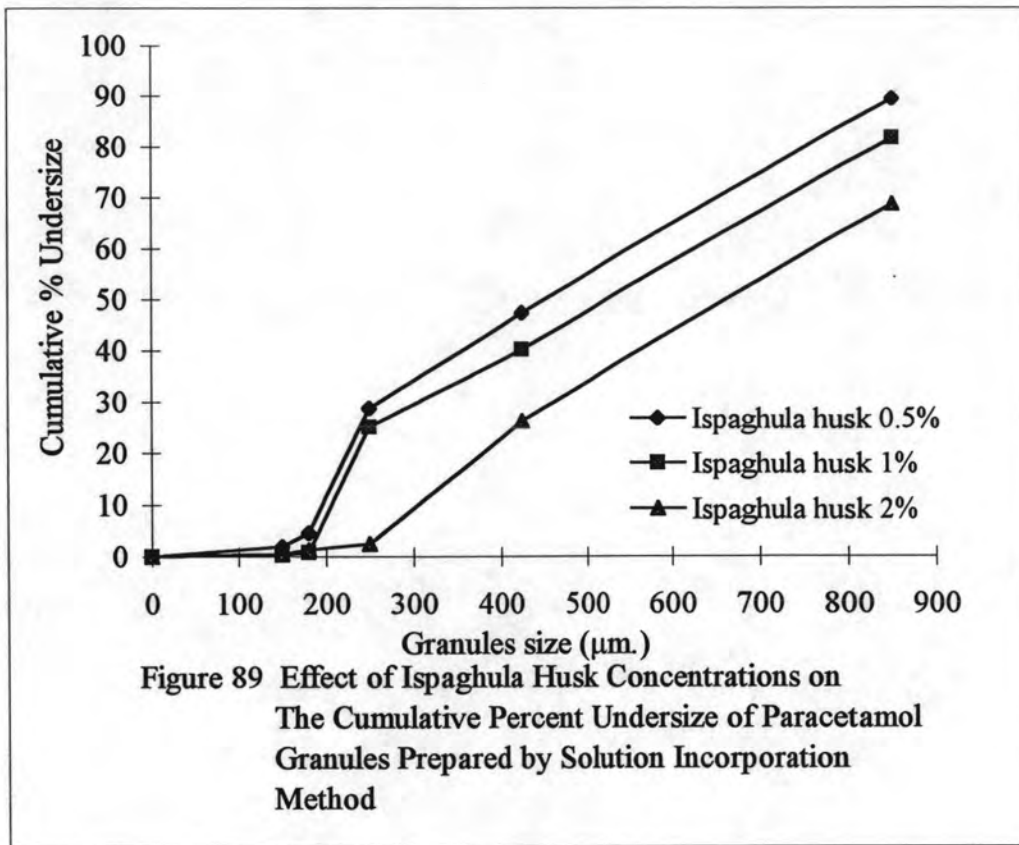
$$Y = 0.0234 X + 0.00164 ; R \text{ square} = 0.9997$$

## Appendix II

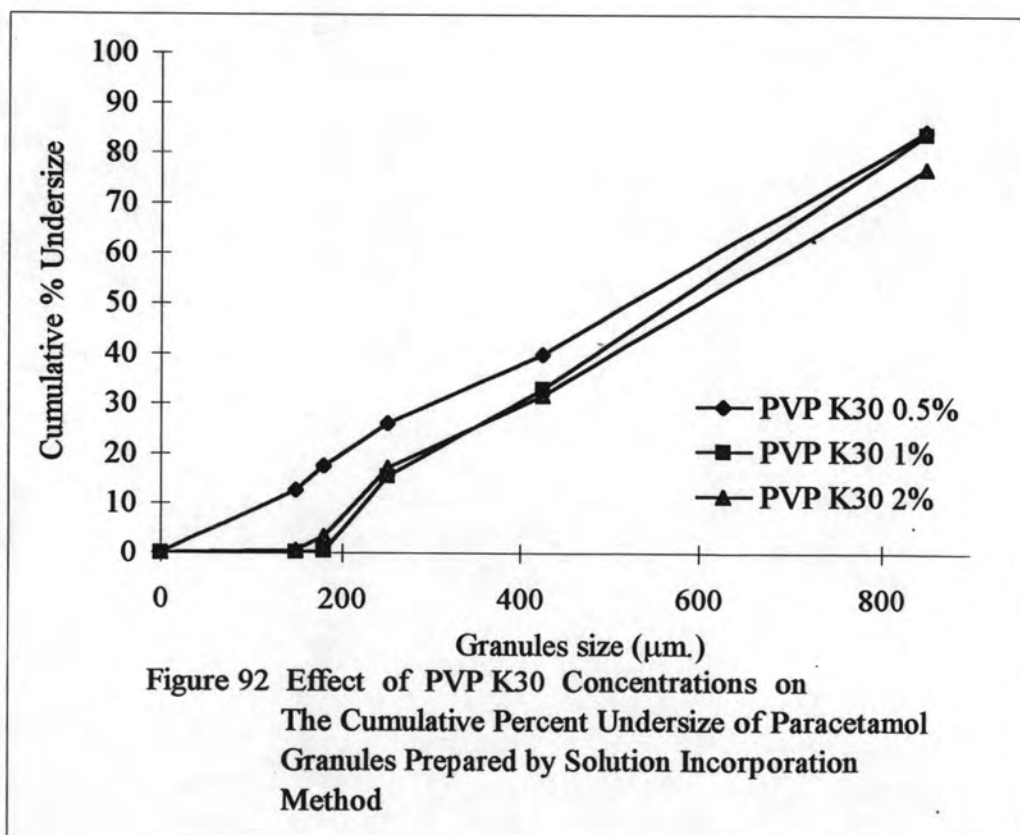
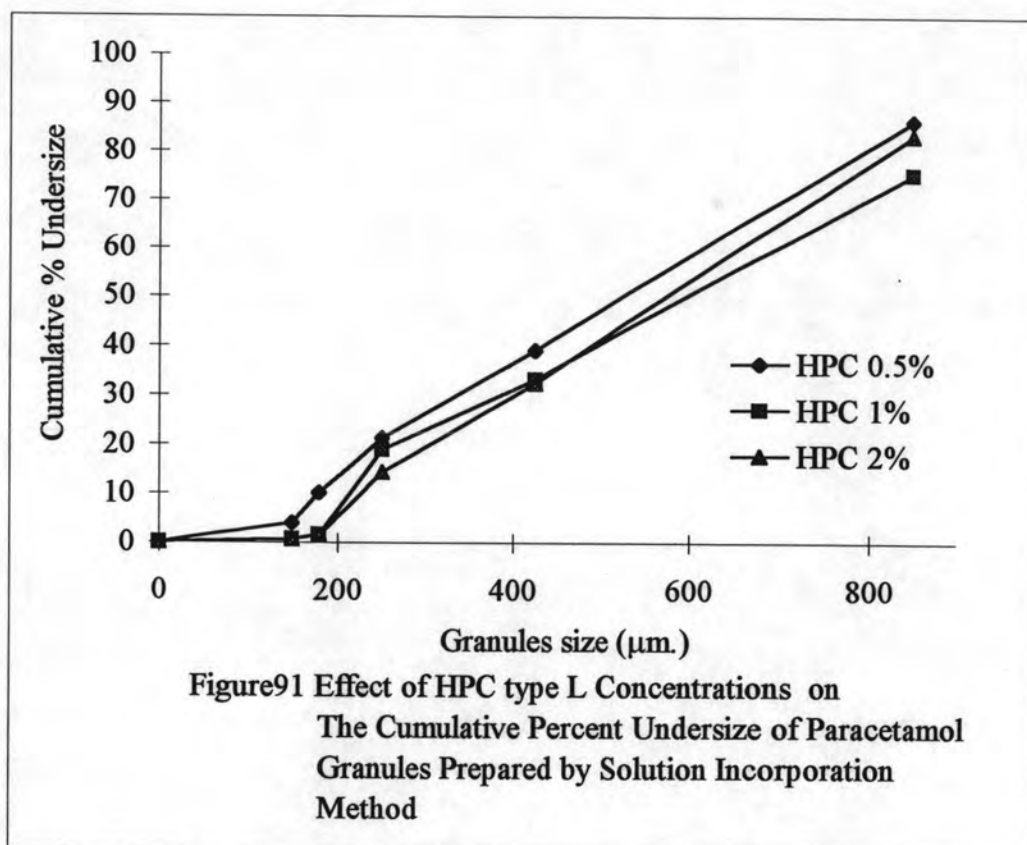
### Cumulative Percent Undersize Plots of Granules

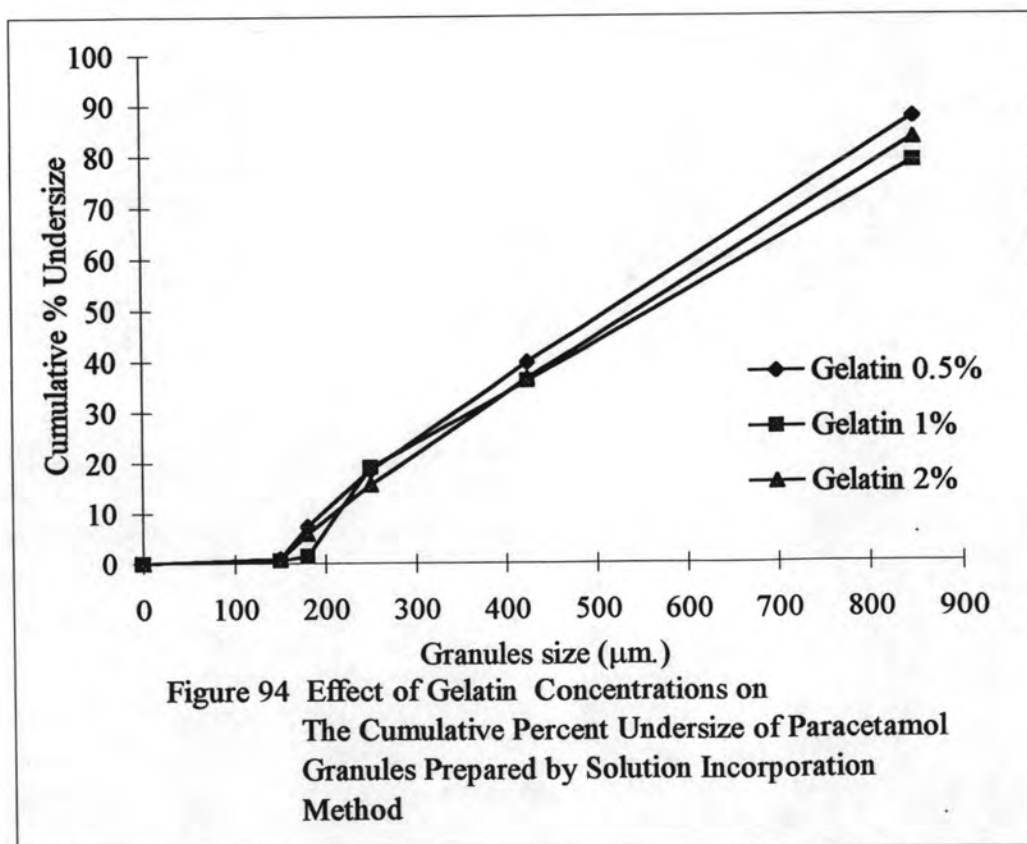
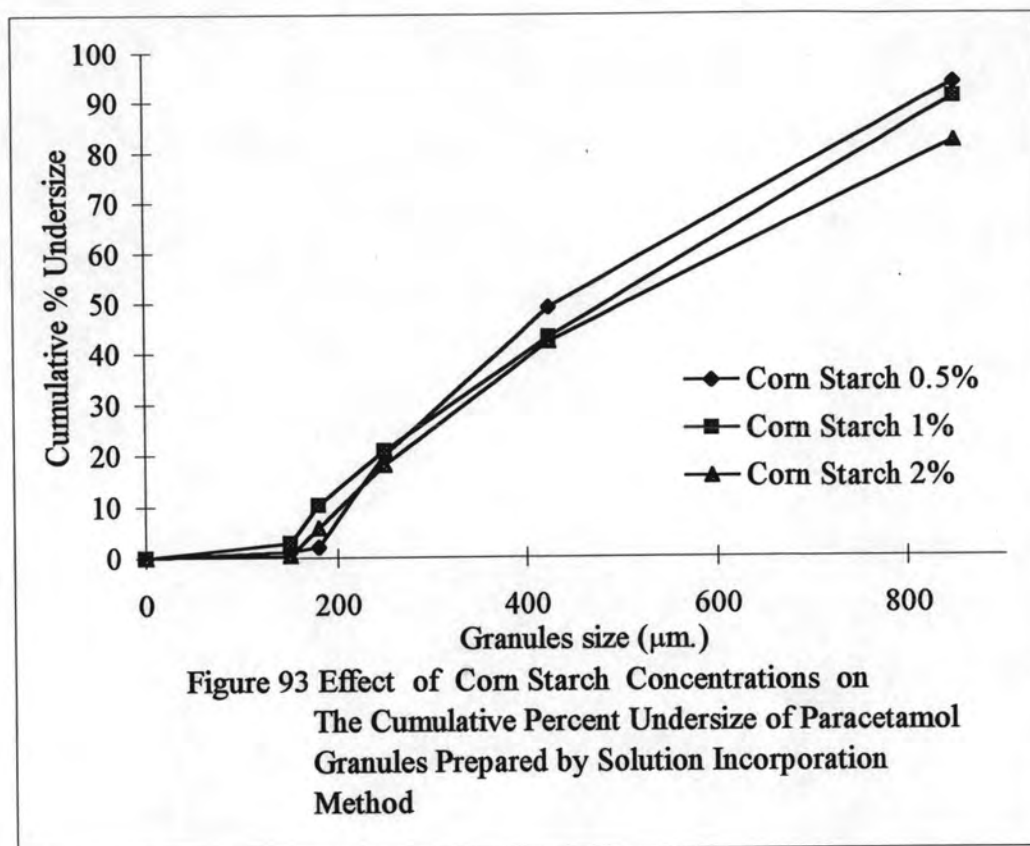


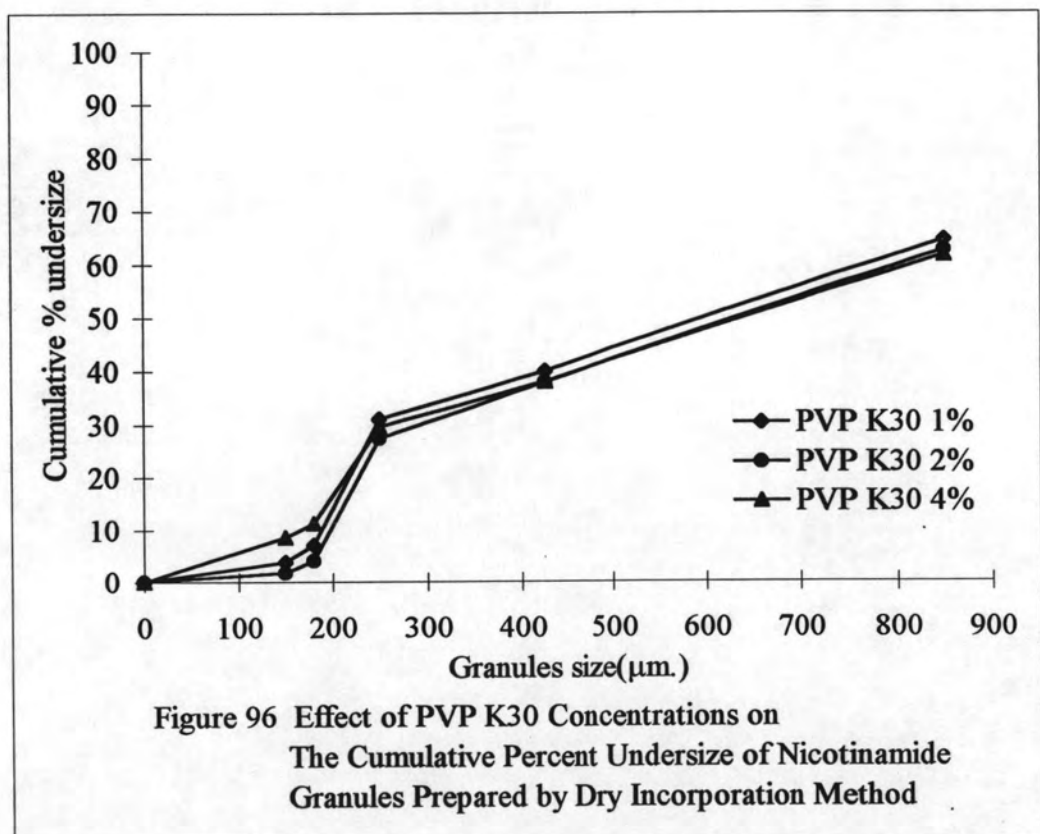
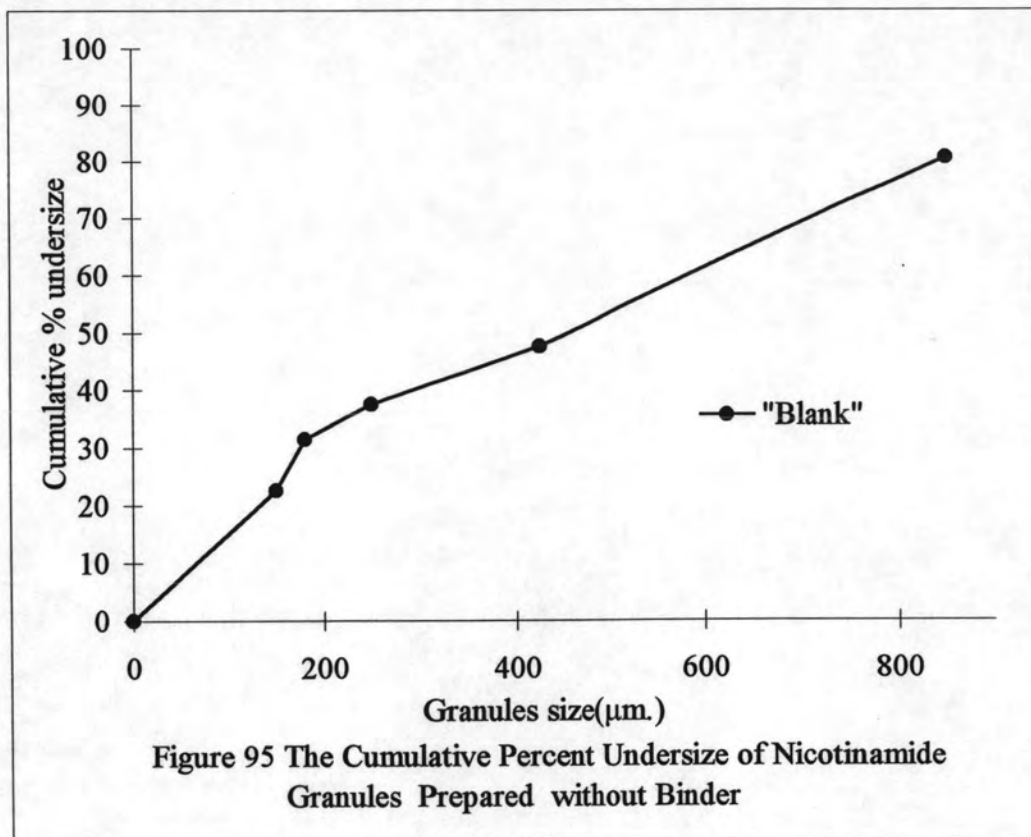


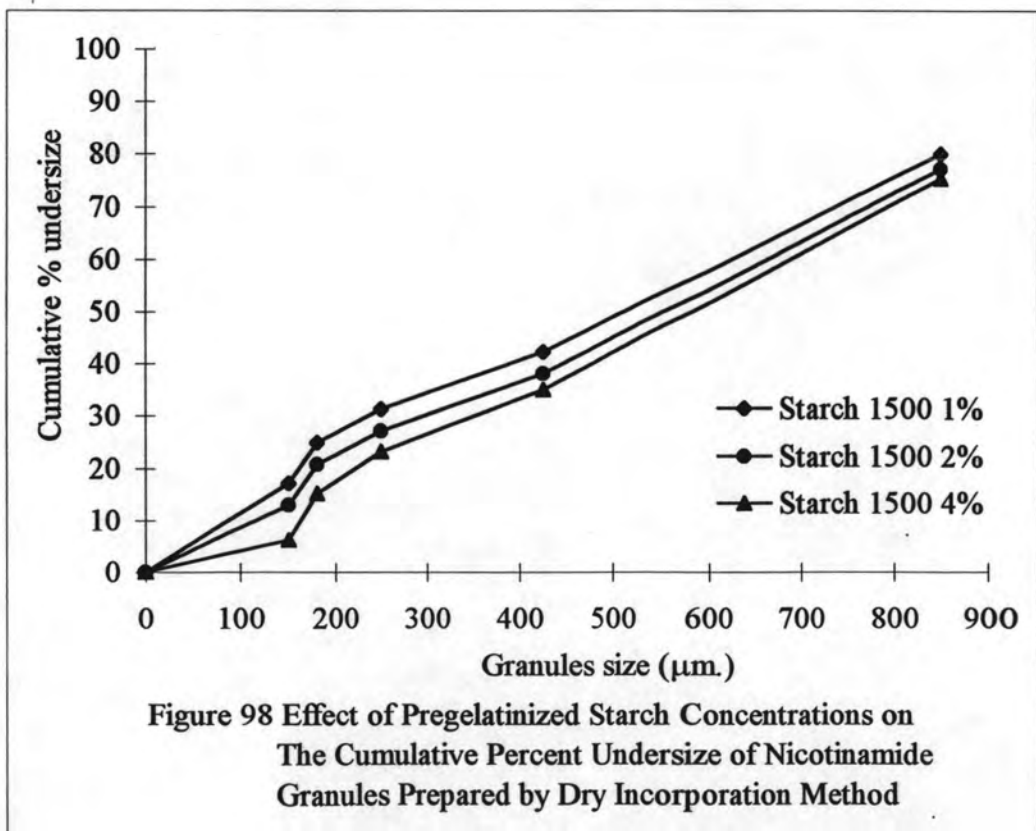
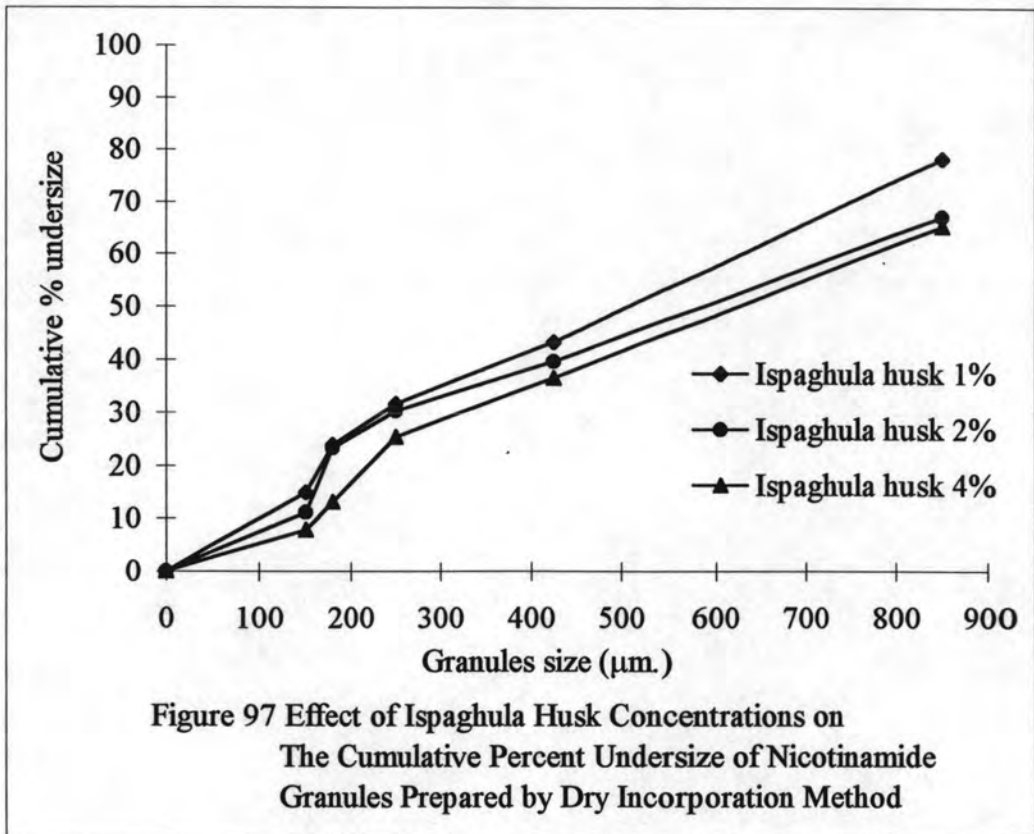


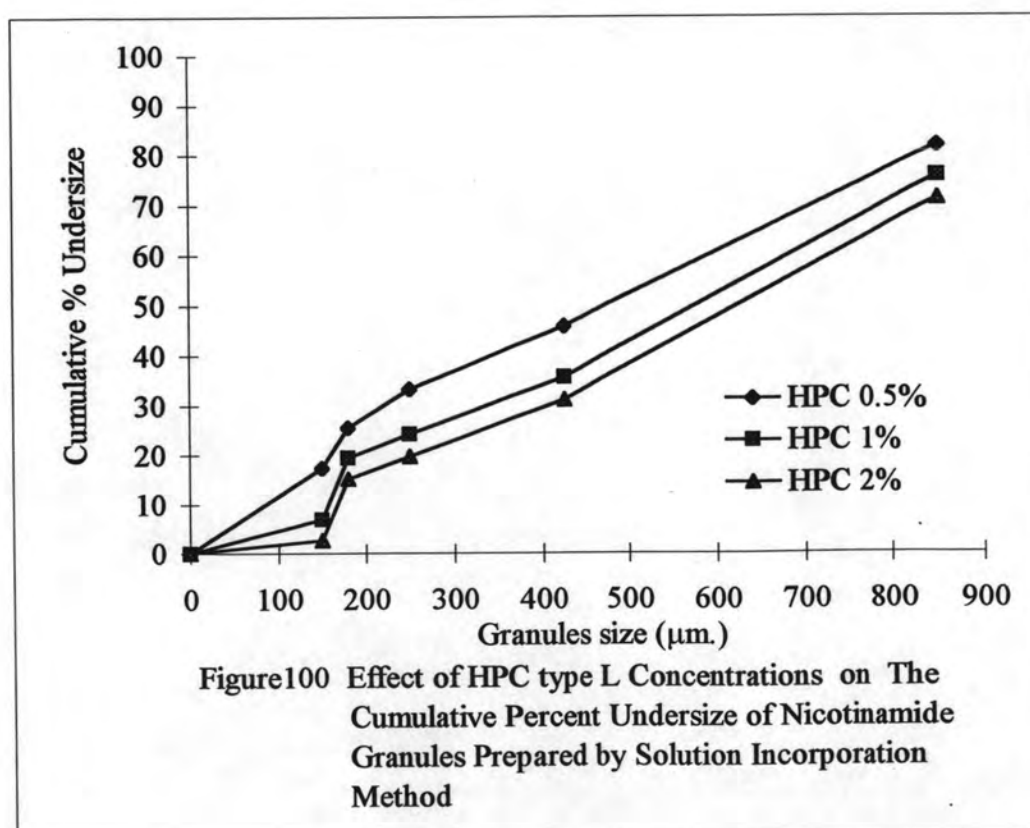
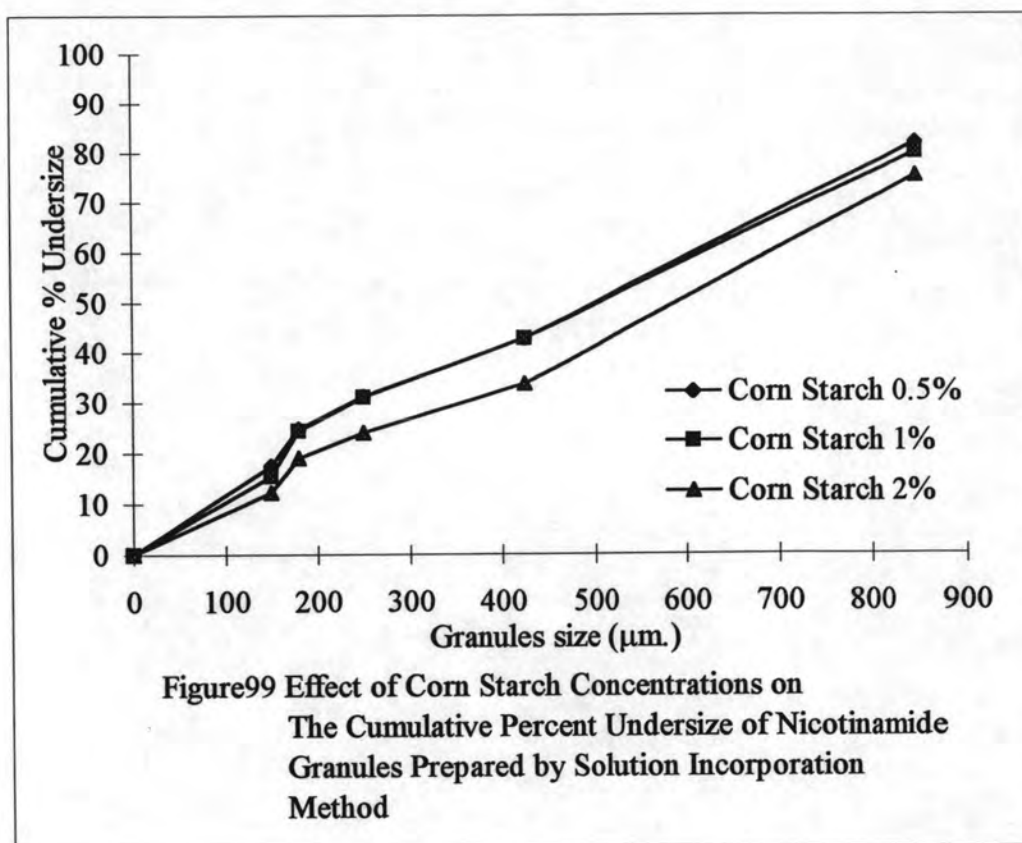


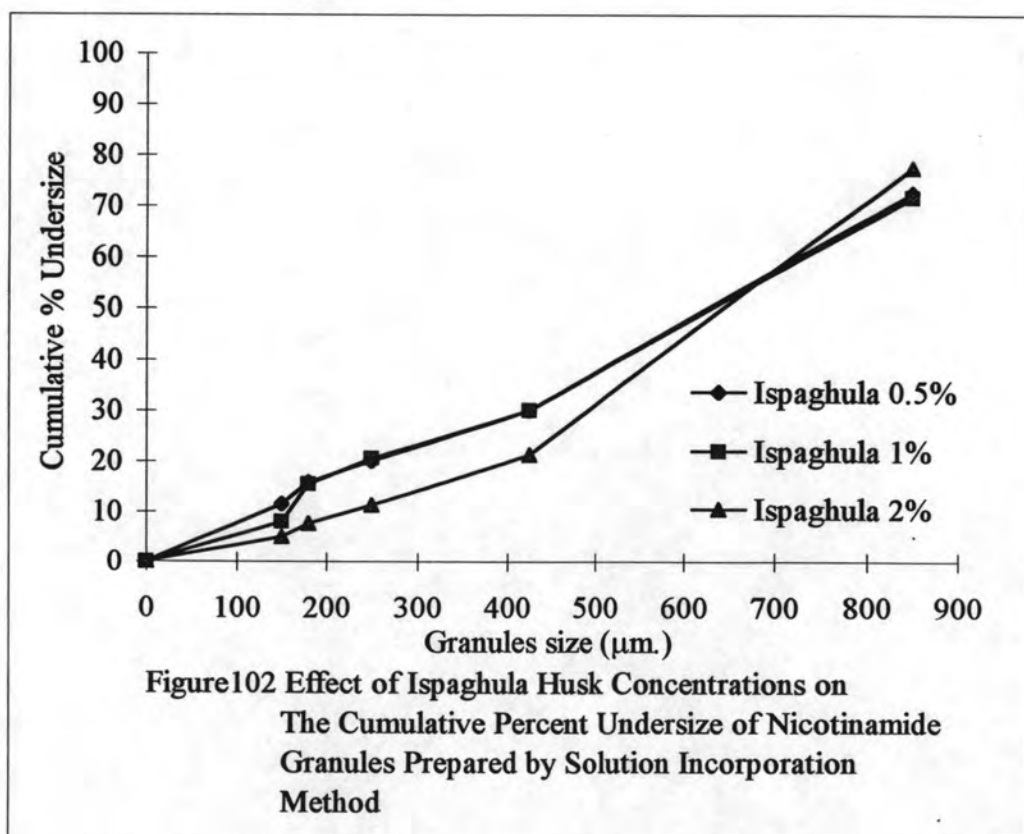
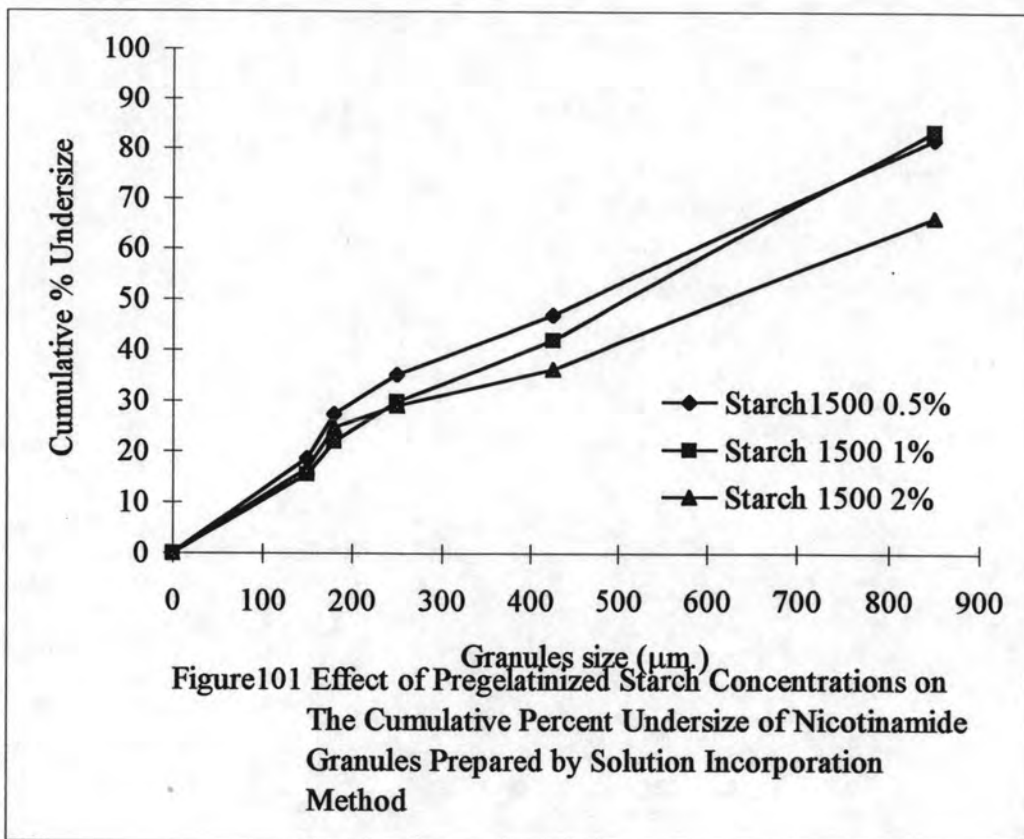


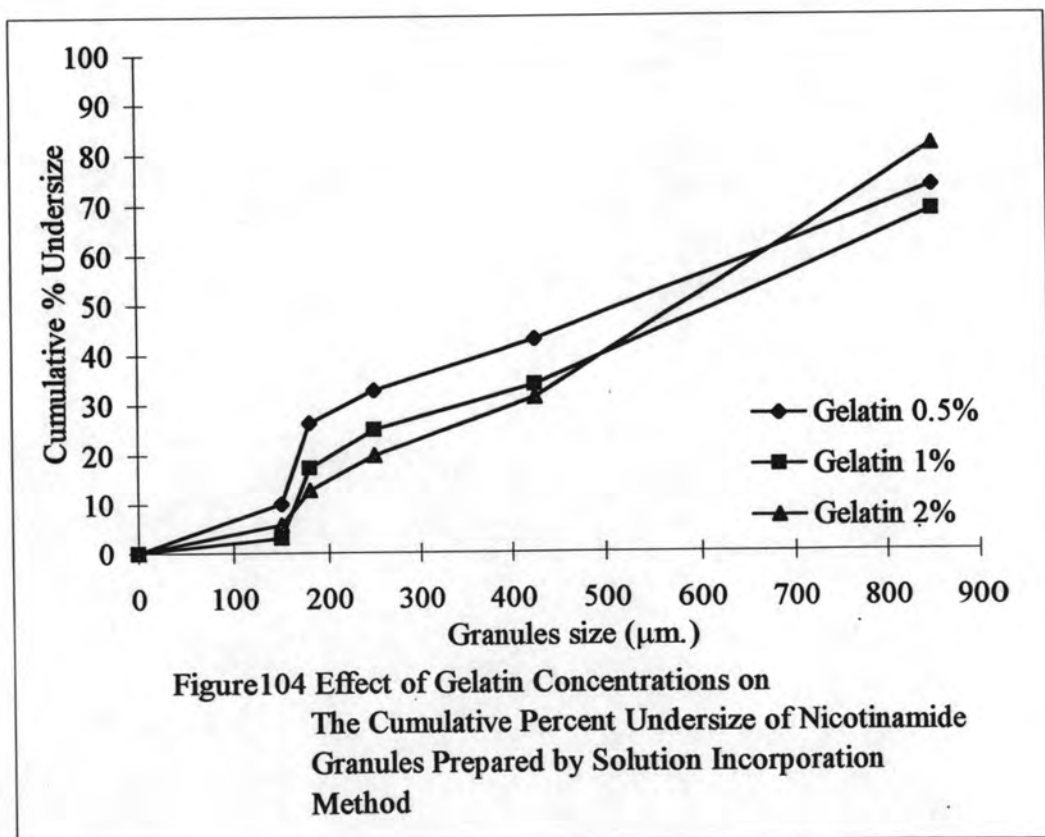
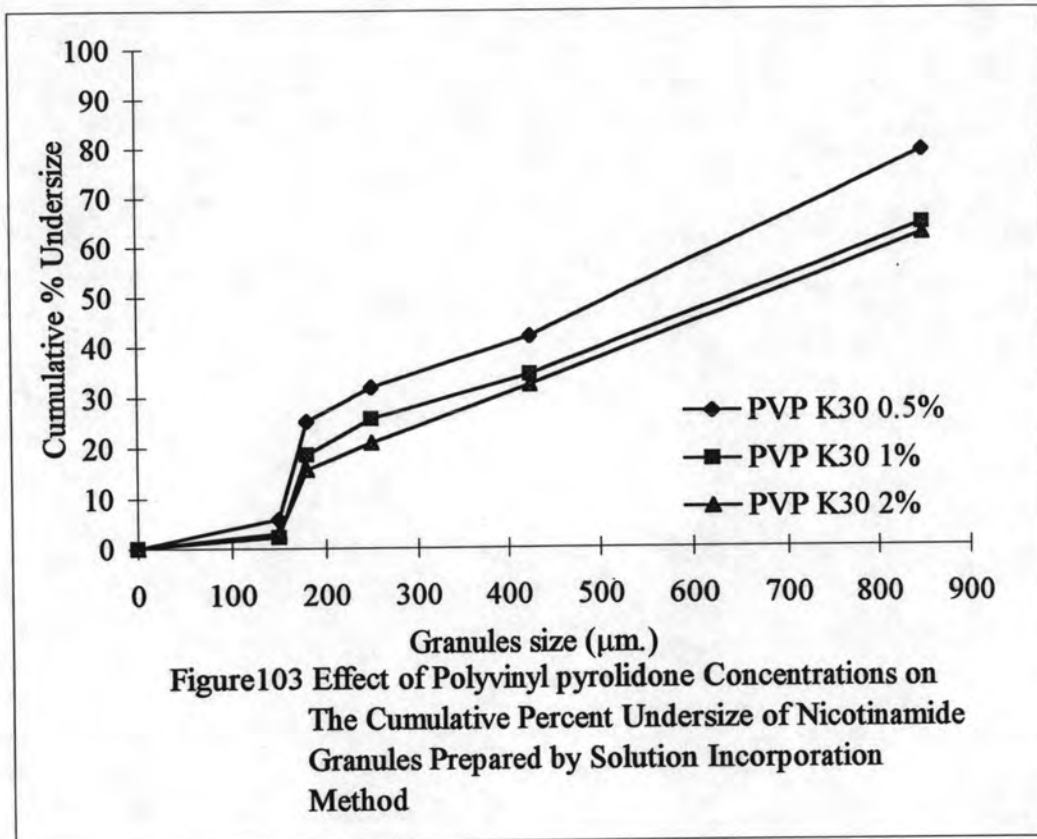












**Appendix III**  
**Dissolution Data of Tablet Preparations**



Table 14 Dissolution Data of Paracetamol Tablets Prepared with Ispaghula Husk by Dry Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG	SD
		# 1	# 2	# 3		
Ispaghula Husk 1%	10	8.71	8.58	8.84	8.71	0.13
	20	14.20	13.98	14.37	14.18	0.19
	30	16.48	15.83	17.41	16.57	0.80
	60	27.91	27.26	28.32	27.83	0.53
	90	34.65	33.86	35.15	34.55	0.65
	120	41.03	40.29	42.09	41.14	0.90
	150	47.95	47.29	48.85	48.03	0.79
	180	54.66	53.51	55.41	54.53	0.96
	240	66.00	65.33	66.75	66.03	0.71
	300	76.78	75.64	77.62	76.68	0.99
	360	83.35	82.20	84.09	83.21	0.95
600	91.46	90.20	92.30	91.32	1.06	
T 50 of %Dissolved		159.17	163.08	155.25	159.17	3.92
Ispaghula Husk 2%	10	6.58	6.47	6.42	6.49	0.08
	20	10.68	10.48	10.24	10.47	0.22
	30	12.83	12.48	11.86	12.39	0.49
	60	23.14	22.98	22.33	22.82	0.43
	90	29.64	29.07	28.74	29.15	0.46
	120	36.74	33.91	35.59	35.41	1.42
	150	39.60	39.01	39.98	39.53	0.49
	180	47.23	46.40	45.27	46.30	0.98
	240	56.86	55.92	55.32	56.03	0.78
	300	64.42	63.18	62.07	63.22	1.18
	360	69.71	68.46	66.53	68.24	1.60
600	80.77	79.51	77.07	79.12	1.88	
T 50 of %Dissolved		197.26	202.69	208.24	202.73	5.49
Ispaghula Husk 4%	10	6.55	6.64	6.87	6.69	0.17
	20	10.11	10.31	10.42	10.28	0.16
	30	10.80	11.35	11.90	11.35	0.55
	60	18.13	18.62	19.35	18.70	0.61
	90	24.44	24.81	25.38	24.87	0.48
	120	28.80	29.14	29.47	29.14	0.33
	150	32.79	33.69	34.35	33.61	0.78
	180	37.89	39.76	40.42	39.36	1.31
	240	47.49	48.82	48.44	48.25	0.69
	300	54.40	55.44	56.36	55.40	0.98
	360	59.73	61.08	63.12	61.31	1.71
600	70.53	71.79	73.64	71.99	1.56	
T 50 of %Dissolved		261.83	250.68	251.81	254.77	6.14

Table 15 Dissolution Data of Paracetamol Tablets Prepared with Pregelatinized starch by Dry Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 1%	10	8.71	8.59	8.79	8.70	0.10
	20	17.66	17.18	18.27	17.70	0.55
	30	22.32	22.07	22.84	22.41	0.40
	60	35.10	34.69	35.43	35.07	0.37
	90	43.43	42.86	43.76	43.35	0.46
	120	47.86	46.97	49.24	48.02	1.15
	150	53.67	53.25	54.79	53.90	0.80
	180	58.82	58.32	60.17	59.10	0.96
	240	65.18	64.32	65.94	65.15	0.81
	300	69.89	69.14	71.62	70.22	1.27
	360	73.17	71.81	74.06	73.01	1.13
T 50 of %Dissolved		131.04	134.48	124.09	129.87	5.30
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 2%	10	5.48	5.56	5.39	5.48	0.09
	20	13.17	13.62	12.89	13.22	0.37
	30	16.75	17.20	16.31	16.75	0.45
	60	27.28	27.89	27.12	27.43	0.41
	90	36.71	37.36	36.30	36.79	0.54
	120	42.71	43.37	42.38	42.82	0.50
	150	46.84	47.76	45.92	46.84	0.92
	180	51.34	52.17	51.17	51.56	0.54
	240	56.78	57.94	54.99	56.57	1.48
	300	60.32	61.64	59.16	60.37	1.24
	360	63.71	65.03	61.58	63.44	1.74
T 50 of %Dissolved		171.06	165.24	173.32	169.87	4.17
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 4%	10	5.16	5.00	5.37	5.18	0.19
	20	11.11	10.91	11.36	11.13	0.22
	30	14.72	14.48	14.89	14.70	0.21
	60	23.79	23.43	24.04	23.75	0.31
	90	30.62	30.05	31.26	30.64	0.61
	120	35.22	34.32	35.95	35.16	0.82
	150	39.46	39.25	40.38	39.70	0.60
	180	43.33	42.22	44.67	43.41	1.23
	240	47.07	47.69	49.03	47.93	1.00
	300	51.68	50.85	52.52	51.68	0.83
	360	54.21	53.06	55.06	54.11	1.00
T 50 of %Dissolved		278.17	283.80	256.72	272.90	14.29

Table 16 Dissolution Data of Paracetamol Tablets Prepared with Polyvinyl pyrrolidone by Dry Incorporation Method

Concentration (% w/w)	Time min.	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Polyvinyl pyrrolidone (PVP K30) 1.0%	10	8.57	8.30	8.75	8.54	0.22
	20	22.90	22.30	23.15	22.78	0.44
	30	33.39	35.08	36.54	35.00	1.57
	60	53.20	51.27	54.19	52.89	1.48
	90	61.36	60.51	62.47	61.45	0.99
	120	67.90	65.80	69.71	67.80	1.96
	150	73.43	70.51	74.77	72.90	2.18
	180	76.33	74.68	79.20	76.74	2.29
	240	82.79	80.33	85.28	82.80	2.47
	300	86.47	83.79	87.75	86.00	2.02
	360	88.55	85.65	89.23	87.81	1.90
T 50 of %Dissolved		55.15	57.64	52.88	55.22	2.38
Polyvinyl pyrrolidone (PVP K30) 2%	10	6.05	6.23	5.95	6.07	0.14
	20	18.17	18.66	17.93	18.25	0.37
	30	30.69	31.10	29.56	30.45	0.80
	60	43.35	43.84	42.86	43.35	0.49
	90	55.04	55.45	53.82	54.77	0.85
	120	61.55	62.89	60.32	61.59	1.28
	150	65.03	65.66	63.32	64.67	1.21
	180	68.93	70.08	66.32	68.45	1.93
	240	75.60	76.43	72.49	74.84	2.08
	300	80.20	81.52	79.49	80.40	1.03
	360	84.66	85.19	82.98	84.28	1.15
T 50 of %Dissolved		77.06	75.91	79.54	77.50	1.86
Polyvinyl pyrrolidone (PVP K30) 4%	10	8.17	8.01	7.91	8.03	0.13
	20	15.35	15.21	15.14	15.23	0.11
	30	22.14	21.99	21.22	21.78	0.50
	60	35.08	34.35	33.98	34.47	0.56
	90	47.04	45.99	45.09	46.04	0.98
	120	52.30	52.61	51.79	52.23	0.41
	150	56.78	56.04	56.43	56.42	0.37
	180	61.28	60.62	60.45	60.78	0.44
	240	69.76	67.32	66.50	67.86	1.69
	300	75.66	73.09	71.62	73.45	2.05
	360	77.76	76.87	74.44	76.36	1.72
T 50 of %Dissolved		106.87	108.17	111.97	109.01	2.65

Table 17 Dissolution Data of Paracetamol Tablets Prepared with Corn starch by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Corn starch 0.5%	10	17.21	17.01	17.41	17.21	0.20
	20	38.37	38.01	38.79	38.39	0.39
	30	44.97	44.40	45.62	45.00	0.61
	60	56.51	56.02	57.96	56.83	1.01
	90	68.18	67.27	69.21	68.22	0.97
	120	75.31	72.98	76.14	74.81	1.64
	150	81.71	80.95	83.67	82.11	1.40
	180	84.57	83.57	85.69	84.61	1.06
	240	88.33	88.58	88.23	88.38	0.18
	300	91.49	90.19	92.24	91.30	1.04
	360	94.78	92.81	95.80	94.46	1.52
	T 50 of % Dissolved		43.08	44.46	40.65	42.73
Corn starch 1%	10	16.87	16.51	16.25	16.54	0.31
	20	35.69	35.31	34.92	35.50	0.39
	30	41.71	41.04	40.37	41.37	0.67
	60	48.23	47.92	47.43	48.07	0.40
	90	58.51	58.02	56.96	58.26	0.79
	120	65.80	65.09	64.26	65.44	0.77
	150	73.82	73.20	72.88	73.51	0.48
	180	79.87	78.64	78.21	79.25	0.86
	240	81.51	80.03	79.04	80.77	1.24
	300	83.88	83.00	82.13	83.44	0.88
	360	86.43	85.83	84.66	85.64	0.90
	T 50 of % Dissolved		65.17	66.19	68.10	66.49
Corn starch 2%	10	5.18	5.01	5.39	5.19	0.19
	20	11.51	11.35	11.95	11.60	0.31
	30	14.99	14.60	15.54	15.05	0.47
	60	19.94	19.65	20.24	19.94	0.30
	90	26.93	26.24	27.46	26.88	0.61
	120	31.63	31.18	32.09	31.63	0.45
	150	36.56	35.82	36.98	36.46	0.58
	180	41.76	41.02	42.02	41.60	0.52
	240	47.07	46.72	47.65	47.15	0.47
	300	51.19	49.96	51.70	50.95	0.89
	360	52.52	52.17	53.51	52.73	0.70
	T 50 of % Dissolved		282.66	301.06	274.86	286.19

Table 18 Dissolution Data of Paracetamol Tablets Prepared with Gelatin by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Gelatin 0.5%	10	8.85	8.95	9.13	8.98	0.14
	20	22.11	22.40	22.79	22.43	0.34
	30	31.25	33.07	33.55	32.62	1.21
	60	43.64	44.86	46.56	45.02	1.47
	90	51.58	52.90	54.13	52.87	1.28
	120	57.40	59.14	60.98	59.17	1.79
	150	63.96	65.51	66.05	65.17	1.08
	180	68.40	69.90	70.66	69.65	1.15
	240	76.15	77.53	78.66	77.45	1.26
	300	78.08	79.12	81.00	79.40	1.48
	360	80.90	81.67	82.71	81.76	0.91
	T 50 of %Dissolved		84.05	79.17	73.64	78.95
Gelatin 1%	10	8.38	8.65	8.57	8.53	0.13
	20	20.93	21.17	21.05	21.05	0.12
	30	26.08	27.21	26.93	26.74	0.59
	60	40.03	41.19	40.34	40.52	0.60
	90	47.33	48.43	47.82	47.86	0.55
	120	54.24	56.03	55.30	55.19	0.90
	150	58.63	62.79	59.75	60.39	2.15
	180	63.28	65.65	64.91	64.61	1.21
	240	70.80	72.56	71.80	71.72	0.88
	300	74.93	74.28	74.48	74.56	0.33
	360	72.09	77.80	75.65	75.18	2.89
	T 50 of %Dissolved		101.61	96.20	98.75	98.85
Gelatin 2%	10	8.09	8.26	8.17	8.17	0.08
	20	15.84	16.06	16.01	15.97	0.11
	30	19.09	19.77	19.26	19.38	0.35
	60	32.94	34.25	33.47	33.55	0.66
	90	40.75	41.91	41.42	41.36	0.58
	120	47.64	50.89	49.67	49.40	1.64
	150	54.44	54.96	53.57	54.32	0.70
	180	59.89	58.56	54.75	57.73	2.67
	240	63.30	65.65	64.90	64.62	1.20
	300	65.60	69.27	67.29	67.39	1.84
	360	67.41	70.25	68.38	68.68	1.45
	T 50 of %Dissolved		130.41	113.45	122.55	122.14

Table 19 Dissolution Data of Paracetamol Tablets Prepared with Polyvinyl pyrrolidone by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Polyvinyl pyrrolidone (PVP K30) 0.5%	10	11.34	11.51	11.42	11.42	0.08
	20	23.96	24.10	24.20	24.09	0.12
	30	37.39	37.68	37.39	37.49	0.17
	60	50.95	52.40	50.71	51.35	0.92
	90	64.37	66.10	65.08	65.18	0.87
	120	70.07	72.40	72.39	71.62	1.35
	150	74.46	76.79	75.32	75.53	1.18
	180	79.34	78.90	78.40	78.88	0.47
	240	82.19	84.29	84.14	83.54	1.17
	300	84.81	88.11	83.99	85.64	2.18
	360	86.96	89.29	87.41	87.89	1.24
T 50 of %Dissolved		57.90	55.10	58.40	57.13	1.78
Polyvinyl pyrrolidone (PVP K30) 1%	10	8.83	8.54	8.37	8.58	0.23
	20	21.86	21.38	21.04	21.43	0.41
	30	32.05	31.27	37.89	33.74	3.62
	60	46.72	47.14	46.93	46.93	0.21
	90	58.01	59.29	59.97	59.09	1.00
	120	65.62	64.92	63.84	64.79	0.89
	150	70.11	69.20	67.82	69.04	1.15
	180	74.42	73.61	72.52	73.52	0.95
	240	78.98	77.76	76.32	77.69	1.33
	300	82.67	81.93	80.00	81.53	1.38
	360	85.05	84.18	82.49	83.91	1.30
T 50 of %Dissolved		68.71	67.07	67.07	67.62	0.95
Polyvinyl pyrrolidone (PVP K30) 2%	10	8.17	8.01	7.91	8.03	0.13
	20	15.35	15.21	14.89	15.15	0.24
	30	22.72	22.38	21.99	22.36	0.37
	60	36.11	35.32	34.77	35.40	0.67
	90	47.86	46.80	46.47	47.04	0.72
	120	55.86	54.32	53.42	54.53	1.24
	150	62.46	61.06	60.00	61.17	1.23
	180	66.18	65.51	64.52	65.40	0.84
	240	72.87	71.43	69.69	71.33	1.59
	300	76.98	75.85	73.63	75.49	1.70
	360	79.29	77.97	76.23	77.83	1.53
T 50 of %Dissolved		98.03	102.77	105.23	102.01	3.66

Table 20 Dissolution Data of Paracetamol Tablets Prepared with Pregelatinized starch by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 0.5%	10	8.75	8.67	8.61	8.67	0.07
	20	18.63	18.43	18.23	18.43	0.20
	30	21.31	21.15	20.91	21.12	0.20
	60	32.62	31.89	31.46	31.99	0.58
	90	40.54	39.68	38.83	39.68	0.85
	120	48.48	47.58	46.93	47.66	0.78
	150	54.25	53.63	51.90	53.26	1.22
	180	59.28	58.05	57.42	58.25	0.94
	240	66.76	65.52	64.79	65.69	0.99
	300	70.36	69.24	68.37	69.32	1.00
360	72.92	71.79	70.79	71.83	1.07	
T 50 of %Dissolved		127.91	132.01	138.55	132.82	5.36
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 1%	10	8.42	8.46	8.57	8.49	0.07
	20	15.24	15.93	16.29	15.82	0.53
	30	19.12	19.40	20.13	19.55	0.52
	60	27.93	28.42	28.85	28.40	0.46
	90	34.43	35.35	37.29	35.69	1.46
	120	41.33	41.83	42.03	41.73	0.36
	150	44.74	46.37	48.00	46.37	1.63
	180	49.82	51.16	52.60	51.19	1.39
	240	57.96	59.10	59.74	58.93	0.90
	300	61.86	63.47	64.84	63.39	1.49
360	65.09	66.59	67.61	66.43	1.26	
T 50 of %Dissolved		181.30	172.74	163.03	172.35	9.14
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 2%	10	7.90	7.76	7.80	7.82	0.07
	20	13.20	12.78	13.06	13.02	0.22
	30	15.80	15.59	15.72	15.70	0.10
	60	23.83	23.14	23.38	23.45	0.35
	90	28.79	27.94	28.27	28.33	0.43
	120	35.62	34.88	35.01	35.17	0.39
	150	39.63	39.01	39.19	39.28	0.32
	180	44.52	43.69	44.02	44.08	0.42
	240	51.13	48.89	49.70	49.91	1.13
	300	55.04	52.78	54.21	54.01	1.14
360	59.65	56.94	57.56	58.05	1.42	
T 50 of %Dissolved		229.74	257.13	243.94	243.60	13.70

Table 21 Dissolution Data of Paracetamol Tablets Prepared with Ispaghula Husk by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG	SD
		# 1	# 2	# 3		
Ispaghula Husk 0.5%	10	6.69	6.87	6.79	6.78	0.09
	20	10.79	11.12	10.97	10.96	0.16
	30	15.00	15.84	15.58	15.47	0.43
	60	22.91	23.81	23.16	23.29	0.46
	90	27.96	29.18	28.69	28.61	0.61
	120	31.94	33.61	32.56	32.70	0.85
	150	36.59	37.91	37.57	37.36	0.68
	180	40.18	41.34	40.68	40.73	0.58
	240	49.02	50.59	49.69	49.77	0.79
	300	57.19	59.82	58.83	58.61	1.33
	360	65.48	67.84	66.24	66.52	1.21
600	77.56	81.63	78.69	79.30	2.10	
T 50 of %Dissolved		247.20	236.14	242.05	241.80	5.53
Ispaghula Husk 1%	10	6.74	6.58	6.26	6.52	0.25
	20	9.71	9.65	9.52	9.62	0.10
	30	13.38	12.54	11.99	12.63	0.70
	60	21.13	20.15	19.70	20.33	0.73
	90	25.47	25.22	25.25	25.32	0.14
	120	29.40	29.03	28.50	28.98	0.46
	150	33.88	33.22	32.48	33.19	0.70
	180	38.90	38.32	37.90	38.37	0.50
	240	46.61	45.86	44.72	45.73	0.95
	300	54.52	53.53	52.54	53.53	0.99
	360	61.15	60.39	58.67	60.07	1.27
600	72.48	70.15	68.30	70.31	2.10	
T 50 of %Dissolved		265.71	272.38	280.53	272.88	7.42
Ispaghula Husk 2%	10	4.92	5.03	4.80	4.92	0.11
	20	7.56	7.69	7.35	7.53	0.17
	30	9.94	10.23	9.55	9.90	0.34
	60	15.56	15.93	15.32	15.60	0.31
	90	21.86	22.38	21.53	21.92	0.43
	120	25.89	26.46	25.56	25.97	0.46
	150	30.30	31.12	28.84	30.09	1.15
	180	35.71	36.53	35.93	36.06	0.42
	240	42.35	42.85	41.69	42.30	0.58
	300	47.98	48.97	47.32	48.09	0.83
	360	51.47	53.27	51.12	51.95	1.15
600	69.32	70.45	66.64	68.80	1.96	
T 50 of %Dissolved		334.72	314.34	342.29	330.45	14.46



Table 22 Dissolution Data of Paracetamol Tablets Prepared with HPC type L by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Hydroxypropyl cellulose ( HPC ) 0.5%	10	9.42	9.21	9.13	9.25	0.15
	20	21.82	21.33	20.93	21.36	0.44
	30	27.83	27.34	26.73	27.30	0.55
	60	42.95	42.22	41.55	42.24	0.70
	90	56.51	55.86	53.51	55.29	1.58
	120	65.47	64.85	62.51	64.28	1.56
	150	71.57	70.25	69.10	70.31	1.24
	180	77.45	75.61	72.18	75.08	2.67
	240	81.01	80.25	78.38	79.88	1.36
	300	83.89	82.16	80.82	82.29	1.54
	360	85.33	84.43	83.51	84.42	0.91
T 50 of %Dissolved		75.59	77.11	81.20	77.97	2.90
Hydroxypropyl cellulose ( HPC ) 1%	10	7.50	7.59	7.93	7.67	0.23
	20	18.14	18.38	18.71	18.41	0.28
	30	22.13	22.39	23.00	22.51	0.45
	60	35.45	34.55	34.98	35.00	0.45
	90	42.54	43.59	45.05	43.73	1.26
	120	50.48	51.89	52.61	51.66	1.09
	150	55.79	57.11	58.04	56.98	1.13
	180	59.92	62.12	63.72	61.92	1.91
	240	66.54	68.99	70.35	68.63	1.93
	300	72.08	72.83	74.56	73.16	1.27
	360	76.00	76.61	77.08	76.56	0.55
T 50 of %Dissolved		118.20	113.17	109.64	113.67	4.31
Hydroxypropyl cellulose ( HPC ) 2%	10	8.75	8.67	8.61	8.67	0.07
	20	18.63	18.43	18.23	18.43	0.20
	30	21.31	21.15	20.87	21.11	0.23
	60	30.86	30.68	29.59	30.38	0.69
	90	39.08	38.65	38.28	38.67	0.40
	120	47.82	47.25	46.51	47.19	0.66
	150	54.63	54.22	52.89	53.91	0.91
	180	59.46	58.04	57.41	58.30	1.05
	240	65.73	65.51	65.08	65.44	0.33
	300	69.86	69.23	68.36	69.15	0.75
	360	72.29	72.99	70.18	71.82	1.46
T 50 of %Dissolved		129.62	131.86	136.41	132.63	3.46

Table 23 Dissolution Data of Nicotinamide Blank Tablets

Time (min.)	% drug dissolved			AVG.	SD.
	# 1	# 2	# 3		
5	27.22	26.22	26.79	26.75	0.50
10	56.72	54.23	55.30	55.41	1.25
15	74.55	71.22	73.12	72.96	1.67
20	84.49	79.83	82.87	82.40	2.36
25	92.05	87.02	90.60	89.89	2.59
30	96.28	93.35	94.83	94.82	1.47
40	98.94	95.10	98.01	97.35	2.00
50	100.89	97.04	98.89	98.94	1.93
60	101.26	98.27	99.25	99.60	1.52
T 50	8.86	9.25	9.07	9.06	0.19

Table 24 Dissolution Data of Nicotinamide Tablets Prepared with Ispaghula Husk by Dry Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Ispaghula Husk 1%	5	17.04	17.75	18.22	17.67	0.60
	10	29.35	30.21	32.43	30.66	1.59
	15	40.14	41.69	45.61	42.48	2.82
	20	48.76	50.08	52.72	50.52	2.02
	25	57.55	59.71	63.31	60.19	2.91
	30	67.33	70.57	73.24	70.38	2.96
	40	77.41	83.32	87.13	82.62	4.90
	50	90.26	94.78	98.44	94.49	4.10
	60	93.05	99.02	100.92	97.67	4.11
T 50 of %Dissolved		19.57	18.62	16.67	18.29	1.48
Ispaghula Husk 2%	5	14.30	14.63	15.05	14.66	0.38
	10	21.57	22.66	23.75	22.12	1.09
	15	29.36	30.08	32.31	29.72	1.54
	20	37.40	38.95	39.92	38.18	1.27
	25	43.64	46.50	46.77	45.07	1.73
	30	52.88	53.62	54.72	53.25	0.92
	40	63.58	66.82	67.80	65.20	2.21
	50	74.11	76.65	78.82	75.38	2.36
	60	85.46	88.54	89.31	87.00	2.04
T 50 of %Dissolved		27.83	26.22	26.62	26.89	0.84
Ispaghula Husk 4%	5	10.22	11.17	11.41	10.93	0.63
	10	16.29	16.77	17.72	16.93	0.73
	15	21.92	22.92	22.98	22.61	0.59
	20	27.68	28.26	28.41	28.11	0.39
	25	31.78	32.39	33.82	32.66	1.05
	30	39.65	39.90	43.71	41.09	2.27
	40	52.29	52.90	53.53	52.91	0.62
	50	58.02	60.41	62.11	60.18	2.05
	60	64.08	67.31	71.44	67.61	3.69
T 50 of %Dissolved		38.19	37.77	36.41	37.45	0.93

Table 25 Dissolution Data of Nicotinamide Tablets Prepared with Pregelatinized starch by Dry Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 1%	5	26.75	27.17	25.94	26.62	0.63
	10	50.56	51.28	50.08	50.64	0.60
	15	62.44	62.92	61.37	62.24	0.79
	20	69.89	70.72	68.45	69.69	1.15
	25	78.55	79.28	77.70	78.51	0.79
	30	82.89	84.15	80.91	82.65	1.63
	40	90.09	92.24	88.98	90.44	1.66
	50	92.17	93.45	91.07	92.23	1.19
	60	93.56	94.31	92.45	93.44	0.94
T 50 of %Dissolved		9.88	9.74	9.98	9.87	0.12
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 2%	5	24.38	23.95	23.38	23.91	0.50
	10	39.43	38.59	37.53	39.01	0.95
	15	51.83	50.64	50.04	51.24	0.91
	20	62.30	61.69	59.79	61.99	1.31
	25	70.80	70.08	68.99	70.44	0.91
	30	77.88	76.79	74.10	77.34	1.94
	40	86.47	84.31	82.85	85.39	1.82
	50	89.07	86.72	85.61	87.90	1.77
	60	90.62	88.44	87.85	89.53	1.46
T 50 of %Dissolved		14.26	14.73	14.98	14.66	0.37
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 4%	5	22.25	21.96	21.68	21.96	0.28
	10	35.72	35.34	34.87	35.31	0.43
	15	47.90	46.94	45.99	46.94	0.95
	20	55.97	54.54	53.82	54.78	1.09
	25	65.04	64.31	62.64	63.99	1.23
	30	72.26	71.17	69.02	70.81	1.65
	40	80.28	78.84	77.20	78.77	1.54
	50	85.87	84.77	82.42	84.35	1.76
	60	88.64	87.71	86.24	87.53	1.21
T 50 of %Dissolved		16.30	17.01	17.56	16.96	0.63

Table 26 Dissolution Data of Nicotinamide Tablets Prepared with Polyvinyl pyrrolidone by Dry Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Polyvinyl pyrrolidone (PVP K30) 1.0%	5	31.66	31.01	30.65	31.10	0.51
	10	52.96	51.30	50.70	51.65	1.17
	15	66.03	64.01	62.94	64.32	1.57
	20	75.86	74.06	74.64	74.86	0.92
	25	82.55	81.10	79.49	81.05	1.53
	30	87.44	86.16	84.37	85.99	1.55
	40	91.65	90.53	89.62	90.60	1.02
	50	93.39	92.62	91.35	92.45	1.03
	60	96.20	94.72	93.61	94.84	1.30
T 50 of %Dissolved		9.31	9.68	9.82	9.60	0.27
Polyvinyl pyrrolidone (PVP K30) 2%	5	28.45	27.74	27.08	27.76	0.69
	10	51.28	49.98	49.03	50.63	1.13
	15	64.35	63.27	62.43	63.81	0.96
	20	72.99	71.19	70.59	72.09	1.25
	25	79.54	78.33	77.37	78.94	1.09
	30	83.47	82.72	81.46	83.10	1.02
	40	89.78	88.15	87.41	88.96	1.21
	50	91.69	90.58	89.48	91.13	1.10
	60	93.60	92.31	91.38	92.96	1.12
T 50 of %Dissolved		9.72	10.01	10.36	10.03	0.32
Polyvinyl pyrrolidone (PVP K30) 4%	5	26.51	26.22	25.89	26.21	0.31
	10	49.61	48.78	46.77	48.39	1.46
	15	61.01	60.30	59.81	60.37	0.60
	20	70.34	69.27	68.54	69.39	0.91
	25	77.36	76.28	75.19	76.28	1.08
	30	81.81	79.30	77.85	79.65	2.00
	40	85.80	83.99	82.71	84.17	1.55
	50	88.04	86.75	85.12	86.64	1.47
	60	90.12	88.46	87.35	88.64	1.39
T 50 of %Dissolved		10.17	10.53	11.24	10.64	0.54

Table 27 Dissolution Data of Nicotinamide Tablets Prepared with Corn starch by Solution Incorporation Method

Concentration (% w/w)	Time min.	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Corn starch 0.5%	5	20.45	20.78	20.69	20.64	0.17
	10	39.69	39.83	39.74	39.75	0.07
	15	57.97	58.09	57.97	58.01	0.07
	20	65.27	67.64	66.69	66.53	1.19
	25	77.70	79.49	78.89	78.69	0.91
	30	83.10	85.61	83.64	84.12	1.32
	40	98.46	98.86	98.66	98.66	0.20
	50	99.53	100.10	99.73	99.79	0.29
	60	100.60	101.18	100.98	100.92	0.29
T 50 of % Dissolved		12.82	12.78	12.81	12.81	0.02
Corn starch 1%	5	18.98	18.08	19.17	18.75	0.58
	10	30.21	30.02	30.45	30.11	0.22
	15	43.59	42.75	45.13	43.17	1.21
	20	57.32	56.83	57.92	57.08	0.54
	25	65.09	64.25	65.58	64.67	0.67
	30	71.48	70.64	72.92	71.06	1.15
	40	78.80	76.64	82.55	77.72	2.99
	50	84.73	83.98	85.48	84.36	0.75
	60	92.64	91.89	93.76	92.27	0.94
T 50 of % Dissolved		17.34	17.57	16.90	17.27	0.34
Corn starch 2%	5	16.57	17.09	17.33	16.99	0.39
	10	27.22	27.74	28.21	27.72	0.50
	15	38.35	39.54	40.96	39.62	1.31
	20	48.74	48.40	50.30	49.15	1.02
	25	53.74	55.17	56.61	55.17	1.44
	30	63.62	63.88	64.85	64.12	0.65
	40	71.13	73.28	75.44	73.28	2.16
	50	81.46	82.73	84.91	83.03	1.75
	60	84.74	86.02	86.97	85.91	1.12
T 50 of % Dissolved		21.26	21.18	19.76	20.74	0.84

Table 28 Dissolution Data of Nicotinamide Tablets Prepared with Polyvinyl pyrrolidone by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Polyvinyl pyrrolidone ( PVP K30) 0.5%	5	26.93	27.69	27.36	27.33	0.38
	10	53.17	55.30	54.47	54.31	1.08
	15	67.07	69.57	68.97	68.54	1.31
	20	77.62	79.66	78.59	78.62	1.02
	25	84.44	87.20	85.65	85.76	1.39
	30	88.15	90.52	90.14	89.60	1.27
	40	89.52	91.19	91.16	90.62	0.95
	50	90.36	92.21	91.48	91.35	0.93
	60	91.20	93.07	92.68	92.32	0.98
T 50 of %Dissolved		9.40	9.04	9.18	9.20	0.18
Polyvinyl pyrrolidone ( PVP K30) 1%	5	26.56	26.32	27.08	26.65	0.39
	10	52.93	51.27	53.76	52.10	1.27
	15	67.78	66.82	68.26	67.30	0.73
	20	77.38	76.42	78.46	76.90	1.02
	25	81.95	80.15	83.27	81.05	1.56
	30	86.54	84.91	87.98	85.73	1.54
	40	87.72	86.97	89.88	87.35	1.51
	50	89.80	89.40	91.79	89.60	1.28
	60	91.88	90.41	92.82	91.14	1.21
T 50 of %Dissolved		9.44	9.75	9.30	9.50	0.23
Polyvinyl pyrrolidone ( PVP K30) 2%	5	26.41	26.84	25.89	26.38	0.47
	10	51.63	52.34	50.20	51.39	1.09
	15	65.76	67.18	66.34	66.43	0.72
	20	74.29	75.25	73.33	74.29	0.96
	25	78.25	79.57	77.64	78.48	0.98
	30	83.82	84.74	82.39	83.65	1.18
	40	85.17	85.91	84.43	85.17	0.74
	50	86.51	86.91	85.95	86.46	0.48
	60	87.69	88.44	86.77	87.63	0.83
T 50 of %Dissolved		9.68	9.54	9.96	9.73	0.21

Table 29 Dissolution Data of Nicotinamide Tablets Prepared with Gelatin by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Gelatin 0.5%	5	35.17	34.37	33.75	34.43	0.71
	10	55.22	54.51	53.92	54.55	0.66
	15	67.48	66.76	66.28	66.84	0.60
	20	78.03	76.96	76.00	77.00	1.02
	25	85.68	84.48	82.69	84.28	1.51
	30	95.68	94.05	93.50	94.41	1.13
	40	96.55	95.28	93.65	95.16	1.45
	50	103.11	100.76	99.13	101.00	2.00
	60	104.56	102.73	100.91	102.73	1.82
T 50 of %Dissolved		8.70	8.88	9.03	8.87	0.17
Gelatin 1%	5	30.25	31.81	33.75	31.94	1.75
	10	51.65	54.14	56.64	52.89	2.49
	15	61.40	63.08	66.06	62.24	2.36
	20	76.24	77.16	77.55	76.70	0.67
	25	83.05	83.97	85.08	83.51	1.02
	30	87.41	89.58	92.82	88.49	2.73
	40	94.63	96.81	98.48	95.72	1.93
	50	99.58	100.35	100.61	99.97	0.54
	60	101.89	102.67	104.17	102.28	1.16
T 50 of %Dissolved		9.62	9.07	8.55	9.08	0.53
Gelatin 2%	5	31.05	31.34	31.91	31.43	0.43
	10	44.43	45.62	46.45	45.50	1.01
	15	55.57	56.88	58.07	56.84	1.25
	20	66.05	66.30	67.50	66.62	0.77
	25	71.38	73.53	75.33	73.41	1.97
	30	76.74	78.90	81.30	78.98	2.28
	40	84.09	85.72	90.92	86.91	3.57
	50	92.71	93.11	98.87	94.90	3.44
	60	93.92	94.68	99.05	95.88	2.77
T 50 of %Dissolved		12.50	11.95	11.53	11.99	0.49



Table 30 Dissolution Data of Nicotinamide Tablets Prepared with HPC type L by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Hydroxypropyl cellulose (HPC) 0.5%	5	34.98	32.43	33.89	33.77	1.28
	10	52.50	50.24	51.90	51.55	1.17
	15	72.32	69.22	71.01	70.85	1.56
	20	84.49	79.83	82.88	82.40	2.37
	25	90.82	87.37	89.02	89.07	1.72
	30	98.41	93.36	94.65	95.47	2.63
	40	99.84	97.06	98.54	98.48	1.39
	50	100.73	98.65	99.61	99.66	1.04
	60	102.17	99.89	100.68	100.91	1.15
T 50 of %Dissolved		9.29	9.93	9.47	9.56	0.33
Hydroxypropyl cellulose (HPC) 1%	5	28.50	29.21	28.64	28.78	0.38
	10	48.44	51.88	49.86	50.16	1.73
	15	67.17	69.21	67.89	68.19	1.03
	20	78.55	81.42	80.69	79.99	1.49
	25	88.92	91.81	90.37	90.37	1.45
	30	91.89	95.33	94.06	93.61	1.74
	40	93.46	97.27	96.17	95.37	1.96
	50	96.81	99.75	97.93	98.28	1.49
	60	98.57	101.18	99.88	99.88	1.30
T 50 of %Dissolved		10.42	9.59	10.04	10.01	0.42
Hydroxypropyl cellulose (HPC) 2%	5	23.29	23.15	23.76	23.40	0.32
	10	40.25	39.42	40.61	40.09	0.61
	15	54.55	53.13	55.03	54.24	0.99
	20	65.09	64.19	66.34	65.21	1.08
	25	76.81	76.26	77.53	76.87	0.64
	30	83.80	82.89	84.88	83.86	1.00
	40	95.80	94.35	96.53	95.56	1.11
	50	100.93	98.59	102.38	100.63	1.91
	60	101.83	99.30	103.29	101.48	2.02
T 50 of %Dissolved		13.41	13.86	13.26	13.51	0.31

Table 31 Dissolution Data of Nicotinamide Tablets Prepared with Pregelatinized starch by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 0.5%	5	23.76	23.34	23.15	23.42	0.32
	10	34.12	33.55	32.89	33.52	0.62
	15	47.30	46.59	45.52	46.47	0.90
	20	56.44	55.72	54.76	55.64	0.84
	25	67.52	67.15	66.07	66.91	0.75
	30	77.12	77.10	77.08	77.10	0.02
	40	90.32	89.83	88.39	89.52	1.00
	50	97.32	96.60	95.68	96.53	0.82
	60	103.71	102.45	100.99	102.38	1.36
T 50 of %Dissolved		16.48	16.87	17.42	16.92	0.48
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 1%	5	20.45	20.31	19.88	20.21	0.30
	10	29.04	28.52	27.66	28.78	0.69
	15	40.27	38.97	35.77	39.62	2.32
	20	48.07	46.28	43.54	47.18	2.28
	25	56.15	55.18	53.48	55.66	1.35
	30	63.91	63.65	62.30	63.78	0.87
	40	73.31	73.28	71.10	73.30	1.27
	50	84.54	82.74	81.25	83.64	1.65
	60	98.13	95.26	93.23	96.70	2.47
T 50 of %Dissolved		21.19	22.09	23.25	22.18	1.03
Pregelatinized starch ( Starch 1500 <sup>(R)</sup> ) 2%	5	17.28	17.61	18.41	17.77	0.58
	10	26.84	26.99	27.32	27.05	0.25
	15	34.56	35.51	36.58	35.55	1.01
	20	43.99	44.35	45.78	44.70	0.95
	25	51.92	52.76	53.61	52.76	0.84
	30	59.78	60.98	61.71	60.82	0.98
	40	63.66	65.45	68.32	65.81	2.35
	50	75.30	76.75	77.51	76.52	1.12
	60	76.25	78.24	78.82	77.77	1.35
T 50 of %Dissolved		23.79	23.36	22.70	23.28	0.55

Table 32 Dissolution Data of Nicotinamide Tablets Prepared with Ispaghula Husk by Solution Incorporation Method

Concentration (% w/w)	Time (min.)	% drug dissolved			AVG.	SD.
		# 1	# 2	# 3		
Ispaghula Husk 0.5%	5	22.76	23.50	23.01	23.09	0.38
	10	38.17	39.42	38.89	38.83	0.63
	15	51.11	54.43	53.60	53.05	1.73
	20	60.44	62.60	61.88	61.64	1.10
	25	66.99	71.64	69.85	69.50	2.35
	30	77.12	79.85	77.69	78.22	1.44
	40	94.58	97.68	95.87	96.04	1.56
	50	97.40	100.88	98.17	98.82	1.82
	60	100.06	103.73	101.18	101.66	1.88
T 50 of %Dissolved		14.57	13.52	13.78	13.96	0.55
Ispaghula Husk 1%	5	19.46	19.60	19.14	19.40	0.24
	10	34.49	35.26	34.78	34.87	0.39
	15	40.89	43.62	42.55	42.25	1.37
	20	50.23	50.84	50.47	50.53	0.31
	25	58.55	60.11	59.39	59.33	0.78
	30	65.56	68.43	66.46	67.00	1.47
	40	76.92	79.99	78.90	78.46	1.55
	50	86.75	89.48	87.31	88.11	1.44
	60	96.63	98.84	98.08	97.74	1.12
T 50 of %Dissolved		19.88	19.42	19.70	19.67	0.23
Ispaghula Husk 2%	5	16.19	16.76	17.14	16.69	0.48
	10	25.94	26.84	27.12	26.63	0.62
	15	37.39	38.82	39.89	38.70	1.25
	20	46.36	48.74	49.46	48.19	1.62
	25	56.32	56.70	59.55	57.52	1.77
	30	62.66	65.06	66.98	64.90	2.16
	40	77.09	78.67	79.89	78.55	1.41
	50	83.96	86.49	87.43	85.96	1.80
	60	90.98	91.58	92.16	91.58	0.59
T 50 of %Dissolved		21.83	20.79	20.27	20.96	0.79

## **Appendix IV**

### **Statistics**

### A. Analysis of Variance (ANOVA)

Source of variation	SS.	d.f.	MS	F
Between Groups	$SS_{\text{Between}}$	$k - 1$	$MS_{\text{Between}} = \frac{SS_{\text{Between}}}{(k - 1)}$	$F = \frac{MS_{\text{Between}}}{MS_{\text{Within}}}$
Within Groups	$SS_{\text{Within}}$	$N - k$	$MS_{\text{Within}} = \frac{SS_{\text{Within}}}{(N - k)}$	
Total	$SS_{\text{Total}}$	$N - 1$		

d.f. = degree of freedom      SS = Sum of Squares  
 F = Variance Ratio          MS = Mean Square

$$SS_{\text{Between}} = \sum_{j=1}^k n_j (x_{.j} - x_{..})^2$$

$$SS_{\text{Within}} = \sum_{j=1}^k \sum_{i=1}^{n_j} (x_{ij} - x_{.j})^2$$

$$SS_{\text{Total}} = \sum_{j=1}^k \sum_{i=1}^{n_j} (x_{ij} - x_{..})^2$$

When  $x_{ij}$  = Observed Value at Treatment  $j$   
 $i = 1, 2, 3, \dots, n_j$   
 $j = 1, 2, 3, \dots, k$

$$T_{.j} = \sum_{i=1}^{n_j} x_{ij} \qquad x_{.j} = \frac{T_{.j}}{n_j}$$

$$T_{..} = \sum_{j=1}^k T_{.j} \qquad x_{..} = \frac{T_{..}}{N}$$

$$N = \sum_{j=1}^k n_j$$

Comparing the  $F$  value with the  $F_{\text{critical}}$  value.  $F$  value obtained from table at degree of freedom  $(k-1)$  and  $(N-k)$ :

- If  $F > F_{\text{critical}}$ , reject the null hypothesis that  $\mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$  and accept the alternative hypothesis.
- If  $F < F_{\text{critical}}$ , accept the null hypothesis

### B. Least Significant Different (LSD)

$$\begin{aligned}
 \text{LSD (0.05)} &= t_{.05} S_d \\
 t_{.05} \text{ df (Within Groups)} &= 2.01 \\
 S_d &= (2 \times MS_{\text{Within Groups}} / (\text{Count} - 1))^{1/2}
 \end{aligned}$$

t value obtained from table at degree of freedom (N-K).

Average or mean of i more than j when outcome of average of i minus average of j more than LSD (0.05) value

Table 33 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 1 % w/w by Dry Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	47.22	4.722	0.0074
PVP K 30	10	57.21	5.721	0.0029
Starch 1500 <sup>R</sup>	10	41.39	4.139	0.0262

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	12.802	2	6.40102	527.332	2.3E-22	3.35413
Within Groups	0.32774	27	0.01214			
Total	13.1298	29				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders

		A		
		Starch 1500 <sup>R</sup>	Ispaghula husk	PVP K 30
B	BINDER at 1 % w/w			
	Starch 1500 <sup>R</sup>	-		
	Ispaghula husk	S	-	
	PVP K 30	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level 95%

Table 34 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 2 % w/w by Dry Incorporation Method

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	50.63	5.063	0.0083
PVP K 30	10	85.18	8.518	0.0077
Starch 1500 <sup>R</sup>	10	48.45	4.845	0.0042

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	84.9183	2	42.4591	6312.06	9E-37	3.35413
Within Groups	0.18162	27	0.00673			
Total	85.0999	29				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binder

		A		
		Starch 1500 <sup>R</sup>	Ispaghula husk	PVP K 30
B	BINDER at 2 % w/w			
	Starch 1500 <sup>R</sup>	-		
	Ispaghula husk	S	-	
	PVP K 30	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level 95%



Table 35 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 4% w/w by Dry Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	52.89	5.289	0.0061
PVP K 30	10	97.28	9.728	0.0060
Starch 1500 <sup>R</sup>	10	53.66	5.366	0.0020

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	129.1256	2	64.5628	13803.1	2.3E-41	3.3541
Within Groups	0.12629	27	0.00468			
Total	129.2519	29				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders

		A		
		Ispaghula husk	Starch 1500 <sup>R</sup>	PVP K 30
B	BINDER at 4 % w/w			
	Ispaghula husk	-		
	Starch 1500 <sup>R</sup>	S	-	
	PVP K 30	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
S means B is significantly more than A at confidential level 95 %  
NS means B is not significantly more than A at confidential level 95%

Table 36 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 0.5 % w/w by Solution Incorporation Method

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	52.09	5.21	0.0153
PVP K 30	10	42.76	4.28	0.0055
Starch 1500 <sup>R</sup>	10	39.65	3.97	0.0084
Corn Starch	10	40.25	4.03	0.0043
HPC type L	10	43.32	4.33	0.0062
Gelatin	10	46.59	4.66	0.0058

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.7069	5	2.14137	282.117	2.1E-37	2.38607
Within Groups	0.40988	54	0.00759			
Total	11.1167	59				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders

		A					
BINDER at 0.5% w/w		Starch 1500 <sup>R</sup>	Corn Starch	PVP K 30	HPC type L	Gelatin	Ispaghula husk
B	Starch 1500 <sup>R</sup>	-					
	Corn Starch	NS	-				
	PVP K 30	S	S	-			
	HPC type L	S	S	NS	-		
	Gelatin	S	S	S	S	-	
	Ispaghula husk	S	S	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others

S means B is significantly more than A at confidential level 95 %

NS means B is not significantly more than A at confidential level 95%

Table 37 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 1 % w/w by Solution Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	61.84	6.18	0.0311
PVP K 30	10	64.63	6.46	0.0038
Starch 1500 <sup>R</sup>	10	42.37	4.24	0.0077
Corn Starch	10	43.48	4.35	0.0020
HPC type L	10	63.84	6.38	0.0048
Gelatin	10	53.33	5.33	0.0073

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	51.2641	5	10.2528	1083.74	8E-53	2.38607
Within Groups	0.51087	54	0.00946			
Total	51.775	59				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binder

		A					
BINDER at 1% w/w		Starch 1500 <sup>R</sup>	Corn Starch	Gelatin	Ispaghula husk	HPC type L	PVP K 30
B	Starch 1500 <sup>R</sup>	-					
	Corn Starch	S	-				
	Gelatin	S	S	-			
	Ispaghula husk	S	S	S	-		
	HPC type L	S	S	S	S	-	
	PVP K 30	S	S	S	S	NS	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level 95%

Table 38 Analysis of Variance and LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders at 2% w/w by Solution Incorporation Method

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	65.49	6.549	0.0057
PVP K 30	10	90.74	9.074	0.0125
Starch 1500 <sup>R</sup>	10	50.66	5.066	0.0124
Corn Starch	10	55.73	5.573	0.0085
HPC type L	10	101.35	10.135	0.0310
Gelatin	10	61.30	6.130	0.0232

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	208.204	5	41.6408	2677.45	2.3E-63	2.3861
Within Groups	0.83983	54	0.01555			
Total	209.0438	59				

LSD Analysis for Hardness of Paracetamol Tablets Prepared with Various Binders

		A					
BINDER at 2% w/w		Starch 1500 <sup>R</sup>	Corn Starch	Gelatin	Ispaghula husk	PVP K 30	HPC type L
B	Starch 1500 <sup>R</sup>	-					
	Corn Starch	S	-				
	Gelatin	S	S	-			
	Ispaghula husk	S	S	S	-		
	PVP K 30	S	S	S	S	-	
	HPC type L	S	S	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others

S means B is significantly more than A at confidential level 95 %

NS means B is not significantly more than A at confidential level 95%

Table 39 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 1 % w/w by Dry Incorporation Method

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	56.9	5.69	0.0210
PVP K 30	10	67.3	6.73	0.0440
Starch 1500 <sup>R</sup>	10	50.43	5.043	0.03636
Blank	10	40.4	4.04	0.04933

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	38.277	3	12.759	338.682	2E-26	2.86627
Within Groups	1.35621	36	0.03767			
Total	39.6332	39				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A			
BINDER at 1 % w/w		Blank	Starch 1500 <sup>R</sup>	Ispaghula husk	PVP K 30
B	Blank	-			
	Starch 1500 <sup>R</sup>	S	-		
	Ispaghula husk	S	S	-	
	PVP K 30	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others

S means B is significantly more than A at confidential level 95 %

NS means B is not significantly more than A at confidential level 95%

Table 40 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 2 % w/w by Dry Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	67.59	6.759	0.0151
PVP K 30	10	93.64	9.364	0.0331
Starch 1500 <sup>R</sup>	10	54.78	5.478	0.0306
Blank	10	40.4	4.04	0.0493

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	153.33	3	51.1115	1595.45	2.52E-38	2.8663
Within Groups	1.1533	36	0.03204			
Total	154.49	39				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A			
		Blank	Starch 1500 <sup>R</sup>	Ispaghula husk	PVP K 30
B	BINDER at 2 % w/w				
	Blank	-			
	Starch 1500 <sup>R</sup>	S	-		
	Ispaghula husk	S	S	-	
	PVP K 30	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level 95%

Table 41 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 4 % w/w by Dry Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	72.81	7.281	0.0225
PVP K 30	10	102.5	10.245	0.0669
Starch 1500 <sup>R</sup>	10	61.2	6.12	0.0334
Blank	10	40.4	4.04	0.0493

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	201.2	3	67.06779	1557.6	3.9E-38	2.8663
Within Groups	1.5501	36	0.043059			
Total	202.75	39				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A			
BINDER at 4 % w/w		Blank	Starch 1500 <sup>R</sup>	Ispaghula husk	PVP K 30
B	Blank	-			
	Starch 1500 <sup>R</sup>	S	-		
	Ispaghula husk	S	S	-	
	PVP K 30	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others

S means B is significantly more than A at confidential level 95 %

NS means B is not significantly more than A at confidential level 95%

Table 42 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 0.5 % w/w by Solution Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	51.42	5.14	0.0258
PVP K 30	10	51.30	5.13	0.0329
Starch 1500 <sup>R</sup>	10	49.6	4.96	0.0438
Corn Starch	10	49.79	4.98	0.0407
HPC type L	10	50.7	5.07	0.0274
Gelatin	10	53.27	5.33	0.0321
Blank	10	40.4	4.04	0.0493

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.55	6	1.7581	48.816	7.7E-22	2.2464
Within Groups	2.269	63	0.036			
Total	12.82	69				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A						
BINDER at 0.5% w/w		Blank	Starch 1500 <sup>R</sup>	Corn Starch	HPC type L	PVP K 30	Ispaghula husk	Gelatin
B	Blank	-						
	Starch 1500 <sup>R</sup>	S	-					
	Corn Starch	S	NS	-				
	HPC type L	S	NS	NS	-			
	PVP K 30	S	NS	NS	NS	-		
	Ispaghula husk	S	S	NS	NS	NS	-	
	Gelatin	S	S	S	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level .95%



Table 43 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 1 % w/w by Solution Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	63.8	6.38	0.0223
PVP K 30	10	70.6	7.06	0.0306
Starch 1500 <sup>R</sup>	10	51.1	5.11	0.0276
Corn Starch	10	52.3	5.23	0.0318
HPC type L	10	73.1	7.31	0.0252
Gelatin	10	64.6	6.46	0.0308
Blank	10	40.4	4.04	0.0493

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	84.001	6	14	450.05	9.8E-50	2.24641
Within Groups	1.9598	63	0.0311			
Total	85.961	69				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A						
BINDER at 1 % w/w		Blank	Starch 1500 <sup>R</sup>	Corn Starch	Ispaghula husk	Gelatin	PVP K 30	HPC type L
B	Blank	-						
	Starch 1500 <sup>R</sup>	S	-					
	Corn Starch	S	NS	-				
	Ispaghula husk	S	S	S	-			
	Gelatin	S	S	S	NS	-		
	PVP K 30	S	S	S	S	S	-	
	HPC type L	S	S	S	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level .95%

Table 44 Analysis of Variance and LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders at 2 % w/w by Solution Incorporation Method

Anova: Single Factor  
SUMMARY

Groups	Count	Sum	Average	Variance
Ispaghula husk	10	72.41	7.241	0.0867
PVP K 30	10	100.8	10.079	0.0375
Starch 1500 <sup>R</sup>	10	63.33	6.333	0.0155
Corn Starch	10	61.7	6.17	0.0301
HPC type L	10	106.5	10.652	0.0252
Gelatin	10	71.91	7.191	0.0523
Blank	10	40.40	4.04	0.0493

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	318	6	52.935	1248.83	2E-63	2.2464
Within Groups	2.67	63	0.0424			
Total	320	69				

LSD Analysis for Hardness of Nicotinamide Tablets Prepared with Various Binders

		A						
BINDER at 2 % w/w		Blank	Corn Starch	Starch 1500 <sup>R</sup>	Gelatin	Ispaghula husk	PVP K 30	HPC type L
B	Blank	-						
	Corn Starch	S	-					
	Starch 1500 <sup>R</sup>	S	NS	-				
	Gelatin	S	S	S	-			
	Ispaghula husk	S	S	S	NS	-		
	PVP K 30	S	S	S	S	S	-	
	HPC type L	S	S	S	S	S	S	-

Note: Statistic values are obtained from LSD Analysis by comparing each binder with the others  
 S means B is significantly more than A at confidential level 95 %  
 NS means B is not significantly more than A at confidential level .95%

**VITAE**

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