CHAPTER III

RESULTS

Moisture Sorption

Tablets prepared by direct compression using α-lactose monohydrate or dicalcium phosphate dihydrate as diluent and sodium starch glycolate, cross linked polyvinylpyrrolidone, corn starch or microcrystalline cellulose as disintegrant were observed for their physical properties when subjected to storage at four different humidity levels up to 72 hours. The following parameters were studied: (a) percent moisture sorption (b) ratio of tablet density at time t, to initial tablet density and (c) hardness. Data from these measurements were shown on Tables 6 - 13.

(a) Percent Moisture Sorption

The result of percent moisture sorption was calculated from percent weight gain at 98% relative humidity exposure and plotted against time in hours. Percent moisture sorption - time curve of tablets prepared from dicalcium phosphate dihydrate or α-lactose monohydrate which contained sodium starch glycolate, corn starch, cross linked polyvinylpyrrolidone and microcrystalline cellulose as disintegrants were shown in Figures 8 - 39.

Table 6 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :EMCOMPRESS + 3% EXPLOTAB

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	2.98(0.36)	0	1.00	2.98(0.36)	0	1.00	2.98(0.36)	0	1.00	2.98(0.36)
	6	-0.141	1.00	2.83(0.55)	-0.029	1.00	2.49(0.49)	0.028	1.00	2.97(0.30)	0.451	0.99	-a
1200	24	-0.171	1.00	2.72(0.60)	-0.057	1.00	2.51(0.61)	0.028	1.00	2.48(0.92)	0.883	0.96	-
	48	-0.113	1.00	2.43(0.88)	-0.057	1.00	2.70(0.57)	0	1.01	2.44(0.91)	1.504	0.94	-
	72	-0.143	1.00	3.22(0.45)	-0.058	1.00	2.57(0.35)	0	1.00	2.59(0.63)	2.026	-	-
	0	0	1.00	4.47(0.52)	0	1.00	4.47(0.52)	0	1.00	4.47(0.52)	0	1.00	4.47(0.52)
	6	-0.166	1.00	4.06(0.68)	-0.028	1.00	4.25(0.20)	0.028	1.00	3.46(0.37)	0.471	0.98	-
1800	24	-0.166	1.00	4.41(0.40)	-0.027	1.00	4.19(0.38)	0.083	0.99	3.72(0.48)	1.082	0.94	-
	48	-0.138	1.00	4.28(0.34)	-0.028	1.00	3.93(0.38)	0.055	1.00	3.37(0.44)	1.766	0.94	-
	72	-0.192	1.00	4.06(0.41)	-0.055	1.00	3.80(0.51)	0.028	0.99	3.54(0.79)	2.541	-	-
	0	0	1.00	5.94(0.33)	0	1.00	5.94(0.33)	0	1.00	5.94(0.33)	0	1.00	5.94(0.33)
	6	-0.139	1.00	5.96(0.97)	-0.084	1.00	5.26(0.66)	0	0.99	5.09(0.57)	0.473	0.98	2.59(1.04)
2400	24	-0.167	1.00	5.95(0.31)	-0.028	1.00	5.53(0.65)	0.056	1.00	4.63(0.69)	1.007	0.95	-
	48	-0.111	1.00	5.98(0.52)	-0.028	1.00	5.32(0.70)	0.056	1.00	4.89(0.52)	1.721	0.93	-
	72	-0.167	1.00	5.82(0.60)	-0.028	1.00	5.16(0.44)	0.056	1.00	4.40(0.35)	2.482	-	-
	0	0	1.00	6.99(0.55)	0	1.00	6.99(0.55)	0	1.00	6.99(0.55)	0	1.00	6.99(0.55)
	6	-0.138	1.00	6.86(0.79)	-0.055	1.00	6.79(0.67)	0.028	0.99	5.90(0.73)	0.524	0.98	3.32(0.43)
3000	24	-0.193	1.00	7.03(0.97)	-0.055	1.00	6.49(1.09)	0.082	1.00	5.38(0.75)	1.109	0.93	-
	48	-0.165	1.00	6.82(0.58)	-0.055	1.00	6.22(1.12)	0.055	1.00	5.60(0.77)	1.856	0.92	-
	72	-0.167	1.01	6.84(0.43)	-0.055	1.00	6.29(0.50)	0.083	0.99	5.51(0.50)	2.701	0.88	-

FORMULATION :EMCOMPRESS + 6% EXPLOTAB

	0	0	1.00	2.53(0.60)	0	1.00	2.53(0.60)	0	1.00	2.53(0.60)	0	1.00	2.53(0.60)
	6	-0.171	1.00	2.90(0.77)	-0.048	1.00	2.66(0.69)	0.024	0.99	1.23(0.85)	0.679	0.96	-
1200	24	-0.342	1.00	2.92(0.75)	-0.049	0.99	1.79(0.46)	0.073	0.99	1.60(0.65)	1.686	0.93	-
	48	-0.293	1.00	2.46(0.69)	-0.073	1.00	2.35(0.55)	0.025	0.98	1.30(0.68)	2.332	-	-
	72	-0.319	1.00	2.55(0.45)	-0.073	1.00	2.19(0.55)	0.049	0.99	1.81(0.65)	3.033	-	-
	0	0	1.00	3.23(0.70)	0	1.00	3.23(0.70)	0	1.00	3.23(0.70)	0	1.00	3.23(0.70)
	6	-0.146	0.99	2.91(0.55)	-0.024	0.99	2.64(0.50)	0.072	0.99	2.69(0.56)	0.768	0.95	-
1800	24	-0.316	1.00	3.18(0.58)	-0.048	0.99	3.00(0.54)	0.145	0.99	2.39(0.70)	1.826	0.92	-
	48	-0.336	1.00	3.06(0.52)	-0.072	0.99	3.32(0.55)	0.145	0.98	2.02(0.53)	2.703	0.90	-
	72	-0.360	1.00	3.51(1.00)	-0.121	1.00	2.82(0.54)	0.097	0.98	2.18(0.40)	3.319	0.87	-
	0	0	1.00	4.92(0.58)	0	1.00	4.92(0.58)	0	1.00	4.92(0.58)	0	1.00	4.92(0.58)
	6	-0.143	0.99	4.63(0.66)	-0.024	0.99	4.29(0.57)	0.108	0.99	4.07(0.47)	0.785	0.95	1.61(0.61)
2400	24	-0.331	1.00	4.12(0.44)	-0.048	0.98	4.61(0.45)	0.191	0.99	3.48(0.47)	1.882	0.91	-
	48	-0.310	1.00	4.47(0.68)	-0.072	1.00	4.72(0.43)	0.143	0.99	3.50(0.54)	2.637	0.90	-
	72	-0.334	1.00	4.26(0.55)	-0.119	0.99	4.91(0.64)	0.143	0.99	3.38(0.64)	3.312	0.92	-
	0	0	1.00	5.44(0.70)	0	1.00	5.44(0.70)	0	1.00	5.44(0.70)	0	1.00	5.44(0.70)
	6	-0.188	0.99	5.17(0.45)	-0.023	0.99	5.15(0.48)	0.141	0.99	4.61(0.32)	0.872	0.94	1.56(0.87)
3000	24	-0.354	0.99	4.76(0.71)	0	0.99	4.68(0.85)	0.212	0.98	3.77(0.47)	2.167	0.91	-
	48	-0.354	1.00	5.98(0.55)	-0.047	0.99	5.51(0.33)	0.212	0.98	3.85(0.37)	3.396	0.89	-
	72	-0.330	0.99	4.66(0.91)	-0.117	0.99	5.07(0.26)	0.165	0.99	3.95(0.40)	3.816	0.91	-

Table 6 - con't

FORMULATION :EMCOMPRESS + 9% EXPLOTAB

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.211	0.99	-	-0.026	0.99	-	0.239	1.00	-	0.955	0.95	-
1200	24	-0.290	1.00	-	-0.027	1.00	-	0.159	0.98	-	1.959	0.93	-
	48	-0.476	1.00	1.21(0.60)	-0.079	1.00	-	0.211	0.98	-	3.851	-	-
	72	-0.505	1.00	-	-0.053	0.98	-	0.187	0.98	-	5.066	-	-
	0	0	1.00	2.32(0.78)	0	1.00	2.32(0.78)	0	1.00	2.32(0.78)	0	1.00	2.32(0.78)
	6	-0.129	0.99	2.31(0.38)	-0.026	0.98	-	0.181	0.98	-	1.053	0.93	-
1800	24	-0.232	0.99	2.45(0.74)	-0.026	0.99	-	0.258	0.97	1.58(0.62)	2.237	0.91	-
	48	-0.137	0.99	1.59(0.91)	-0.051	0.99	1.65(0.68)	0.284	0.97	-	3.913	-	-
	72	-0.570	0.98	1.64(1.00)	-0.026	0.98	1.58(0.60)	0.259	0.97	0.68(0.34)	5.359	-	-
	0	0	1.00	3.89(0.56)	0	1.00	3.89(0.56)	0	1.00	3.89(0.56)	0	1.00	3.89(0.56)
	6	-0.103	0.99	2.84(0.53)	0	0.99	2.85(0.35)	0.154	0.98	2.25(0.75)	0.883	0.95	-
2400	24	-0.231	0.99	3.44(0.88)	0.051	0.98	3.08(0.54)	0.252	0.97	2.13(0.36)	2.123	0.91	-
	48	-0.411	0.99	2.60(0.56)	-0.051	0.98	3.06(0.30)	0.308	0.97	2.14(0.61)	3.553	-	-
	72	-0.437	0.99	3.18(0.88)	0	0.99	3.04(0.60)	0.284	0.97	1.49(0.72)	5.109	-	-
	0	0	1.00	4.75(0.70)	0	1.00	4.75(0.70)	0	1.00	4.75(0.70)	0	1.00	4.75(0.70)
	6	-0.128	0.99	4.20(1.10)	0.026	0.98	3.87(0.40)	0.179	0.98	3.42(0.49)	1.002	0.94	1.73(0.66)
3000	24	-0.267	0.98	3.77(0.30)	0.077	0.98	3.81(0.22)	0.256	0.98	2.90(0.40)	2.444	0.90	-
	48	-0.640	0.98	3.45(0.40)	0	0.99	3.87(0.34)	0.308	0.97	2.74(0.64)	3.947	-	-
	72	-0.487	0.98	3.89(0.42)	0.025	0.98	3.76(0.32)	0.307	0.97	2.84(0.60)	4.978	-	-

FORMULATION :EMCOMPRESS + 12% EXPLOTAB

	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.247	1.01	-	-0.138	1.00	-	0.083	0.99	-	0.662	0.95	-
1200	24	-0.554	1.01	-	-0.166	1.00	-	0.221	0.98	-	2.439	-	-
	48	-0.612	1.01	-	-0.166	1.00	-	0.195	0.99	-	3.409	-	-
	72	-0.638	1.01	0.60(0.19)	-0.192	1.00	-	0.222	0.98	-	4.932	-	-
	0	0	1.00	0.83(0.59)	0	1.00	0.83(0.59)	0	1.00	0.83(0.59)	0	1.00	0.83(0.59)
	6	-0.188	1.00	-	-0.080	0.99	-	0.161	0.98	0.52(0.07)	0.908	0.94	-
1800	24	-0.564	1.00	1.59(0.46)	-0.134	0.99	1.29(0.40)	0.323	0.98	-	2.835	0.91	-
	48	-0.622	1.01	1.33(0.64)	-0.108	0.99	1.33(0.70)	0.374	0.97	-	4.131	-	-
	72	-0.670	1.00	1.22(0.58)	-0.134	0.99	1.12(0.63)	0.376	0.97	-	6.129	-	-
	0	0	1.00	2.84(0.66)	0	1.00	2.84(0.66)	0	1.00	2.84(0.66)	0	1.00	2.84(0.66)
	6	-0.160	0.99	2.32(0.71)	-0.053	0.99	2.34(0.79)	0.188	0.98	2.02(0.74)	0.936	0.93	-
2400	24	-0.588	1.00	2.30(0.55)	-0.134	0.99	2.54(0.85)	0.159	0.97	1.11(0.57)	2.739	0.89	-
	48	-0.693	1.00	1.93(0.96)	-0.134	0.99	2.29(0.78)	0.399	0.97	0.82(0.42)	4.247	-	-
	72	-0.667	0.99	2.40(0.59)	-0.107	0.99	2.36(0.68)	0.399	0.97	1.30(0.56)	6.238	-	-
	0	0	1.00	3.69(0.67)	0	1.00	3.69(0.67)	0	1.00	3.69(0.67)	0	1.00	3.69(0.67)
	6	-0.213	0.99	3.52(0.63)	-0.027	0.99	3.53(0.59)	0.159	0.98	2.76(0.55)	1.041	0.94	1.34(0.36)
3000	24	-0.668	0.99	3.16(0.48)	-0.080	0.98	3.46(0.20)	0.372	0.97	2.52(0.15)	2.969	0.89	-
	48	-0.694	0.99	3.01(0.56)	-0.107	0.99	3.77(0.54)	0.427	0.97	2.02(0.69)	4.451	-	-
	72	-0.691	0.99	3.15(0.47)	-0.106	0.99	3.90(0.36)	0.426	0.97	1.85(0.62)	6.449	-	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units, a Unable to take a accurate measurement because the tablets were too soft to handle.

Table 7 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :TABLETTOSE + 3% EXPLOTAB

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	2.84(0.68)	0	1.00	2.84(0.68)	0	1.00	2.84(0.68)	0	1.00	2.84(0.68)
	6	-0.151	1.31	2.23(0.46)	-0.025	0.99	2.08(0.33)	0	0.99	1.91(0.28)	0.302	0.98	-a
1200	24	-0.152	1.31	2.30(0.46)	-0.050	0.99	1.87(0.36)	0	0.99	1.65(0.60)	1.101	0.95	-
	48	-0.126	1.31	2.18(0.76)	-0.126	0.99	2.72(0.60)	0.025	0.99	1.82(0.44)	1.707	0.93	-
	72	-0.277	1.31	2.31(0.50)	-0.025	0.99	2.37(0.33)	0.025	0.99	1.86(0.38)	2.409	0.90	-
	0	0	1.00	4.22(0.59)	0	1.00	4.22(0.59)	0	1.00	4.22(0.59)	0	1.00	4.22(0.59)
	6	-0.102	1.34	3.39(0.39)	-0.025	0.99	3.11(0.29)	0.026	0.99	2.98(0.27)	0.332	0.98	1.69(0.46)
1800	24	-0.177	1.34	3.31(0.56)	-0.051	0.99	3.01(0.43)	0.051	0.99	2.69(0.47)	1.145	0.93	-
	48	-0.177	1.34	3.50(0.66)	-0.076	0.99	3.38(0.42)	0.025	0.99	2.77(0.39)	1.822	0.91	-
	72	-0.203	1.34	3.18(0.67)	-0.102	0.99	3.22(0.47)	0.076	0.98	3.01(0.30)	2.502	0.90	-
	0	0	1.00	4.95(0.55)	0	1.00	4.95(0.55)	0	1.00	4.95(0.55)	0	1.00	4.95(0.55)
	6	-0.150	1.00	4.43(0.80)	-0.025	0.98	3.89(0.58)	0.051	0.99	3.99(0.57)	0.421	0.98	2.54(0.32)
2400	24	-0.125	0.99	4.85(0.53)	-0.025	0.99	4.32(0.62)	0.052	0.98	4.03(0.50)	1.179	0.93	-
	48	-0.150	0.99	4.62(0.39)	-0.025	0.99	4.39(0.56)	0.050	0.99	3.94(0.42)	1.933	0.91	-
	72	-0.201	0.99	4.83(0.52)	-0.050	0.99	4.40(0.42)	0.995	0.99	3.95(0.59)	2.633	0.90	-
	0	0	1.00	6.30(0.81)	0	1.00	6.30(0.81)	0	1.00	6.30(0.81)	0	1.00	6.30(0.81)
	6	-0.123	0.98	5.52(0.40)	0.025	0.99	5.13(0.78)	0.074	0.99	4.61(0.45)	0.446	0.97	2.86(0.36)
3000	24	-0.173	0.99	5.95(0.51)	-0.025	0.99	5.19(0.69)	0.099	0.99	5.02(0.66)	1.307	0.93	-
	48	-0.148	0.99	5.89(0.44)	-0.049	0.99	5.20(0.58)	0.099	0.99	4.60(0.70)	1.979	0.90	-
	72	-0.198	0.99	5.68(0.64)	-0.025	0.99	5.47(0.60)	0.123	0.99	4.78(0.32)	3.014	0.87	-

FORMULATION :TABLETTOSE + 6% EXPLOTAB

	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.224	0.98	-	-0.084	0.99	-	0.028	0.99	-	0.559	0.96	-
1200	24	-0.336	0.99	-	-0.113	0.99	-	0.056	0.98	-	1.842	-	-
	48	-0.339	0.99	-	-0.003	0.99	-	0.084	0.98	-	2.998	-	-
	72	-0.196	0.99	-	-0.112	0.99	-	0.112	0.98	-	4.321	-	-
	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.193	0.99	-	-0.055	0.99	-	0.025	0.98	-	0.074	0.94	-
1800	24	-0.277	0.99	-	-0.083	0.99	-	0.110	0.97	-	1.864	-	-
	48	-0.331	0.99	-	-0.089	0.99	-	0.111	0.97	-	3.112	-	-
	72	-0.165	0.99	-	-0.083	0.99	-	0.165	0.97	-	4.432	-	-
	0	0	1.00	1.39(0.71)	0	1.00	1.39(0.71)	0	1.00	1.39(0.71)	0	1.00	1.39(0.71)
	6	-0.137	0.99	1.23(0.55)	-0.055	0.99	-	0.136	0.98	-	0.607	0.95	-
2400	24	-0.273	0.99	1.88(0.49)	-0.082	0.99	1.97(0.44)	0.218	0.97	-	2.053	0.90	-
	48	-0.328	0.99	2.00(0.48)	-0.055	0.99	1.67(0.74)	0.192	0.98	-	3.185	-	-
	72	-0.191	0.99	-	-0.055	0.99	0.57(0.19)	0.218	0.97	-	4.386	-	-
	0	0	1.00	2.43(0.74)	0	1.00	2.43(0.74)	0	1.00	2.43(0.74)	0	1.00	2.43(0.74)
	6	-0.135	1.00	1.56(0.87)	-0.027	0.99	1.50(0.56)	0.189	0.99	1.17(0.49)	0.081	0.95	-
3000	24	-0.242	1.00	2.30(0.45)	-0.054	0.99	2.33(0.34)	0.268	0.97	-	2.174	0.89	-
	48	-0.323	1.00	2.22(0.46)	-0.027	0.99	2.16(0.49)	0.269	0.97	-	3.459	-	-
	72	-0.215	1.00	1.42(0.76)	-0.054	0.99	-	0.243	0.96	-	4.641	-	-

Table 7 - con't

FORMULATION :TABLETTOSE + 5% EXPLOTAB

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
1200	0	0	1.00	1.67(0.73)	0	1.00	1.67(0.73)	0	1.00	1.67(0.73)	0	1.00	1.67(0.73)
	6	-0.271	0.98	-	-0.163	0.99	-	0	0.98	-	1.225	0.73	-
	24	-0.488	0.98	-	-0.136	0.99	-	0.055	0.98	-	3.058	-	-
	48	-0.625	0.98	-	-0.136	0.99	-	0.055	0.98	-	4.381	-	-
	72	-0.602	0.99	-	-0.189	0.99	-	0.054	0.97	-	5.329	-	-
1800	0	0	1.00	2.10(0.73)	0	1.00	2.10(0.73)	0	1.00	2.10(0.73)	0	1.00	2.10(0.73)
	6	-0.190	0.98	-	-0.082	0.99	1.45(0.31)	1.144	0.99	-	1.337	0.77	-
	24	-0.461	0.98	-	-0.108	0.98	1.07(0.29)	0.109	0.97	-	3.025	-	-
	48	-0.594	0.98	-	-0.082	0.99	-	0.137	0.97	-	4.845	-	-
	72	-0.601	0.98	-	-0.134	0.99	-	0.109	0.96	-	5.219	-	-
2400	0	0	1.00	2.05(0.76)	0	1.00	2.05(0.76)	0	1.00	2.05(0.76)	0	1.00	2.05(0.76)
	6	-0.163	0.99	1.54(0.51)	-0.054	0.99	1.36(0.62)	0.108	0.98	-	1.225	0.77	-
	24	-0.434	0.98	1.63(0.60)	-0.081	0.99	2.09(0.58)	0.136	0.98	-	3.244	-	-
	48	-0.570	0.99	1.29(0.57)	-0.109	0.99	1.09(0.48)	0.163	0.97	-	4.659	-	-
	72	-0.570	0.99	1.34(0.42)	-0.108	0.99	1.54(0.70)	0.163	0.97	-	5.482	-	-
3000	0	0	1.00	3.23(0.74)	0	1.00	3.23(0.74)	0	1.00	3.23(0.74)	0	1.00	3.23(0.74)
	6	0.135	1.00	2.30(0.41)	-0.053	1.00	2.72(0.63)	0.027	0.98	1.98(0.52)	1.185	0.93	-
	24	-0.456	0.99	2.42(0.20)	-0.054	1.00	2.40(0.81)	0.241	0.98	2.09(0.49)	3.133	-	-
	48	-0.539	1.00	2.60(0.41)	-0.054	1.00	2.66(0.61)	0.243	0.98	1.22(0.44)	5.012	-	-
	72	-0.643	0.99	2.24(0.67)	-0.108	0.99	2.93(0.70)	0.268	0.97	1.64(0.57)	5.979	-	-

FORMULATION :TABLETTOSE + 12% EXPLOTAB

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
1200	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.118	0.96	-	0.029	0.97	-	0.147	0.95	-	0.943	-	-
	24	-0.322	0.97	-	-0.029	0.97	-	0.322	0.95	-	2.909	-	-
	48	-0.533	0.98	-	-0.029	0.97	-	0.352	0.95	-	4.564	-	-
	72	-0.569	0.97	-	-0.148	0.96	-	0.381	0.95	-	6.609	-	-
1800	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.140	0.96	-	0.139	0.96	-	0.307	0.95	-	1.136	0.93	-
	24	-0.336	0.97	-	0.056	0.97	-	0.420	0.95	-	3.191	-	-
	48	-0.563	0.98	-	0	0.96	-	0.391	0.95	-	4.782	-	-
	72	-0.532	0.97	-	0	0.97	-	0.364	0.95	-	6.769	-	-
2400	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.113	0.97	-	0.169	0.97	-	0.419	0.98	-	1.461	0.91	-
	24	-0.029	0.96	-	0.141	0.97	-	0.503	0.94	-	3.422	-	-
	48	-0.447	0.98	-	0.057	0.96	-	0.499	0.94	-	4.849	-	-
	72	-0.434	0.98	-	0.056	0.96	-	0.477	0.94	-	6.989	-	-
3000	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	0	0.97	-	0.225	0.96	-	0.577	0.98	-	1.517	0.90	-
	24	-0.168	0.97	-	0.197	0.96	-	0.563	0.95	-	3.749	-	-
	48	-0.476	0.98	-	0.141	0.96	-	0.564	0.95	-	5.521	-	-
	72	-0.421	0.97	-	0.084	0.97	-	0.591	0.94	-	7.562	-	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Stroug-Cobb-Arner Units. a Unable to take a accurate measurement because the tablets were too soft too handle.

Table 8 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :EMCOMPRESS + 3% STARCH

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	3.61(0.65)	0	1.00	3.61(0.65)	0	1.00	3.61(0.65)	0	1.00	3.61(0.65)
	6	-0.158	1.00	4.26(0.43)	-0.079	1.00	3.46(0.48)	0	1.00	3.49(0.60)	0.201	0.99	2.24(0.36)
1200	24	-0.183	1.00	4.25(0.26)	-0.079	1.00	3.72(0.30)	-0.026	1.00	3.54(0.59)	0.317	0.99	1.09(0.75)
	48	-0.159	1.00	4.14(0.60)	-0.106	1.00	3.63(0.36)	-0.026	1.00	3.56(0.39)	0.421	0.98	0.94(0.54)
	72	-0.175	1.00	3.70(0.44)	-0.079	1.00	3.65(0.18)	-0.026	1.00	3.73(0.34)	0.343	0.98	-a
	0	0	1.00	5.45(0.59)	0	1.00	5.45(0.59)	0	1.00	5.45(0.59)	0	1.00	5.45(0.59)
	6	-0.159	1.00	5.35(0.63)	-0.079	1.00	5.16(0.53)	0	1.00	4.98(0.32)	0.186	0.99	2.97(0.49)
1800	24	-0.212	0.99	5.54(0.44)	-0.079	1.01	5.17(0.22)	0	1.00	5.15(0.62)	0.291	0.98	2.14(0.40)
	48	-0.212	1.00	5.82(0.93)	-0.079	1.00	5.47(0.58)	-0.026	1.01	6.43(0.71)	0.344	0.98	1.61(0.69)
	72	-0.237	1.00	5.82(0.54)	-0.106	1.00	4.83(0.68)	-0.053	1.00	5.14(0.51)	0.341	0.98	1.74(0.74)
	0	0	1.00	7.10(0.40)	0	1.00	7.10(0.40)	0	1.00	7.10(0.40)	0	1.00	7.10(0.40)
	6	-0.132	1.00	6.94(0.37)	-0.053	1.00	7.06(0.30)	0	1.00	6.73(0.41)	0.184	0.99	4.28(0.25)
2400	24	-0.184	1.00	7.29(0.59)	-0.079	1.00	7.29(0.29)	-0.026	1.00	6.82(0.29)	0.316	0.99	3.60(0.38)
	48	-0.211	1.00	6.87(0.52)	-0.079	1.00	6.90(0.84)	0	1.00	4.73(0.50)	0.342	0.98	2.83(0.53)
	72	-0.211	1.00	7.33(0.63)	-0.105	1.00	7.00(0.63)	-0.026	1.00	7.20(0.52)	0.369	0.98	2.83(0.45)
	0	0	1.00	7.91(1.01)	0	1.00	7.91(1.01)	0	1.00	7.91(1.01)	0	1.00	7.91(1.01)
	6	-0.132	1.00	7.87(0.41)	-0.052	1.00	7.87(0.44)	0	1.00	7.63(0.46)	0.158	0.99	5.02(0.34)
3000	24	-0.185	1.00	8.44(0.62)	-0.079	1.00	8.42(0.42)	0	1.00	7.98(0.54)	0.317	0.99	4.14(0.18)
	48	-0.184	1.00	8.31(1.01)	-0.079	1.00	8.35(0.63)	-0.026	1.00	7.35(0.68)	0.344	0.98	3.65(0.38)
	72	-0.236	1.00	8.97(0.30)	-0.079	1.00	8.58(1.10)	-0.026	1.00	7.51(0.69)	0.397	0.98	3.56(0.28)

FORMULATION :EMCOMPRESS + 6% STARCH

	0	0	1.00	2.88(0.61)	0	1.00	2.88(0.61)	0	1.00	2.80(0.61)	0	1.00	2.80(0.61)
	6	-0.163	1.00	2.80(0.42)	-0.081	1.00	3.01(0.63)	0.027	1.00	2.69(0.40)	0.326	0.99	1.37(0.76)
1200	24	-0.272	1.00	3.12(0.54)	-0.082	1.00	3.14(0.28)	0.059	1.00	2.84(0.34)	0.435	0.97	0.79(0.32)
	48	-0.300	1.00	3.14(0.47)	-0.136	1.00	3.17(0.56)	0.027	1.01	2.81(0.49)	0.488	0.96	-
	72	-0.300	0.99	3.03(0.48)	-0.136	1.00	3.41(0.60)	0	1.01	3.02(0.51)	0.759	0.96	-
	0	0	1.00	4.39(0.20)	0	1.00	4.39(0.20)	0	1.00	4.39(0.20)	0	1.00	4.39(0.20)
	6	-0.163	1.00	4.35(0.35)	-0.054	1.00	4.20(0.35)	0.054	1.00	3.83(0.57)	0.299	0.98	1.64(0.90)
1800	24	-0.298	1.00	4.18(0.68)	-0.136	1.00	4.19(0.38)	0	1.01	3.83(0.63)	0.461	0.97	0.80(0.61)
	48	-0.299	1.00	4.18(0.60)	-0.109	1.00	4.23(0.49)	0.027	1.01	4.22(0.44)	0.541	0.97	-
	72	-0.298	0.99	4.11(0.42)	-0.136	1.00	3.87(0.28)	0	1.00	4.00(0.32)	0.732	0.95	-
	0	0	1.00	5.73(0.77)	0	1.00	5.73(0.77)	0	1.00	5.73(0.77)	0	1.00	5.73(0.77)
	6	-0.213	1.00	5.66(0.46)	-0.080	1.00	5.86(0.34)	0	1.00	5.51(0.43)	0.321	0.98	2.92(0.51)
2400	24	-0.293	1.00	5.57(0.52)	-0.107	1.00	5.70(0.68)	0	1.00	5.31(0.56)	0.506	0.97	2.45(0.22)
	48	-0.318	1.00	5.94(0.60)	-0.134	1.00	5.90(0.48)	0.053	1.01	5.38(0.35)	0.532	0.96	1.90(0.32)
	72	-0.345	1.00	5.80(0.59)	-0.134	1.00	5.40(0.37)	0	0.99	5.20(0.63)	0.689	0.95	1.41(0.58)
	0	0	1.00	6.73(0.96)	0	1.00	6.73(0.96)	0	1.00	6.73(0.96)	0	1.00	6.73(0.96)
	6	-0.212	0.99	6.82(0.53)	-0.080	1.00	6.79(0.51)	0	0.99	5.98(0.46)	0.318	0.98	3.73(0.32)
3000	24	-0.344	1.00	6.39(0.77)	-0.132	1.00	6.59(0.55)	0	1.00	5.31(0.62)	0.582	0.96	2.74(0.50)
	48	-0.371	1.00	6.70(0.72)	-0.132	1.00	6.89(0.52)	0	1.00	5.06(0.76)	0.634	0.96	2.03(0.54)
	72	-0.370	0.99	6.43(0.74)	-0.158	1.00	6.84(0.66)	0	1.00	5.66(0.61)	0.746	0.95	1.78(0.75)

Table 8 -con't

FORMULATION :EMCOMPRESS + 9% STARCH

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
	0	0	1.00	1.89(0.52)	0	1.00	1.89(0.52)		1.00	1.89(0.52)	0	1.00	1.89(0.52)
	6	-0.217	1.01	1.49(0.58)	-0.107	1.01	1.91(0.56)	0	1.01	1.42(0.66)	0.429	0.97	-
1200	24	-0.456	1.01	1.31(0.62)	-0.163	1.01	1.27(0.72)	0.027	1.00	1.42(0.59)	0.891	0.95	-
	48	-0.434	1.01	1.92(0.74)	-0.135	1.01	2.12(0.52)	0.027	1.01	1.57(0.59)	0.893	0.95	-
	72	-0.484	1.00	1.93(0.72)	-0.162	1.00	1.58(0.64)	0	1.01	1.82(0.56)	0.929	0.95	-
	0	0	1.00	3.41(0.62)	0	1.00	3.41(0.62)	0	1.00	3.41(0.62)	0	1.00	3.41(0.62)
	6	-0.214	1.00	3.26(0.51)	-0.080	1.01	3.35(0.61)	0.027	1.00	2.95(0.67)	0.374	0.98	-
1800	24	-0.452	1.00	3.21(0.46)	-0.107	1.01	3.73(0.70)	0.027	1.00	3.25(0.47)	0.854	0.95	-
	48	-0.427	1.01	3.19(0.21)	-0.134	1.00	3.30(0.62)	0.027	1.00	3.00(0.74)	0.935	0.94	-
	72	-0.479	1.00	3.43(0.55)	-0.134	1.01	3.21(0.43)	0	1.00	3.28(0.26)	0.933	0.95	-
	0	0	1.00	4.96(0.65)	0	1.00	4.96(0.65)	0	1.00	4.96(0.65)	0	1.00	4.96(0.65)
	6	-0.235	1.00	4.67(0.41)	-0.105	1.01	5.05(0.26)	0	1.00	4.94(0.20)	0.393	0.99	2.21(0.62)
2400	24	-0.471	1.01	4.08(0.26)	-0.078	1.01	5.37(0.60)	0	1.00	4.73(0.36)	0.786	0.96	-
	48	-0.471	1.01	4.74(0.28)	-0.131	1.01	5.24(0.33)	0	1.01	5.08(0.59)	0.967	0.95	-
	72	-0.496	1.00	4.78(0.31)	-0.184	1.00	5.20(0.29)	0	1.00	4.74(0.44)	0.914	0.94	1.40(0.09)
	0	0	1.00	6.13(0.50)	0	1.00	6.13(0.50)	0	1.00	6.13(0.50)	0	1.00	6.13(0.50)
	6	-0.236	1.00	5.77(0.46)	-0.079	1.00	6.23(0.34)	0.026	1.00	6.32(0.44)	0.447	0.99	3.37(0.27)
3000	24	-0.446	1.00	5.69(0.43)	-0.132	1.00	6.52(0.35)	0	1.00	6.10(0.26)	0.894	0.95	1.44(0.51)
	48	-0.472	1.01	5.80(0.49)	-0.132	1.00	6.33(0.49)	0	1.00	6.23(0.43)	0.973	0.94	1.29(0.55)
	72	-0.501	1.01	6.08(0.38)	-0.183	1.00	6.26(0.26)	0	1.00	5.93(0.52)	0.944	0.94	1.33(0.67)

FORMULATION :EMCOMPRESS + 12% STARCH

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
	0	0	1.00	2.41(0.55)	0	1.00	2.41(0.55)	0	1.00	2.41(0.55)	0	1.00	2.41(0.55)
	6	-0.339	1.00	2.36(0.27)	-0.157	1.00	2.33(0.19)	0	1.00	2.03(0.46)	0.524	0.97	1.18(0.46)
1200	24	-0.368	1.00	2.19(0.12)	-0.183	1.00	2.32(0.14)	0.026	1.00	1.79(0.52)	1.075	0.94	-
	48	-0.680	1.00	1.98(0.52)	-0.183	1.01	2.00(0.62)	0.026	1.00	1.87(0.96)	1.262	0.92	-
	72	-0.680	1.00	1.92(0.49)	-0.210	1.01	2.31(0.27)	0	1.00	2.01(0.56)	1.361	0.92	-
	0	0	1.00	3.95(0.37)	0	1.00	3.95(0.37)	0	1.00	3.95(0.37)	0	1.00	3.95(0.37)
	6	-0.289	1.00	3.64(0.37)	-0.131	1.00	3.61(0.71)	0.026	1.00	3.75(0.64)	0.524	0.97	2.08(0.46)
1800	24	-0.605	1.00	3.36(0.64)	-0.188	1.00	3.77(0.38)	0.026	1.00	4.00(0.22)	1.133	0.93	-
	48	-0.682	1.00	3.23(0.37)	-0.184	1.00	3.70(0.61)	0.026	1.00	3.80(0.31)	1.288	0.91	-
	72	-0.710	1.00	3.29(0.51)	-0.210	1.00	3.79(0.83)	0	1.00	3.82(0.44)	1.368	0.91	-
	0	0	1.00	4.94(0.66)	0	1.00	4.94(0.66)	0	1.00	4.94(0.66)	0	1.00	4.94(0.66)
	6	-0.289	1.00	5.00(0.28)	-0.131	1.00	4.86(0.58)	0	1.00	5.06(0.57)	0.446	0.97	2.79(0.68)
2400	24	-0.579	1.00	4.77(0.29)	-0.158	1.00	5.02(0.59)	0	1.00	5.14(0.33)	1.131	0.94	-
	48	-0.632	1.00	4.80(0.31)	-0.184	1.00	5.33(0.38)	0.026	1.00	4.86(0.42)	1.339	0.92	-
	72	-0.683	1.00	4.79(0.40)	-0.210	1.00	5.44(0.40)	0	1.00	5.01(0.24)	1.339	0.91	-
	0	0	1.00	6.40(0.76)	0	1.00	6.40(0.76)	0	1.00	6.40(0.76)	0	1.00	6.40(0.76)
	6	-0.264	1.00	5.90(0.89)	-0.105	1.00	6.41(0.72)	0	1.00	6.02(0.75)	0.604	0.97	3.68(0.35)
3000	24	-0.580	1.00	5.54(0.64)	-0.105	1.00	6.67(0.69)	0.026	1.00	5.68(0.60)	1.129	0.94	2.07(0.27)
	48	-0.683	1.00	5.76(0.75)	-0.183	1.00	6.67(0.70)	0.026	1.00	6.16(0.23)	1.439	0.91	-
	72	-0.709	1.00	6.02(0.29)	-0.236	1.00	6.78(0.53)	0	1.00	6.64(0.46)	1.394	0.91	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units. a Unable to take a accurate measurement because the tablets were too soft too handle.

Table 9 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :TABLETTOSE + 3% STARCH

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	0.74(0.30)	0	1.00	0.74(0.30)	0	1.00	0.74(0.30)	0	1.00	0.74(0.30)
	6	-0.114	1.00	1.13(0.35)	-0.029	1.00	1.18(0.69)	0.085	1.00	-	0.315	0.99	-a
1200	24	-0.257	1.00	0.78(0.30)	-0.057	1.00	1.51(0.42)	0.086	1.00	1.43(0.34)	0.605	0.96	-
	48	-0.289	1.00	1.02(0.43)	-0.057	1.00	1.20(0.42)	0.143	1.00	1.34(0.56)	0.767	0.95	-
	72	-0.200	1.00	0.80(0.40)	-0.086	1.00	1.00(0.29)	0.144	0.99	-	0.685	0.94	-
	0	0	1.00	2.22(0.45)	0	1.00	2.22(0.45)	0	1.00	2.22(0.45)	0	1.00	2.2(0.45)
	6	-0.149	1.00	2.17(0.58)	-0.030	1.00	2.40(0.26)	0.089	1.00	2.19(0.35)	0.327	0.99	1.47(0.54)
1800	24	-0.266	1.00	2.47(0.62)	-0.030	1.00	2.56(0.43)	0.059	0.99	2.47(0.33)	0.658	0.96	-
	48	-0.296	1.00	2.11(0.89)	-0.030	1.00	1.99(0.44)	0.149	0.99	2.28(0.59)	0.701	0.95	-
	72	-0.209	1.00	2.52(0.29)	-0.030	1.00	2.15(0.65)	0.090	0.99	2.34(0.31)	0.805	0.93	-
	0	0	1.00	3.63(0.33)	0	1.00	3.63(0.33)	0	1.00	3.63(0.33)	0	1.00	3.63(0.33)
	6	-0.170	1.00	3.99(0.44)	-0.029	1.01	3.85(0.42)	0.113	1.00	4.06(0.33)	0.369	0.99	2.77(0.53)
2400	24	-0.255	1.00	3.82(0.63)	-0.028	1.00	3.86(0.40)	0.113	1.00	4.00(0.59)	0.738	0.96	1.93(0.33)
	48	-0.370	1.00	3.83(0.59)	0	1.00	3.87(0.47)	0.142	1.00	3.83(0.51)	0.849	0.95	0.87(0.29)
	72	-0.228	1.00	3.84(0.80)	-0.028	1.00	3.89(0.46)	0.143	1.00	4.09(0.38)	0.767	0.94	-
	0	0	1.00	5.03(0.52)	0	1.00	5.03(0.52)	0	1.00	5.03(0.52)	0	1.00	5.03(0.52)
	6	-0.139	1.00	5.10(0.49)	0.028	1.00	5.20(0.53)	0.083	1.00	5.03(0.52)	0.447	1.00	3.99(0.25)
3000	24	-0.279	1.00	4.90(0.63)	-0.028	1.01	4.77(0.98)	0.113	0.99	4.62(0.84)	0.702	0.97	2.60(0.47)
	48	-0.249	1.00	4.98(0.55)	0	1.00	4.89(0.45)	0.169	1.00	4.85(0.62)	0.926	0.94	1.93(0.49)
	72	-0.337	1.00	4.99(0.61)	-0.028	1.00	4.85(0.67)	0.113	0.99	5.04(0.50)	0.809	0.94	1.31(0.59)

FORMULATION :TABLETTOSE + 6% STARCH

	0	0	1.00	1.50(0.65)	0	1.00	1.50(0.65)	0	1.00	1.50(0.65)	0	1.00	1.50(0.65)
	6	-0.213	1.00	1.60(0.48)	-0.091	1.00	1.73(0.58)	0.031	1.00	1.58(0.65)	0.243	0.98	-
1200	24	-0.274	1.00	1.60(0.54)	-0.091	1.00	1.54(0.71)	0	1.00	1.32(0.22)	0.576	0.94	-
	48	-0.274	1.00	1.90(0.57)	-0.121	0.99	1.49(0.49)	0.068	1.00	1.48(0.48)	0.762	0.92	-
	72	-0.151	1.00	1.69(0.36)	-0.091	1.00	1.36(0.60)	0.068	1.00	1.71(0.41)	0.732	0.92	-
	0	0	1.00	2.93(0.32)	0	1.00	2.93(0.32)	0	1.00	2.93(0.32)	0	1.00	2.93(0.32)
	6	-0.150	1.00	2.76(0.98)	-0.030	1.00	2.68(0.45)	0.059	1.00	2.22(0.48)	0.269	0.98	1.22(0.37)
1800	24	-0.267	0.99	2.76(0.55)	-0.030	1.00	2.55(0.70)	0.059	1.00	2.59(0.34)	0.569	0.94	0.90(0.33)
	48	-0.239	1.00	2.43(0.54)	-0.012	0.99	2.67(0.41)	0.149	1.00	2.78(0.43)	0.778	0.93	-
	72	-0.150	1.00	2.24(0.18)	-0.030	1.00	2.56(0.53)	0.091	1.00	2.72(0.48)	0.774	0.92	0.64(0.21)
	0	0	1.00	3.59(0.56)	0	1.00	3.59(0.56)	0	1.00	3.59(0.56)	0	1.00	3.59(0.56)
	6	-0.237	1.00	3.31(0.61)	-0.029	1.00	3.82(0.97)	0.118	1.00	3.33(0.90)	0.297	0.99	1.82(0.55)
2400	24	-0.237	1.00	3.65(0.31)	-0.059	1.00	3.31(0.56)	0.059	1.00	3.34(0.59)	0.297	0.94	0.76(0.39)
	48	-0.531	0.99	3.38(0.62)	-0.088	1.00	3.40(0.47)	0.179	1.00	3.48(0.53)	0.856	0.94	1.00(0.46)
	72	-0.179	1.00	3.22(0.41)	-0.059	1.00	3.32(0.80)	0.118	1.00	3.42(0.59)	0.828	0.93	0.79(0.23)
	0	0	1.00	4.23(0.61)	0	1.00	4.23(0.61)	0	1.00	4.23(0.61)	0	1.00	4.23(0.61)
	6	-0.118	1.00	4.39(0.48)	0.029	1.00	4.53(0.45)	0.147	1.00	4.08(0.60)	0.325	0.98	2.66(0.45)
3000	24	-0.177	1.00	4.51(0.26)	-0.029	1.00	4.48(0.44)	0.118	1.00	4.22(0.40)	0.711	0.95	1.65(0.52)
	48	-0.177	1.00	4.31(0.31)	-0.059	1.00	4.30(0.32)	0.119	1.00	4.28(0.35)	0.828	0.93	-
	72	-0.118	1.00	4.45(0.41)	-0.030	1.00	4.17(0.57)	0.119	1.00	4.24(0.39)	0.882	0.93	1.29(0.36)

Table 9 con't

FORMULATION :TABLETTOSE + 9% STARCH

F	T	25% R.H. W	25% R.H. D	25% R.H. H	44% R.H. W	44% R.H. D	44% R.H. H	67% R.H. W	67% R.H. D	67% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
1200	0	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)
	6	-0.291	1.00	0.82(0.27)	-0.029	1.00	1.01(0.45)	0.087	1.00	1.46(0.53)	0.529	0.98	-
	24	-0.433	1.00	1.31(0.58)	-0.058	1.00	1.27(0.58)	0.116	1.00	0.88(0.59)	1.015	0.93	-
	48	-0.434	1.00	-	-0.058	1.00	1.22(0.46)	0.087	1.00	1.28(0.52)	1.226	0.91	-
	72	-0.499	1.00	0.54(0.09)	-0.117	1.00	-	0.117	1.00	1.05(0.43)	1.162	0.91	-
1800	0	0	1.00	2.16(0.71)	0	1.00	2.16(0.71)	0	1.00	2.16(0.71)	0	1.00	2.16(0.71)
	6	-0.232	1.00	2.00(0.30)	-0.029	1.00	2.26(0.45)	0.087	1.00	2.13(0.33)	0.523	0.98	1.30(0.56)
	24	-0.349	0.99	1.88(0.37)	-0.058	1.00	2.37(0.47)	0.115	1.00	2.00(0.57)	0.964	0.93	-
	48	-0.462	0.99	2.29(0.59)	-0.088	1.00	1.84(0.80)	0.116	1.00	2.20(0.51)	1.223	0.91	-
	72	-0.465	0.99	2.34(0.37)	-0.116	1.00	2.25(0.51)	0.146	1.00	2.50(0.50)	1.192	0.91	-
2400	0	0	1.00	3.44(0.67)	0	1.00	3.44(0.67)	0	1.00	3.44(0.67)	0	1.00	3.44(0.67)
	6	-0.202	0.99	3.63(0.17)	0	1.00	3.38(0.42)	0.086	1.00	3.52(0.41)	0.575	0.98	2.40(0.36)
	24	-0.374	0.99	3.33(0.32)	-0.058	1.00	3.56(0.52)	0.087	1.00	3.16(0.51)	1.064	0.94	0.76(0.30)
	48	-0.376	0.99	3.11(0.43)	-0.057	1.00	3.64(0.50)	0.144	1.00	3.26(0.54)	1.236	0.92	0.65(0.28)
	72	-0.431	1.00	3.54(0.40)	-0.086	1.00	3.45(0.59)	0.144	1.00	3.58(0.34)	1.302	0.91	-
3000	0	0	1.00	4.44(0.44)	0	1.00	4.44(0.44)	0	1.00	4.44(0.44)	0	1.00	4.44(0.44)
	6	-0.198	1.00	4.49(0.49)	0	1.00	4.25(0.53)	0.197	1.00	4.25(0.67)	0.564	0.98	3.13(0.51)
	24	-0.339	1.00	4.13(0.20)	0	1.00	4.35(0.48)	0.169	1.00	4.10(0.54)	1.068	0.94	1.75(0.45)
	48	-0.366	0.99	4.20(0.29)	-0.028	1.00	4.34(0.33)	0.169	1.00	4.32(0.24)	1.346	0.92	1.04(0.24)
	72	-0.423	1.00	4.33(0.18)	-0.028	1.00	4.32(0.58)	0.169	1.00	4.46(0.48)	1.383	0.90	-

FORMULATION :TABLETTOSE + 12% STARCH

F	T	W	D	H	W	D	H	W	D	H	W	D	H
1200	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.237	1.00	-	-0.059	1.00	0.77(0.37)	0.118	1.01	1.01(0.85)	0.646	0.98	-
	24	-0.177	1.00	0.87(0.59)	-0.118	1.00	1.06(0.47)	0.148	1.00	-	1.205	0.93	-
	48	-0.502	1.00	0.68(0.20)	-0.088	1.00	0.88(0.38)	0.208	1.00	-	1.506	0.91	-
	72	-0.559	1.00	0.80(0.71)	-0.059	1.00	-	0.206	0.99	-	1.301	0.90	-
1800	0	0	1.00	1.44(0.68)	0	1.00	1.44(0.68)	0.118	1.00	1.44(0.68)	0	1.00	1.44(0.68)
	6	-0.177	1.00	1.81(0.47)	-0.029	1.00	2.14(0.30)	0.207	1.00	1.64(0.66)	0.707	0.99	1.24(0.66)
	24	-0.412	0.99	1.56(0.45)	-0.059	1.00	1.78(0.77)	0.207	1.00	1.91(0.71)	1.209	0.94	0.70(0.29)
	48	-0.501	0.99	1.79(0.59)	-0.059	1.00	1.84(0.58)	0.207	1.00	2.00(0.68)	1.589	0.92	-
	72	-0.531	0.99	1.59(0.64)	-0.029	1.00	1.70(0.70)	0.295	1.00	1.98(0.69)	1.878	0.90	-
2400	0	0	1.00	3.09(0.68)	0	1.00	3.09(0.68)	0	1.00	3.09(0.68)	0	1.00	3.09(0.68)
	6	-0.202	0.99	2.88(0.46)	0	1.00	2.66(0.63)	0.173	1.00	3.24(0.42)	0.804	0.99	2.26(0.49)
	24	-0.437	0.99	2.64(0.43)	-0.029	1.00	2.79(0.63)	0.202	1.00	2.76(0.56)	1.209	0.94	1.04(0.38)
	48	-0.493	0.99	2.29(0.57)	0	1.00	2.80(0.67)	0.259	1.00	2.69(0.73)	1.647	0.91	-
	72	-0.433	1.00	2.51(0.78)	-0.029	1.00	2.80(0.54)	0.289	1.00	3.17(0.56)	1.869	0.90	-
3000	0	0	1.00	3.44(0.92)	0	1.00	3.44(0.92)	0	1.00	3.44(0.92)	0	1.00	3.44(0.92)
	6	-0.170	1.00	3.28(0.68)	-0.028	1.00	3.59(0.59)	0.227	1.00	3.65(0.60)	0.766	0.99	2.91(0.44)
	24	-0.395	1.00	3.38(0.52)	-0.056	1.00	3.72(0.33)	0.282	1.00	3.60(0.51)	1.251	0.94	1.52(0.45)
	48	-0.452	0.99	3.39(0.46)	0.028	1.00	3.73(0.31)	0.256	1.00	3.13(0.56)	1.675	0.91	-
	72	-0.537	1.00	3.20(0.62)	0	1.00	3.54(0.44)	0.285	1.00	3.59(0.48)	1.868	0.90	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units. a Unable to take a accurate measurement because the tablets were too soft too handle.

Table 10 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :EMCOMPRESS + 1% KOLLIDON CL

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
1200	0	0	1.00	3.21(0.37)	0	1.00	3.21(0.37)	0	1.00	3.21(0.37)	0	1.00	3.21(0.37)
	6	-0.139	1.00	3.10(0.55)	-0.054	1.00	2.95(0.58)	-0.027	1.00	3.10(0.43)	0.169	0.96	-a
	24	-0.191	1.00	3.28(0.68)	-0.082	1.00	3.02(0.57)	-0.027	1.00	3.39(0.98)	0.384	0.91	-
	48	-0.161	1.00	3.27(0.59)	-0.109	1.00	3.07(0.44)	-0.027	1.00	2.76(0.75)	0.459	0.91	-
	72	-0.193	1.00	3.33(0.47)	-0.108	1.01	3.26(0.48)	-0.055	1.00	3.01(0.35)	0.384	0.90	-
1800	0	0	1.00	4.34(0.39)	0	1.00	4.34(0.39)	0	1.00	4.34(0.39)	0	1.00	4.34(0.39)
	6	-0.133	1.00	4.26(0.44)	-0.027	1.00	4.26(0.45)	-0.027	1.00	4.27(0.53)	0.186	0.97	1.78(0.50)
	24	-0.160	1.00	4.63(0.54)	-0.053	1.00	4.27(0.48)	-0.027	1.00	4.27(0.47)	0.398	0.93	-
	48	-0.187	1.00	4.72(0.92)	-0.107	1.00	4.41(0.60)	-0.027	1.00	3.95(0.35)	0.454	0.91	-
	72	-0.133	1.00	4.47(0.57)	-0.106	1.01	4.46(0.55)	-0.053	1.00	4.48(0.35)	0.349	0.91	-
2400	0	0	1.00	5.67(0.54)	0	1.00	5.67(0.54)	0	1.00	5.67(0.54)	0	1.00	5.67(0.54)
	6	-0.105	1.00	5.55(0.81)	-0.053	1.00	5.84(0.57)	-0.026	1.00	6.02(0.58)	0.209	0.97	1.81(1.12)
	24	-0.184	1.00	6.35(0.35)	-0.079	1.00	5.90(0.53)	-0.026	1.00	5.25(1.12)	0.394	0.93	-
	48	-0.183	1.00	5.65(1.32)	-0.132	1.00	5.53(0.67)	-0.053	1.00	5.37(0.46)	0.395	0.93	-
	72	-0.131	1.00	6.14(0.85)	-0.105	1.00	5.36(0.73)	-0.052	1.00	6.10(0.60)	0.421	0.91	-
3000	0	0	1.00	7.36(0.66)	0	1.00	7.36(0.66)	0	1.00	7.36(0.66)	0	1.00	7.36(0.66)
	6	-0.104	1.00	6.58(0.68)	-0.078	1.00	6.61(0.90)	-0.026	1.00	6.65(0.58)	0.182	0.98	3.31(0.42)
	24	0.183	1.00	6.94(0.64)	-0.078	1.00	6.72(0.71)	-0.052	1.00	6.55(0.54)	0.389	0.94	1.50(0.46)
	48	-0.183	1.00	6.82(1.16)	-0.078	1.01	6.88(0.61)	-0.052	1.00	6.22(0.91)	0.469	0.93	-
	72	-0.156	1.00	6.45(1.17)	-0.130	1.00	6.76(0.77)	-0.078	1.00	6.30(1.67)	0.416	0.92	-

FORMULATION :EMCOMPRESS + 3% KOLLIDON CL

1200	0	0	1.00	2.18(0.51)	0	1.00	2.18(0.51)	0	1.00	2.18(0.51)	0	1.00	2.18(0.51)
	6	-0.328	1.01	2.45(0.49)	-0.166	1.01	2.47(0.34)	-0.054	1.01	1.55(0.86)	0.413	0.89	-
	24	0.484	1.01	2.22(0.69)	-0.248	1.01	2.03(0.44)	-0.082	1.00	1.88(0.85)	0.767	-	-
	48	-0.467	1.00	2.26(0.52)	-0.247	1.01	2.53(0.63)	-0.055	1.00	2.07(0.54)	0.985	-	-
	72	-0.629	1.01	2.47(0.68)	-0.330	1.01	1.94(0.72)	-0.110	1.00	2.09(0.53)	1.009	-	-
1800	0	0	1.00	3.40(0.42)	0	1.00	3.40(0.42)	0	1.00	3.40(0.42)	0	1.00	3.40(0.42)
	6	-0.349	1.00	3.31(0.88)	-0.188	1.01	3.08(0.54)	-0.054	1.01	2.65(0.76)	0.539	0.90	-
	24	-0.483	1.00	3.06(0.37)	-0.217	1.00	3.03(0.58)	-0.081	1.00	2.97(0.37)	0.779	-	-
	48	-0.486	1.00	3.19(0.46)	-0.268	1.00	2.94(0.45)	-0.054	1.00	2.78(0.21)	0.939	-	-
	72	-0.511	1.01	3.68(0.88)	-0.270	1.01	3.42(0.31)	-0.081	1.00	3.35(0.18)	0.942	-	-
2400	0	0	1.	4.41(0.62)	0	1.00	4.41(0.62)	0	1.00	4.41(0.62)	0	1.00	4.41(0.62)
	6	-0.316	1.00	4.09(0.34)	-0.184	1.00	4.22(0.48)	-0.052	1.00	4.14(0.14)	0.393	0.90	-
	24	-0.497	1.00	4.34(0.38)	-0.238	1.01	4.16(0.35)	-0.053	1.00	4.31(0.50)	0.765	-	-
	48	-0.522	1.01	4.07(0.34)	-0.290	1.01	4.57(0.23)	-0.026	1.00	3.98(0.47)	0.944	-	-
	72	-0.497	1.00	4.09(0.44)	-0.317	1.01	4.71(0.45)	-0.079	1.01	4.64(0.25)	0.996	-	-
3000	0	0	1.00	5.42(0.33)	0	1.00	5.42(0.33)	0	1.00	5.42(0.33)	0	1.00	5.42(0.33)
	6	-0.316	1.00	4.75(0.32)	-0.184	1.01	5.08(0.51)	-0.052	1.00	5.10(0.43)	0.417	0.91	-
	24	-0.522	1.00	4.97(0.77)	-0.235	1.00	5.16(0.41)	-0.052	1.00	5.34(0.45)	0.757	-	-
	48	-0.521	1.00	5.09(0.51)	-0.262	1.00	5.29(0.42)	-0.105	1.00	4.99(0.40)	0.996	-	-
	72	-0.522	1.00	4.85(0.63)	-0.313	1.00	5.12(0.61)	-0.105	1.00	5.00(0.54)	0.966	-	-

Table 10 -con't

FORMULATION :EMCOMPRESS + 5% KOLLIDON CL

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)	0	1.00	0.83(0.61)
	6	-0.477	1.02	-	-0.312	1.01	0.99(0.43)	-0.056	1.01	1.04(0.52)	0.704	0.83	-
1200	24	-0.736	1.02	-	-0.365	1.01	1.13(0.58)	-0.028	1.01	-	1.121	-	-
	48	-0.789	1.01	-	-0.422	1.01	-	-0.057	1.01	0.68(0.28)	1.654	-	-
	72	-0.789	1.02	1.20(0.43)	-0.480	1.01	1.19(0.80)	-0.112	1.00	0.79(0.31)	1.741	-	-
	0	0	1.00	1.62(0.40)	0	1.00	1.62(0.40)	0	1.00	1.62(0.40)	0	1.00	1.62(0.40)
	6	-0.473	1.01	2.48(0.44)	-0.309	1.01	1.62(0.65)	-0.055	1.01	1.90(0.47)	0.696	0.80	-
1800	24	-0.778	1.02	2.13(0.55)	-0.391	1.02	1.88(0.72)	-0.056	1.01	1.99(0.69)	0.978	-	-
	48	-0.810	1.01	2.13(0.51)	-0.697	1.01	2.31(0.62)	-0.056	1.01	1.90(0.61)	1.649	-	-
	72	-0.810	1.01	2.46(0.37)	-0.474	1.01	2.16(0.60)	-0.083	1.01	1.52(0.34)	1.699	-	-
	0	0	1.00	2.59(0.27)	0	1.00	2.59(0.27)	0	1.00	2.59(0.27)	0	1.00	2.59(0.27)
	6	-0.465	1.01	2.98(0.37)	-0.302	1.01	2.95(0.50)	-0.027	1.01	2.52(0.68)	0.655	0.83	-
2400	24	-0.765	1.01	2.92(0.56)	-0.385	1.01	3.01(0.39)	-0.027	1.00	2.47(0.37)	1.509	-	-
	48	-0.795	1.01	2.92(0.25)	-0.438	1.01	2.97(0.37)	-0.082	1.00	2.53(0.25)	1.637	-	-
	72	-0.794	1.01	2.95(0.71)	-0.465	1.01	3.09(0.52)	-0.109	1.00	2.87(0.41)	1.719	-	-
	0	0	1.00	3.73(0.25)	0	1.00	3.73(0.25)	0	1.00	3.73(0.25)	0	1.00	3.73(0.25)
	6	-0.487	1.01	3.59(0.50)	-0.296	1.01	3.72(0.26)	-0.054	1.01	3.71(0.34)	0.649	0.83	-
3000	24	-0.789	1.01	3.61(0.32)	-0.405	1.01	3.75(0.01)	-0.054	1.00	3.28(0.46)	1.409	-	-
	48	-0.836	1.01	3.42(0.32)	-0.434	1.01	3.80(0.29)	-0.081	1.00	3.41(0.40)	1.685	-	-
	72	-0.816	1.01	3.94(0.52)	-0.461	1.01	3.64(0.44)	-0.108	1.00	3.80(0.32)	1.842	-	-

FORMULATION :EMCOMPRESS + 7% KOLLIDON CL

	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.560	1.01	-	-0.401	1.02	-	0.027	1.02	-	0.856	-	-
1200	24	-1.156	1.03	-	-0.559	1.01	-	0	1.01	-	1.721	-	-
	48	-1.248	1.03	-	-0.613	1.02	-	-0.053	1.01	-	2.257	-	-
	72	-1.123	1.03	-	-0.586	1.02	-	-0.027	1.01	-	1.985	-	-
	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.539	1.01	-	-0.385	1.01	0.77(0.24)	0	1.01	-	0.845	0.85	-
1800	24	-1.155	1.02	1.14(0.47)	-0.588	1.01	0.74(0.46)	0	1.01	-	1.751	-	-
	48	-1.235	1.02	0.77(0.25)	-0.619	1.01	-	-0.026	1.01	-	2.162	-	-
	72	-1.145	1.02	1.53(0.61)	-0.617	1.01	0.95(0.49)	-0.026	1.01	0.62(0.26)	2.008	-	-
	0	0	1.00	1.70(0.22)	0	1.00	1.70(0.22)	0	1.00	1.70(0.22)	0	1.00	-
	6	-0.552	1.01	1.83(0.60)	-0.402	1.01	1.85(0.39)	0	1.01	1.60(0.55)	0.704	0.88	-
2400	24	-1.153	1.02	2.12(0.79)	-0.604	1.01	2.13(0.24)	-0.050	1.00	2.04(0.77)	1.655	-	-
	48	-1.255	1.01	1.74(0.63)	-0.630	1.01	1.89(0.41)	-0.050	1.01	1.90(0.46)	2.345	-	-
	72	-1.176	1.02	2.06(0.35)	-0.653	1.01	2.08(0.50)	-0.050	1.00	1.70(0.50)	1.895	-	-
	0	0	1.00	2.08(0.42)	0	1.00	2.08(0.42)	0	1.00	2.08(0.42)	0	1.00	-
	6	-0.629	1.01	2.62(0.28)	-0.404	1.01	2.49(0.03)	-0.101	1.01	2.46(0.28)	0.629	0.81	-
3000	24	-1.126	1.02	2.38(0.31)	-0.653	1.01	2.54(0.30)	-0.100	1.01	2.58(0.28)	1.715	-	-
	48	-1.336	1.02	2.21(0.32)	-0.731	1.01	2.62(0.43)	-0.076	1.01	2.27(0.32)	2.405	-	-
	72	-1.235	1.02	2.11(0.54)	-0.710	1.01	2.32(0.32)	-0.101	1.01	2.24(0.15)	1.889	-	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units. @Unable to take a accurate measurement because the tablets were too soft of handle.

Table II Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :TABLETTOSE + 1% KOLLIDON CL

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	2.07(0.46)	0	1.00	2.07(0.46)	0	1.00	2.07(0.46)	0	1.00	2.07(0.46)
	6	-0.085	1.00	2.98(0.61)	-0.028	1.00	2.54(0.40)	0.028	1.00	2.36(0.30)	0.057	0.95	-a
1200	24	-0.085	1.00	2.39(0.39)	-0.028	1.00	2.48(0.52)	0	1.00	2.28(0.51)	0.428	0.94	-
	48	-0.057	1.00	2.57(0.26)	-0.028	1.00	2.56(0.48)	0.057	1.00	2.82(0.53)	0.484	0.93	-
	72	-0.057	1.00	2.16(0.52)	0	1.00	2.63(0.49)	0.028	1.00	2.22(0.67)	0.484	0.92	-
	0	0	1.00	3.66(0.48)	0	1.00	3.66(0.48)	0	1.00	3.66(0.48)	0	1.00	3.66(0.48)
	6	-0.112	0.99	4.10(0.41)	-0.029	1.00	3.83(0.45)	0	1.00	3.74(0.70)	0.056	0.94	1.72(0.39)
1800	24	-0.111	1.00	4.64(0.43)	-0.029	1.00	3.62(0.70)	0	1.00	3.54(0.58)	0.112	0.93	1.05(0.49)
	48	-0.112	1.00	4.34(0.60)	-0.029	1.00	4.01(0.37)	0.056	1.00	3.68(0.54)	0.501	0.92	-
	72	-0.083	1.00	4.14(0.62)	0	1.00	3.67(0.32)	0.056	1.00	3.86(0.72)	0.529	0.92	-
	0	0	1.00	5.11(0.57)	0	1.00	5.11(0.57)	0	1.00	5.11(0.57)	0	1.00	5.11(0.57)
	6	-0.055	1.00	5.90(0.71)	0	1.00	5.50(0.75)	0.027	1.00	5.34(0.54)	0.082	0.96	2.89(0.55)
2400	24	-0.109	1.00	5.77(0.67)	-0.027	1.00	5.77(0.47)	0.027	1.00	5.69(0.88)	0.109	0.93	2.64(0.49)
	48	-0.110	1.00	6.37(0.49)	0	1.00	5.83(0.47)	0.055	0.99	5.77(0.57)	0.494	0.92	1.26(0.49)
	72	-0.055	1.00	5.64(0.46)	-0.027	1.00	5.45(0.68)	0.055	1.00	5.84(0.84)	0.519	0.92	-
	0	0	1.00	6.17(1.01)	0	1.00	6.17(1.01)	0	1.00	6.17(1.01)	0	1.00	6.17(1.01)
	6	-0.054	1.00	6.24(0.82)	0	1.00	6.35(0.60)	0.080	1.00	6.14(0.84)	0.107	0.96	3.56(0.58)
3000	24	-0.107	1.00	7.20(1.00)	0	1.00	6.47(0.69)	0.054	1.00	6.57(0.54)	0.161	0.93	3.25(0.50)
	48	-0.054	1.00	7.17(0.56)	0	1.00	5.98(0.98)	0.081	1.00	6.28(0.84)	0.511	0.92	1.97(0.54)
	72	-0.054	1.00	6.58(0.58)	0	1.00	6.26(0.81)	0.054	1.00	6.58(1.18)	0.486	0.91	1.74(0.66)

FORMULATION :TABLETTOSE + 3% KOLLIDON CL

	0	0	1.00	1.16(0.39)	0	1.00	1.16(0.39)	0	1.00	1.16(0.39)	0	1.00	1.16(0.39)
	6	-0.166	0.99	1.83(0.39)	0.028	0.99	1.79(0.58)	0.110	0.98	1.48(0.33)	0.438	0.92	-
1200	24	-0.247	0.99	2.34(0.30)	0	0.99	2.14(0.52)	0.219	0.97	0.92(0.29)	1.069	0.86	-
	48	-0.276	0.99	2.24(0.33)	0.028	0.99	1.88(0.50)	0.247	0.97	1.18(0.46)	1.269	0.85	-
	72	-0.521	0.99	1.92(0.49)	-0.028	0.99	1.79(0.47)	0.164	0.97	1.10(0.43)	1.371	0.84	-
	0	0	1.00	3.31(0.38)	0	1.00	3.31(0.38)	0	1.00	3.31(0.38)	0	1.00	3.31(0.38)
	6	-0.137	0.99	3.46(0.61)	0.027	0.99	3.16(0.56)	0.082	0.98	2.16(0.58)	0.464	0.92	0.720.26
1800	24	-0.192	0.99	3.56(0.15)	0.027	0.99	3.27(0.54)	0.246	0.97	2.11(0.53)	1.093	0.85	-
	48	-0.246	0.99	3.47(0.29)	0.027	0.99	3.57(0.71)	0.219	0.97	2.02(0.68)	1.335	0.83	-
	72	-0.246	0.99	3.67(0.45)	-0.027	0.99	3.14(0.62)	0.192	0.97	2.63(0.73)	1.451	0.83	-
	0	0	1.00	4.66(0.91)	0	1.00	4.66(0.91)	0	1.00	4.66(0.91)	0	1.00	4.66(0.91)
	6	-0.105	0.99	5.57(0.66)	0.026	0.99	5.04(1.20)	0.158	0.98	4.21(0.58)	0.475	0.91	2.01(0.36)
2400	24	-0.186	0.99	4.85(0.81)	-0.026	0.99	4.60(0.32)	0.262	0.97	3.79(0.74)	1.084	0.84	-
	48	-0.238	0.99	5.30(0.38)	0.026	0.99	4.69(0.50)	0.264	0.97	3.98(0.28)	1.293	0.83	-
	72	-0.211	0.99	5.42(0.89)	0	0.99	4.97(0.88)	0.212	0.95	4.06(0.35)	1.453	0.82	-
	0	0	1.00	5.78(0.10)	0	1.00	5.78(0.10)	0	1.00	5.78(0.10)	0	1.00	5.78(0.10)
	6	-0.104	0.99	6.27(0.86)	0.052	0.99	5.55(0.53)	0.105	0.99	5.07)0.32)	0.522	0.93	2.47(0.46)
3000	24	-0.183	1.00	6.27(0.71)	0.026	0.99	5.72(0.80)	0.234	0.98	4.63(0.63)	1.121	0.84	-
	48	-0.209	1.00	7.09(0.48)	0.026	0.99	5.79(0.50)	0.234	0.97	4.73(0.61)	1.412	0.83	-
	72	-0.209	1.00	6.89(0.53)	-0.026	0.99	5.91(0.72)	0.208	0.96	4.74(0.76)	1.462	0.81	-

Table 11 - con't

FORMULATION :TABLETTOSE + 5% KOLLIDON CL

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	0.64(0.31)	0	1.00	0.64(0.31)	0	1.00	0.64(0.31)	0	1.00	0.64(0.31)
	6	-0.269	0.99	1.35(0.59)	-0.090	0.99	1.00(0.41)	0.149	0.97	-	0.835	0.83	-
1200	24	-0.420	0.99	1.23(0.62)	-0.060	0.98	1.01(0.49)	0.330	0.95	-	1.639	0.81	-
	48	-0.481	0.99	-	-0.060	0.99	1.17(0.21)	0.330	0.95	-	2.089	0.78	-
	72	-0.390	0.99	1.43(0.51)	-0.060	0.98	0.99(0.39)	0.418	0.94	-	2.301	0.77	-
	0	0	1.00	2.46(0.27)	0	1.00	2.46(0.27)	0	1.00	2.46(0.27)	0	1.00	2.46(0.27)
	6	-0.149	0.98	2.27(0.60)	0.030	0.98	2.34(0.54)	0.179	0.97	1.84(0.46)	0.864	0.85	-
1800	24	-0.388	0.98	2.47(0.55)	0.090	0.98	2.41(0.57)	0.389	0.95	1.12(0.60)	1.639	0.81	-
	48	-0.299	0.98	2.45(0.39)	0.060	0.98	2.10(0.54)	0.359	0.95	1.18(0.48)	2.235	0.77	-
	72	-0.329	0.98	2.79(0.80)	0.119	0.98	2.19(0.58)	0.419	0.95	1.42(0.38)	2.382	0.75	-
	0	0	1.00	3.20(0.57)	0	1.00	3.20(0.57)	0	1.00	3.20(0.57)	0	1.00	3.20(0.57)
	6	-0.147	0.98	3.39(0.28)	0.059	0.99	3.11(0.30)	0.176	0.97	2.42(0.27)	0.877	0.85	-
2400	24	-0.293	98	3.34(0.22)	0.059	0.98	3.05(0.41)	0.352	0.95	2.19(0.09)	1.604	0.78	-
	48	-0.382	0.98	3.70(0.46)	0.059	0.99	3.32(0.70)	0.411	0.95	2.31(0.79)	2.278	0.76	-
	72	-0.351	0.98	3.53(0.84)	0.059	0.99	3.27(0.39)	0.411	0.95	2.22(0.50)	2.277	0.73	-
	0	0	1.00	4.15(0.45)	0	1.00	4.15(0.45)	0	1.00	4.15(0.45)	0	1.00	4.15(0.45)
	6	-0.117	0.99	4.14(0.61)	0.029	0.99	4.27(0.20)	0.202	0.98	3.34(0.39)	0.901	0.85	-
3000	24	-0.292	0.99	4.05(0.78)	0.058	0.99	4.04(0.67)	0.348	0.97	2.66(0.44)	1.654	0.79	-
	48	-0.378	0.99	4.64(0.490	0.029	0.99	3.96(0.73)	0.375	0.95	2.66(0.54)	2.231	0.75	-
	72	-0.349	0.99	4.35(0.51)	0.029	0.99	4.33(0.33)	0.464	0.95	2.94(0.48)	2.378	0.73	-

FORMULATION :TABLETTOSE + 7% KOLLIDON CL

	0	0	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-
	6	-0.348	0.97	-	-0.115	0.96	-	0.173	0.94	-	0.891	0.83	-
1200	24	-0.694	0.97	-	-0.231	0.96	-	0.375	0.92	-	1.908	0.77	-
	48	-0.754	0.96	-	-0.232	0.95	-	0.405	0.91	-	2.684	0.74	-
	72	-0.751	0.97	-	-0.231	0.96	-	0.347	0.91	-	3.055	-	-
	0	0	1.00	1.32(0.49)	0	0	1.32(0.49)	0	1.00	1.32(0.49)	0	1.00	
	6	-0.202	0.96	0.64(0.38)	0.086	0.95	-	0.145	0.95	-	0.952	0.82	-
1800	24	-0.491	0.96	-	-0.173	0.95	0.88(0.36)	0.374	0.94	-	1.991	0.76	-
	48	-0.690	0.96	-	-0.173	0.95	1.19(0.20)	0.346	0.93	-	2.682	0.75	-
	72	-0.662	0.96	1.17(0.31)	-0.144	0.96	1.19(0.47)	0.805	0.92	-	3.051	-	-
	0	0	1.00	2.61(0.29)	0	1.00	2.61(0.29)	0	1.00	2.61(0.29)	0	1.00	
	6	0	0.97	2.32(0.48)	-0.115	0.96	1.68(0.61)	0.461	0.95	-	1.098	0.84	
2400	24	-0.261	0.97	2.58(0.31)	0.029	0.96	1.86(0.25)	0.693	0.93	1.21(0.59)	2.135	0.74	-
	48	-0.375	0.97	2.13(0.46)	0	0.96	1.99(0.38)	0.694	0.92	1.06(0.37)	2.892	0.71	-
	72	-0.464	0.97	2.41(0.36)	0.116	0.96	2.06(0.54)	0.691	0.92	-	3.199	0.71	-
	0	0	1.00	4.61(0.89)	0	1.00	4.61(0.89)	0	1.00	4.61(0.89)	0	1.00	-
	6	-0.086	0.98	3.17(0.43)	0.173	0.96	2.46(0.57)	0.375	0.96	2.32(0.21)	1.238	0.81	
3000	24	-0.347	0.97	3.40(0.76)	0.116	0.97	2.71(0.51)	0.577	0.93	1.44(0.48)	2.269	0.72	
	48	-0.403	0.97	3.32(0.44)	0.116	0.97	2.96(0.22)	0.603	0.92	1.43(0.41)	2.908	0.72	-
	72	-0.403	0.97	3.20(0.61)	0.116	0.97	2.74(0.33)	0.665	0.92	1.88(0.31)	3.353	0.71	-

F = compressional force(pounds), T = time(hours), W = percent increase in weight, D = ratio of density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units. a Unable to ta accurate measurement because the tablets were too soft too handle.

Table 12 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :TABLETTOSE + 20% AVICEL PH101

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
	0	0	1.00	2.87(0.33)	0	1.00	2.87(0.33)	0	1.00	2.87(0.33)	0	1.00	2.87(0.33)
	6	-0.139	0.99	2.54(0.03)	-0.028	0.98	2.11(0.57)	0.056	0.98	2.25(0.08)	0.781	0.95	-a
1200	24	-0.335	0.98	2.43(0.21)	-0.112	0.98	1.89(0.52)	0.112	0.98	1.89(0.52)	1.198	0.94	-
	48	-0.390	0.98	2.96(0.42)	-0.051	0.99	2.52(0.40)	0.139	0.98	2.28(0.12)	1.594	0.92	-
	72	-0.391	0.98	2.69(0.50)	-0.112	0.98	2.42(0.24)	0.084	0.97	2.21(0.20)	1.701	0.91	-
	0	0	1.00	4.57(0.53)	0	1.00	4.57(0.53)	0	1.00	4.57(0.53)	0	1.00	4.57(0.53)
	6	-0.112	0.98	3.98(0.74)	0.028	0.99	4.07(0.26)	0.056	0.98	3.67(0.53)	0.751	0.95	2.18(0.20)
1800	24	-0.365	0.98	3.98(0.74)	-0.056	0.98	3.85(0.34)	0.139	0.98	3.68(0.44)	1.197	0.94	1.87(0.39)
	48	-0.390	0.99	4.22(0.83)	-0.056	0.99	4.04(0.48)	0.196	0.98	3.70(0.29)	1.586	0.92	1.06(0.31)
	72	-0.363	0.98	4.86(0.76)	-0.139	0.98	4.37(0.48)	0.139	0.97	3.63(0.48)	1.699	0.91	1.03(0.40)
	0	0	1.00	6.48(0.61)	0	1.00	6.48(0.61)	0	1.00	6.48(0.61)	0	1.00	6.48(0.61)
	6	-0.112	0.99	5.00(0.55)	0.056	0.99	5.26(0.33)	0.112	0.98	4.83(0.44)	0.781	0.96	3.10(0.29)
2400	24	-0.307	0.99	5.21(0.57)	0.028	0.99	5.43(0.47)	0.223	0.98	4.68(0.47)	1.227	0.94	2.42(0.19)
	48	-0.307	0.99	5.91(1.36)	0	0.99	4.95(0.52)	0.196	0.98	4.66(0.52)	1.618	0.92	1.56(0.45)
	72	-0.391	0.99	6.16(0.42)	0.028	0.98	5.47(0.42)	0.168	0.98	4.83(0.50)	1.728	0.91	1.66(0.38)
	0	0	1.00	7.41(1.10)	0	1.00	7.41(1.10)	0	1.00	7.41(1.10)	0	1.00	7.41(1.10)
	6	-0.084	0.99	6.74(0.75)	0.084	0.99	6.70(0.40)	0.139	0.99	5.99(0.39)	0.752	0.96	4.07(0.37)
3000	24	-0.307	0.99	6.68(0.83)	0.056	0.99	6.29(0.51)	0.139	0.99	5.90(0.42)	1.199	0.95	2.99(0.36)
	48	-0.391	0.99	6.69(0.83)	0.056	0.99	6.90(0.20)	0.195	0.98	6.01(0.24)	1.508	0.93	2.06(0.48)
	72	-0.419	0.99	7.07(0.33)	0.056	0.99	6.63(1.07)	0.241	0.98	6.14(0.39)	1.643	0.92	2.19(0.23)

FORMULATION :TABLETTOSE + 30% AVICEL PH101

	0	0	1.00	4.67(0.37)	0	1.00	4.67(0.37)	0	1.00	4.67(0.37)	0	1.00	4.67(0.37)
	6	-0.051	0.99	4.10(0.30)	-0.055	0.98	3.81(0.36)	0.138	0.98	3.47(0.28)	0.908	0.94	2.01(0.61)
1200	24	-0.442	0.99	4.27(0.46)	-0.112	0.98	3.76(0.41)	0.305	0.97	2.99(0.31)	1.847	0.91	-
	48	-0.582	0.99	4.28(0.39)	-0.137	0.98	3.87(0.46)	0.301	0.97	3.32(0.31)	2.259	0.90	-
	72	-0.522	0.98	4.10(0.26)	-0.165	0.99	3.70(0.35)	0.278	0.97	3.18(0.32)	2.039	0.90	-
	0	0	1.00	6.38(0.51)	0	1.00	6.38(0.51)	0	1.00	6.38(0.51)	0	1.00	6.38(0.51)
	6	-0.142	0.98	5.60(0.66)	0.028	0.98	5.69(0.38)	0.199	0.98	5.13(0.33)	0.962	0.95	3.47(0.19)
1800	24	-0.485	0.99	5.66(0.72)	-0.060	0.99	5.40(0.39)	0.339	0.98	4.74(0.54)	1.844	0.92	2.01(0.41)
	48	-0.596	0.99	6.48(0.35)	-0.114	0.98	5.51(0.38)	0.311	0.97	5.09(0.29)	2.294	0.90	1.65(0.23)
	72	-0.542	0.98	6.02(0.31)	-0.141	0.98	5.65(0.57)	0.341	0.97	5.03(0.27)	2.072	0.91	1.92(0.57)
	0	0	1.00	9.04(0.44)	0	1.00	9.04(0.44)	0	1.00	9.04(0.44)	0	1.00	9.04(0.44)
	6	-0.089	0.99	7.67(1.31)	-0.027	0.99	7.70(0.32)	0.214	0.98	6.99(0.41)	1.007	0.96	4.93(0.43)
2400	24	-0.487	0.99	8.15(0.79)	-0.080	0.99	4.80(0.79)	0.424	0.98	6.37(0.55)	1.873	0.93	2.78(0.24)
	48	-0.589	0.99	8.67(0.29)	-0.133	0.99	8.05(0.56)	0.401	0.98	6.81(0.32)	2.301	0.91	2.46(0.17)
	72	-0.531	0.99	8.67(0.89)	-0.108	0.99	7.35(0.38)	0.378	0.98	6.34(0.74)	2.142	0.91	2.58(0.25)
	0	0	1.00	9.81(1.00)	0	1.00	9.81(1.00)	0	1.00	9.81(1.00)	0	1.00	9.81(1.00)
	6	-0.109	0.99	9.60(1.34)	0.027	0.99	8.81(0.90)	0.162	0.98	8.58(0.64)	0.999	0.96	5.77(0.53)
3000	24	-0.512	0.99	8.91(1.48)	0.027	0.99	7.83(0.91)	0.378	0.99	7.91(0.36)	1.951	0.93	3.36(0.38)
	48	-0.594	0.99	9.87(0.84)	0	0.99	9.34(0.64)	0.351	0.98	8.25(0.97)	2.439	0.92	3.10(0.38)
	72	-0.863	0.99	9.66(1.12)	-0.027	0.99	9.45(0.52)	0.296	0.98	7.83(0.52)	2.163	0.92	3.42(0.15)

Table 12 - con't

FORMULATION :TABLETTOSE + 40% AVICEL PH101

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
1200	0	0	1.00	7.44(0.84)	0	1.00	7.44(0.84)	0	1.00	7.44(0.84)	0	1.00	7.44(0.84)
	6	-0.057	0.99	6.28(0.45)	0	0.99	6.33(0.90)	0.228	0.98	5.30(0.99)	1.011	0.95	3.59(0342)
	24	-0.481	0.99	7.36(0.43)	0	0.99	6.25(0.59)	0.394	0.98	5.12(0.53)	1.985	0.93	2.39(0.23)
	48	-0.609	0.99	6.38(0.64)	-0.200	0.99	6.32(0.65)	0.515	0.98	5.12(0.53)	2.779	0.90	-
	72	-0.712	0.99	6.87(0.58)	-0.261	0.99	7.25(2.07)	0.385	0.98	5.31(0.44)	3.222	0.89	-
1800	0	0	1.00	10.40(0.89)	0	1.00	10.40(0.89)	0	1.00	10.40(0.89)	0	1.00	10.40(0.89)
	6	-0.028	0.99	9.29(1.24)	-0.027	0.99	8.99(0.50)	0.241	0.99	8.09(1.10)	1.077	0.96	5.40(0.58)
	24	-0.478	0.99	9.78(0.49)	-0.054	0.99	9.71(0.74)	0.378	0.99	8.01(0.63)	2.102	0.93	3.69(0.14)
	48	-0.589	0.99	9.56(1.17)	-0.163	0.99	9.08(1.61)	0.429	0.99	8.07(0.48)	2.827	0.91	2.59(0.22)
	72	-0.670	0.99	10.47(0.37)	-0.109	0.99	8.78(2.15)	0.454	0.99	7.68(0.82)	3.214	0.89	2.23(0.16)
2400	0	0	1.00	13.25(0.71)	0	1.00	13.25(0.71)	0	1.00	13.25(0.71)	0	1.00	13.25(0.71)
	6	0	0.99	12.26(0.87)	0.084	0.99	11.40(1.67)	0.377	0.98	10.74(0.89)	1.191	0.96	6.92(0.22)
	24	-0.048	0.99	11.61(1.04)	0	0.99	12.20(0.86)	0.413	0.99	10.39(0.88)	2.147	0.94	4.83(0.51)
	48	-0.059	0.99	12.30(0.83)	-0.056	0.99	11.51(0.74)	0.447	0.99	9.27(0.66)	2.837	0.92	3.42(0.24)
	72	-0.067	0.99	12.42(0.83)	-0.028	0.99	10.91(1.22)	0.443	0.98	9.76(0.60)	3.215	0.90	2.95(0.32)
3000	0	0	1.00	14.64(0.71)	0	1.00	14.64(0.71)	0	1.00	14.64(0.71)	0	1.00	14.64(0.71)
	6	-0.109	0.99	12.12(1.13)	0.164	0.99	13.11(0.62)	0.136	1.00	11.74(0.78)	1.136	0.97	8.36(0.72)
	24	-0.488	0.99	14.80(0.67)	0.135	1.00	13.37(0.80)	0.326	0.99	11.74(0.62)	2.102	0.94	5.21(0.24)
	48	-0.979	0.99	14.14(1.01)	0.055	1.00	12.93(1.94)	0.433	0.98	10.89(0.43)	2.856	0.92	4.06(0.34)
	72	-0.708	0.99	13.70(0.71)	0.027	1.00	12.93(2.56)	0.409	0.98	10.40(0.99)	3.276	0.91	3.49(0.22)

FORMULATION :TABLETTOSE + 50% AVICEL PH101

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
1200	0	0	1.00	9.26(0.73)	0	1.00	9.26(0.73)	0	1.00	9.26(0.73)	0	1.00	9.26(0.73)
	6	-0.056	0.99	8.71(1.44)	-0.084	0.99	8.80(1.64)	0.424	0.99	8.04(0.96)	1.041	0.95	5.29(0.44)
	24	-0.617	0.99	10.21(1.33)	-0.256	0.99	8.39(0.61)	0.713	0.98	7.20(0.98)	2.396	0.92	3.40(0.32)
	48	-0.906	0.99	9.63(0.84)	-0.283	0.99	8.67(1.44)	0.739	0.98	7.01(0.84)	3.253	0.91	2.75(0.29)
	72	-0.849	0.99	9.60(1.02)	-0.284	0.99	8.11(1.78)	0.821	0.98	6.75(0.70)	3.883	0.88	1.93(0.69)
1800	0	0	1.00	13.61(1.19)	0	1.00	13.61(1.19)	0	1.00	13.61(1.19)	0	1.00	13.61(1.19)
	6	-0.084	0.99	12.36(0.88)	0.056	0.98	11.93(1.46)	0.336	0.99	11.36(1.02)	1.033	0.97	7.95(1.17)
	24	-0.620	0.99	12.70(0.88)	-0.113	0.99	12.87(1.80)	0.667	0.98	11.09(0.59)	2.508	0.94	5.07(0.29)
	48	-0.896	0.99	14.18(0.93)	-0.112	0.99	12.68(0.78)	0.758	0.98	10.37(0.56)	3.269	0.92	4.02(0.45)
	72	-0.899	0.99	14.04(1.48)	-0.140	0.99	12.51(0.61)	0.672	0.97	9.99(1.03)	3.901	0.90	3.28(0.16)
2400	0	0	1.00	16.57(0.84)	0	1.00	16.57(0.84)	0	1.00	16.57(0.84)	0	1.00	16.57(0.84)
	6	-0.028	0.99	15.15(0.91)	0.168	0.99	15.39(0.57)	0.422	0.99	14.19(0.84)	1.344	0.97	10.09(0.56)
	24	-0.614	0.99	16.56(0.88)	0.028	0.99	15.71(1.08)	0.723	0.98	13.40(1.10)	2.719	0.94	6.40(0.44)
	48	-0.899	0.99	17.01(0.87)	0	0.99	15.26(0.92)	0.813	0.98	13.05(0.48)	3.512	0.92	5.06(0.27)
	72	-0.923	0.99	16.45(0.95)	-0.056	0.99	15.82(0.95)	0.757	0.98	12.80(0.63)	4.142	0.91	4.06(0.19)
3000	0	0	1.00	16.97(0.59)	0	1.00	16.97(0.59)	0	1.00	16.97(0.59)	0	1.00	16.97(0.59)
	6	0	0.99	16.91(0.46)	0.253	0.99	16.05(1.14)	0.362	0.99	15.64(0.56)	1.445	0.97	11.07(0.40)
	24	-0.612	0.99	17.61(0.96)	0.112	0.99	16.33(1.47)	1.316	0.99	13.87(0.71)	2.787	0.94	7.20(0.24)
	48	-0.866	0.99	17.45(0.81)	0.112	0.99	17.10(1.01)	0.779	0.98	13.58(1.49)	3.611	0.93	5.66(0.21)
	72	-0.894	0.99	17.08(1.41)	0.056	0.99	16.38(1.29)	0.809	0.98	13.41(0.97)	4.246	0.91	4.37(0.26)

F = compressional force (pounds), T = time (hours), W = percent increase in weight, D = ratio of tablet density at time, T to initial tablet density, H = hardness in Strong-Cobb-Arner Units. [a] Unable to take a accurate measurement because the tablets were too soft to handle.

Table 13 Compressional Force, Percent Weight Increased, Ratio of Tablet Density, and Hardness at Room Temperature and Various Time at Four Humidity Levels.

FORMULATION :EMCOMPRESS + 20% AVICEL PH101

F	T	25% R.H. W	D	H	44% R.H. W	D	H	67% R.H. W	D	H	98% R.H. W	D	H
1200	0	0	1.00	3.78(0.23)	0	1.00	3.78(0.23)	0	1.00	3.78(0.23)	0	1.00	3.78(0.23)
	6	-0.341	1.01	3.96(0.26)	-0.141	1.00	3.81(0.27)	0	1.00	3.56(0.24)	0.678	0.98	2.29(0.26)
	24	-0.540	1.01	4.20(0.64)	-0.226	1.00	3.89(0.17)	0	1.00	3.52(0.16)	1.076	0.96	1.93(0.21)
	48	-0.681	1.00	4.06(0.40)	-0.254	1.00	3.78(0.18)	0	1.00	3.57(0.15)	1.298	0.95	0.93(0.56)
	72	-0.508	1.01	4.07(0.22)	-0.283	1.00	3.74(0.40)	-0.028	1.00	3.65(0.32)	1.049	0.96	1.78(0.20)
1800	0	0	1.00	5.05(0.30)	0	1.00	5.05(0.30)	0	1.00	5.05(0.30)	0	1.00	5.05(0.30)
	6	-0.366	1.00	5.35(0.37)	-0.169	1.00	5.35(0.20)	0.028	1.00	5.09(0.23)	0.617	0.98	3.57(0.08)
	24	-0.589	1.00	5.49(0.31)	-0.225	1.00	5.09(0.40)	0	1.00	5.09(0.22)	0.988	0.97	2.45(0.40)
	48	-0.645	1.00	5.48(0.45)	-0.252	1.00	5.26(0.33)	0.028	1.00	5.00(0.21)	1.236	0.95	1.93(0.37)
	72	-0.504	1.01	5.58(0.23)	-0.283	1.00	5.52(0.20)	0	1.00	5.07(0.39)	1.014	0.96	2.40(0.26)
2400	0	0	1.00	6.82(0.34)	0	1.00	6.82(0.34)	0	1.00	6.82(0.34)	0	1.00	6.82(0.34)
	6	-0.336	1.00	6.61(0.46)	-0.197	1.00	6.78(0.80)	0	1.00	6.37(0.69)	0.618	0.98	4.21(0.45)
	24	-0.587	1.00	7.42(0.65)	-0.224	1.00	6.75(0.33)	0	1.00	6.30(0.44)	0.895	0.97	3.56(0.18)
	48	-0.587	1.00	6.98(0.56)	-0.280	1.00	6.63(0.65)	0.028	1.00	6.47(0.41)	1.174	0.96	2.50(0.33)
	72	-0.585	1.00	7.26(0.27)	-0.308	1.00	7.01(0.32)	0	1.00	6.94(0.33)	1.007	0.97	2.93(0.40)
3000	0	0	1.00	8.30(0.41)	0	1.00	8.30(0.41)	0	1.00	8.30(0.41)	0	1.00	8.30(0.41)
	6	-0.390	1.00	8.45(0.39)	-0.223	1.00	8.30(0.45)	0	1.00	7.50(0.63)	0.586	0.99	5.17(0.57)
	24	-0.615	1.01	8.09(0.97)	-0.279	1.00	8.31(0.42)	0	1.00	8.15(0.34)	0.922	0.98	4.19(0.18)
	48	-0.724	1.00	8.09(0.81)	-0.279	1.00	8.03(0.88)	-0.028	1.00	7.65(0.55)	1.196	0.96	3.23(0.23)
	72	-0.585	1.00	8.77(1.22)	-0.474	1.00	8.51(0.19)	-0.028	1.00	8.29(0.25)	1.003	0.97	3.81(0.25)

FORMULATION :EMCOMPRESS + 30% AVICEL PH101

F	T	W	D	H	W	D	H	W	D	H	W	D	H
1200	0	0	1.00	4.73(0.27)	0	1.00	4.73(0.27)	0	1.00	4.73(0.27)	0	1.00	4.73(0.27)
	6	-0.448	1.00	5.33(0.41)	-0.282	1.00	5.16(0.30)	0	1.00	5.10(0.40)	0.703	0.98	3.42(0.21)
	24	-0.840	1.00	5.34(0.51)	-0.382	1.00	5.01(0.58)	0	1.00	4.75(0.21)	1.366	0.97	2.73(0.19)
	48	-1.064	1.00	5.83(0.22)	-0.475	1.01	5.65(0.51)	-0.028	1.00	4.82(0.25)	1.904	0.94	2.20(0.65)
	72	-0.959	1.00	5.23(0.16)	-0.532	1.00	5.42(0.31)	-0.028	1.00	4.95(0.20)	1.499	0.95	1.93(0.72)
1800	0	0	1.00	6.51(0.53)	0	1.00	6.51(0.53)	0	1.00	6.51(0.53)	0	1.00	6.51(0.53)
	6	-0.410	1.01	7.00(0.69)	-0.246	1.01	7.06(0.55)	0	1.01	6.74(0.32)	0.715	0.99	5.13(0.39)
	24	-0.828	1.00	7.10(0.75)	-0.441	1.00	7.10(0.45)	0.028	1.00	6.40(0.64)	1.283	0.97	3.76(0.31)
	48	-1.075	1.00	7.71(0.23)	-0.497	1.00	7.60(0.20)	0	1.00	6.74(0.31)	1.907	0.95	2.40(0.55)
	72	-0.937	1.00	7.68(0.40)	-0.492	1.00	7.01(0.40)	-0.055	1.01	6.70(0.45)	1.497	0.96	3.19(0.28)
2400	0	0	1.00	8.01(0.38)	0	1.00	8.01(0.38)	0	1.00	8.01(0.38)	0	1.00	8.01(0.38)
	6	-0.438	1.01	8.75(0.53)	-0.275	1.00	8.60(0.36)	0	1.00	8.62(0.75)	0.602	0.99	6.14(0.38)
	24	-0.847	1.00	8.67(0.46)	-0.412	1.00	8.61(0.31)	0	1.00	8.08(0.26)	1.207	0.97	4.78(0.28)
	48	-1.092	1.00	9.62(0.36)	-0.492	1.01	8.81(0.32)	0	1.00	8.38(0.24)	1.752	0.95	3.10(0.92)
	72	-0.930	1.00	8.88(0.28)	-0.520	1.00	8.84(0.25)	-0.082	1.00	8.39(0.19)	1.393	0.96	4.01(0.34)
3000	0	0	1.00	9.20(0.22)	0	1.00	9.20(0.22)	0	1.00	9.20(0.22)	0	1.00	9.20(0.22)
	6	-0.436	1.01	10.32(0.36)	-0.301	1.01	10.13(0.44)	-0.027	1.00	9.91(0.39)	0.736	0.99	7.49(0.28)
	24	-0.902	1.00	9.75(0.92)	-0.437	1.01	10.06(0.49)	-0.027	1.01	9.73(0.46)	1.199	0.97	5.65(0.19)
	48	-1.113	1.00	10.03(0.43)	-0.519	1.01	10.62(0.38)	-0.055	1.01	8.49(0.67)	1.685	0.95	4.07(0.41)
	72	-0.923	1.00	10.38(0.76)	-0.573	1.01	10.57(0.86)	-0.109	1.00	9.97(0.31)	1.366	0.96	4.99(0.41)

Table 13. con't

FORMULATION :EMCOMPRESS + 40% AVICEL PH101

F	T	24% R.H. W	24% R.H. D	24% R.H. H	32% R.H. W	32% R.H. D	32% R.H. H	68% R.H. W	68% R.H. D	68% R.H. H	98% R.H. W	98% R.H. D	98% R.H. H
	0	0	1.00	6.61(0.49)	0	1.00	6.61(0.49)	0	1.00	6.61(0.49)	0	1.00	6.61(0.49)
	6	-0.61	1.01	7.12(0.45)	-0.329	1.00	6.99(0.48)	-0.082	1.00	6.58(0.48)	0.682	0.99	5.03(0.43)
1200	24	-1.146	1.00	7.43(0.46)	-0.298	1.00	6.87(0.58)	-0.055	1.00	6.32(0.54)	1.198	0.97	4.14(0.21)
	48	-1.478	1.01	7.72(0.78)	-0.653	1.01	7.62(0.35)	-0.110	1.00	6.37(0.48)	2.256	0.95	2.62(0.34)
	72	-1.210	1.00	8.02(0.67)	-0.684	1.00	7.05(0.34)	-0.110	1.00	6.55(0.26)	1.779	0.95	3.42(0.19)
	0	0	1.00	8.09(0.33)	0	1.00	8.09(0.33)	0	1.00	8.09(0.33)	0	1.00	8.09(0.33)
	6	-0.588	1.01	9.35(0.52)	-0.338	1.00	8.79(0.30)	-0.056	1.00	8.31(0.35)	0.754	0.98	6.36(0.36)
1800	24	-1.151	1.00	9.47(0.46)	-0.618	1.00	9.15(0.44)	-0.056	1.00	8.83(0.28)	1.486	0.97	5.15(0.20)
	48	-1.515	1.01	9.90(0.28)	-0.673	1.01	9.01(0.38)	-0.084	1.00	8.45(0.48)	2.189	0.95	3.59(0.22)
	72	-1.206	1.01	9.33(0.65)	-0.677	1.00	8.70(0.46)	-0.112	1.00	8.06(0.41)	1.705	0.96	4.38(0.18)
	0	0	1.00	10.20(0.45)	0	1.00	10.20(0.45)	0	1.00	10.20(0.45)	0	1.00	10.20(0.45)
	6	-0.604	1.00	11.05(0.86)	-0.357	1.00	10.94(0.64)	-0.082	1.00	10.20(0.86)	0.628	0.99	8.41(0.38)
2400	24	-1.153	1.00	11.69(0.66)	-0.661	1.00	11.30(0.80)	-0.082	1.01	10.88(0.42)	1.398	0.97	6.36(0.34)
	48	-1.517	1.01	12.25(0.47)	-0.718	1.01	11.61(0.88)	-0.110	1.00	10.40(0.43)	2.088	0.96	4.69(0.35)
	72	-1.246	1.01	11.71(1.01)	-0.743	1.00	11.43(0.64)	-0.138	1.00	10.44(0.77)	1.594	0.95	5.62(0.36)
	0	0	1.00	12.54(1.01)	0	1.00	12.54(1.01)	0	1.00	12.54(1.01)	0	1.00	12.54(1.01)
	6	-0.598	1.01	13.54(0.92)	-0.340	1.00	12.98(0.99)	-0.113	1.00	12.33(1.23)	0.626	0.99	10.04(0.65)
3000	24	-1.058	1.01	13.40(1.04)	-0.618	1.01	13.51(1.53)	-0.086	1.00	12.48(0.66)	1.459	0.97	7.70(0.66)
	48	-1.234	1.00	13.89(1.17)	-0.686	1.00	13.59(1.10)	-0.116	1.00	12.64(0.59)	2.109	0.95	6.02(0.44)
	72	-1.258	1.00	13.50(1.08)	-0.653	1.00	13.17(1.19)	-0.144	1.00	12.26(1.04)	1.787	0.96	6.74(0.45)

FORMULATION : EMCOMPRESS + 50% AVICEL PH101

	0	0	1.00	8.95(0.37)	0	1.00	8.95(0.37)	0	1.00	8.95(0.37)	0	1.00	8.95(0.37)
	6	-0.744	1.00	9.72(0.83)	-0.430	1.00	9.54(0.41)	-0.086	1.00	9.27(0.58)	0.715	0.98	6.77(0.84)
1200	24	-1.398	1.00	9.70(0.82)	-0.772	1.00	9.81(0.44)	-0.114	1.00	8.97(0.57)	1.643	0.97	5.85(0.21)
	48	-1.755	1.01	10.18(1.05)	-0.859	1.00	9.48(0.58)	-0.085	1.00	8.93(0.51)	2.574	0.95	3.87(0.41)
	72	-1.827	1.00	10.29(0.31)	-0.745	1.00	9.42(0.42)	0	1.00	8.63(0.54)	3.389	0.93	3.44(0.54)
	0	0	1.00	11.76(0.50)	0	1.00	11.76(0.50)	0	1.00	11.76(0.50)	0	1.00	11.76(0.50)
	6	-0.730	1.00	13.39(0.78)	-0.479	1.00	13.32(0.74)	-0.113	1.00	12.70(0.79)	0.649	0.99	9.58(0.52)
1800	24	-1.414	1.00	14.26(0.97)	-0.761	1.00	13.24(0.50)	-0.113	1.00	12.14(0.82)	1.551	0.97	7.61(0.51)
	48	-1.778	1.01	14.33(0.98)	-0.862	1.00	13.23(1.11)	-0.112	1.00	12.36(0.57)	2.496	0.95	5.52(0.56)
	72	-1.839	1.00	13.38(0.99)	-0.787	1.00	12.33(0.65)	-0.282	1.00	11.58(0.48)	3.261	0.93	4.48(0.19)
	0	0	0	15.05(0.83)	0	0	15.05(0.83)	0	1.00	15.05(0.83)	0	1.00	15.05(0.83)
	6	-0.375	1.00	16.21(0.68)	-0.454	1.00	15.62(0.69)	-0.085	1.00	14.80(0.60)	0.733	0.99	11.41(0.92)
2400	24	-1.351	1.00	16.11(0.88)	-0.762	1.00	15.84(0.74)	-0.084	1.00	14.42(0.84)	1.585	0.97	9.30(0.37)
	48	-1.788	1.00	16.28(1.05)	-0.871	1.00	16.30(0.80)	-0.112	1.00	15.39(0.95)	2.459	0.95	6.61(0.18)
	72	-1.774	1.00	15.83(0.57)	-0.762	1.00	14.62(0.76)	0	1.00	13.54(0.54)	3.189	0.94	5.42(0.13)
	0	0	1.00	16.28(0.35)	0	1.00	16.28(0.35)	0	1.00	16.28(0.35)	0	1.00	16.28(0.35)
	6	-0.700	1.00	17.68(0.66)	-0.391	1.00	16.58(0.85)	-0.140	1.00	16.71(0.65)	0.619	0.99	13.85(0.64)
3000	24	-1.345	1.00	18.54(0.35)	-0.758	1.00	17.61(1.12)	-0.112	1.00	16.45(0.88)	1.454	0.98	9.85(0.32)
	48	-1.739	1.00	18.37(0.57)	-0.840	1.00	17.79(0.85)	-0.141	1.00	14.89(0.73)	2.412	0.96	7.36(0.56)
	72	-1.806	1.00	16.60(0.84)	-0.784	1.00	16.26(0.60)	-0.056	1.00	14.72(0.70)	3.126	0.94	6.11(0.32)

F = compressional force (pounds), T = time (hours), W = percent increase in weight, D = ratio of tablet density at time,T to initial tablet density, H = hardness in Strong-Cobb-Arner Units, a Unable to take a accurate measurement becuase the tablets were too soft to handle.

Most dicalcium phosphate dihydrate tablets showed the maximum moisture sorption within 48 hours as illustrated in Figures 16 - 19, 24 - 27, 32 - 34, excepted for the tablets which contained sodium starch glycolate and 50% micorcrystalline cellulose as their disintegrants were continuously picking up moisture after 48 hours.

Opposition to dicalcium phosphate dihydrate tablets, most of the α-lactose monohydrate tablets which contained 7% cross linked polyvinylpyrrolidone , 40% and 50% microcrystalline cellulose , 12% corn starch and all concentration of sodium starch glycolate as disintegrants, were continued to pick up moisture after 48 hours as shown in Figures 31, 38, 39, 33, 23 and 12-15 respectively.

In both systems, insoluble dicalcium phosphate and soluble α-lactose monohydrate, corn starch appeared to absorb the minimum amount of moisture while sodium starch glycolate appeared to absorb the maximum. Both microcrystalline cellulose and cross linked polyvinylpyrrolidone appeared to absorb moderate amount of moisture.

Difference was found between these two types of systems. The tablet with soluble system picked up more moisture than the tablet with insoluble system when the same type and amount of disintegrant was used. This result showed that the α-lactose monohydrate tablets were more sensitive to

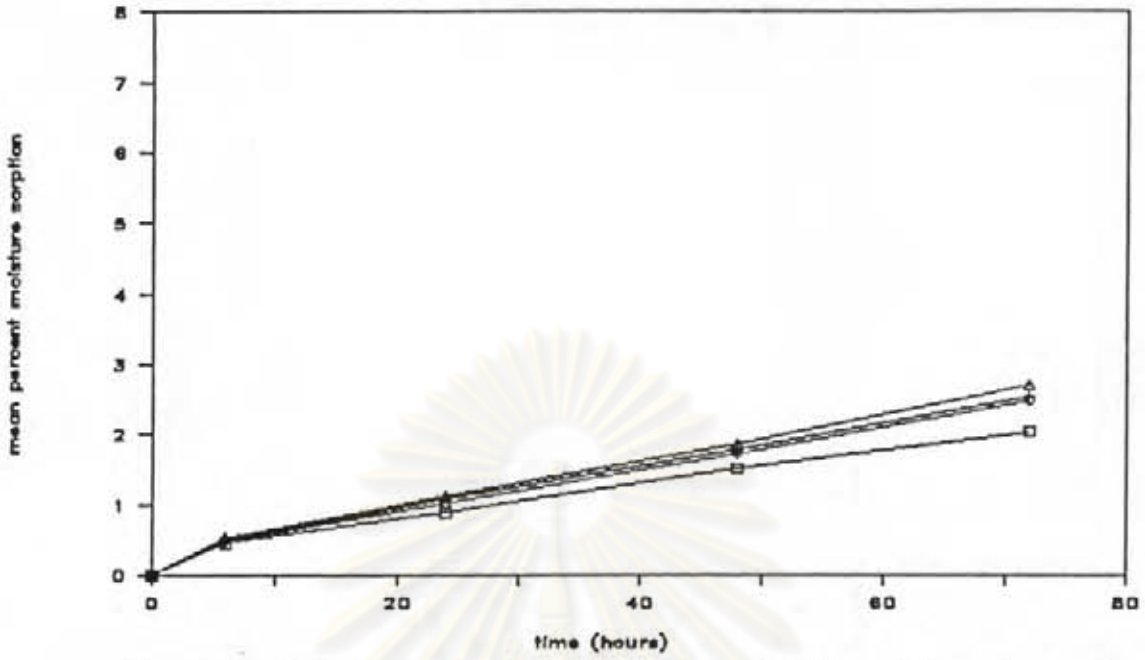

Figure 8. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 3% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

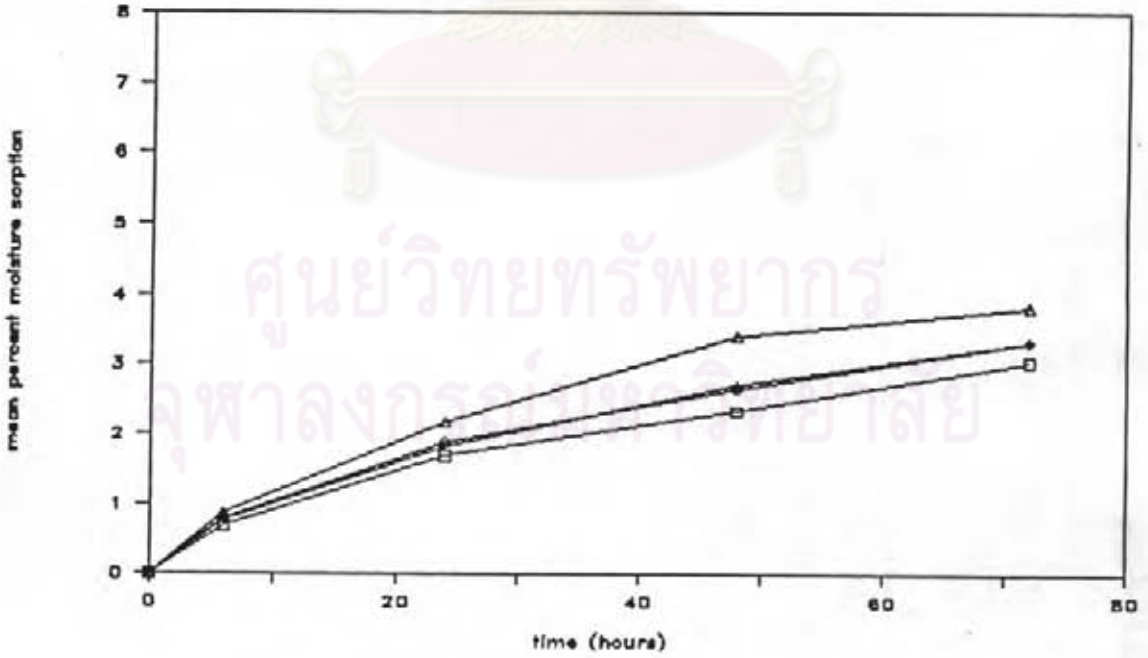

Figure 9. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 6% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

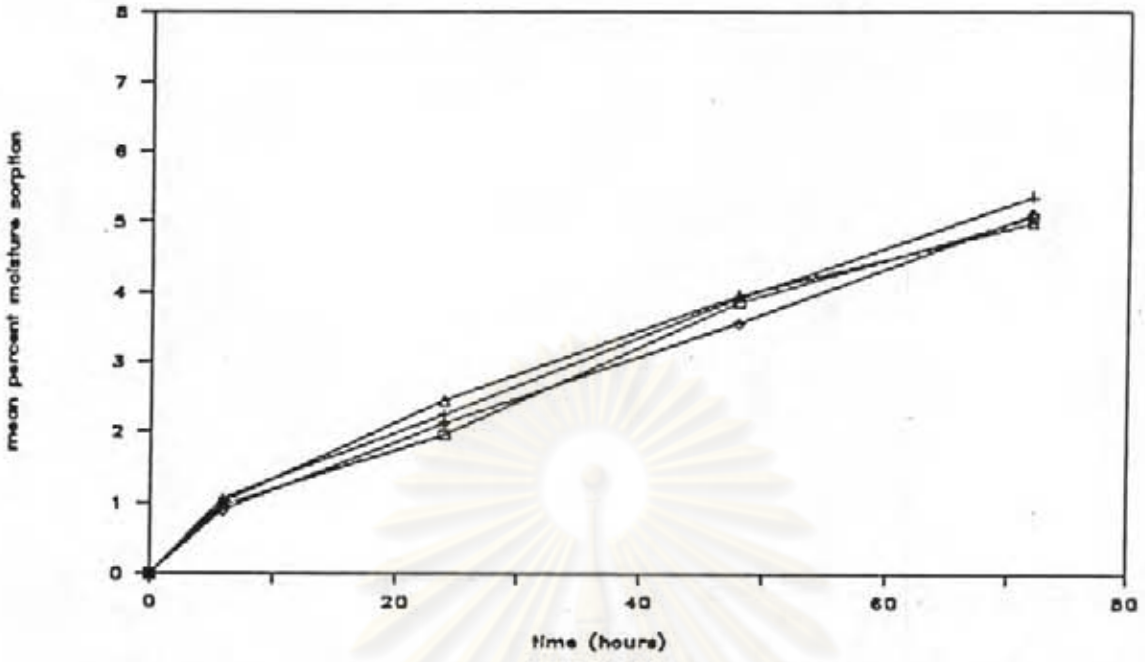

Figure 10. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 9% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

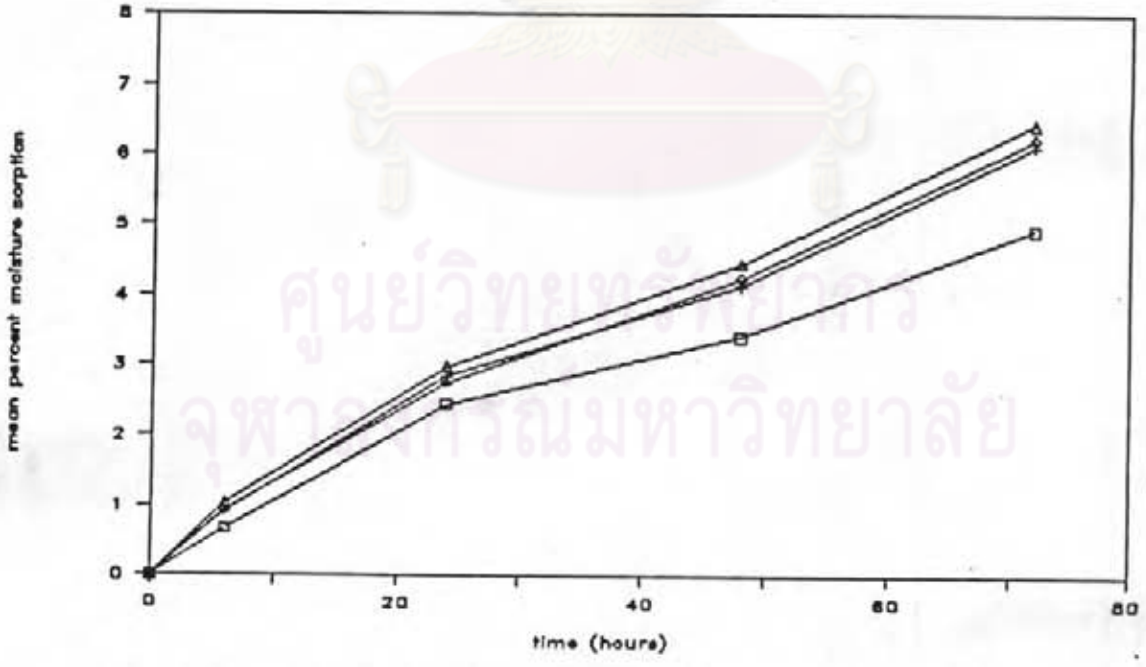

Figure 11. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 12% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

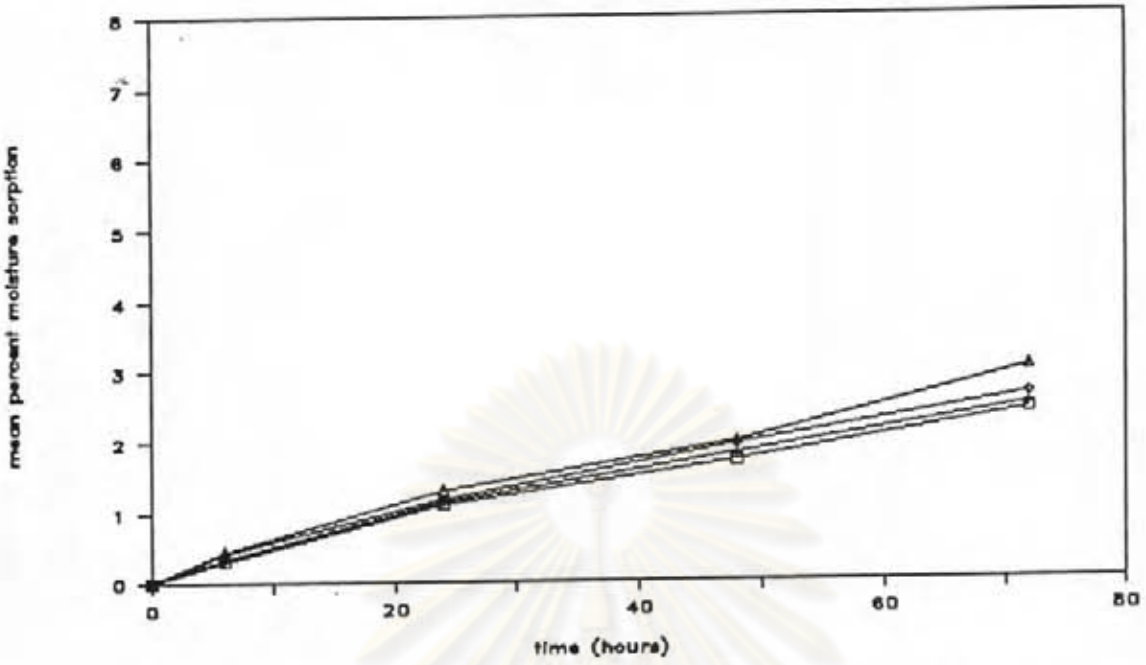

Figure 12. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 3% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

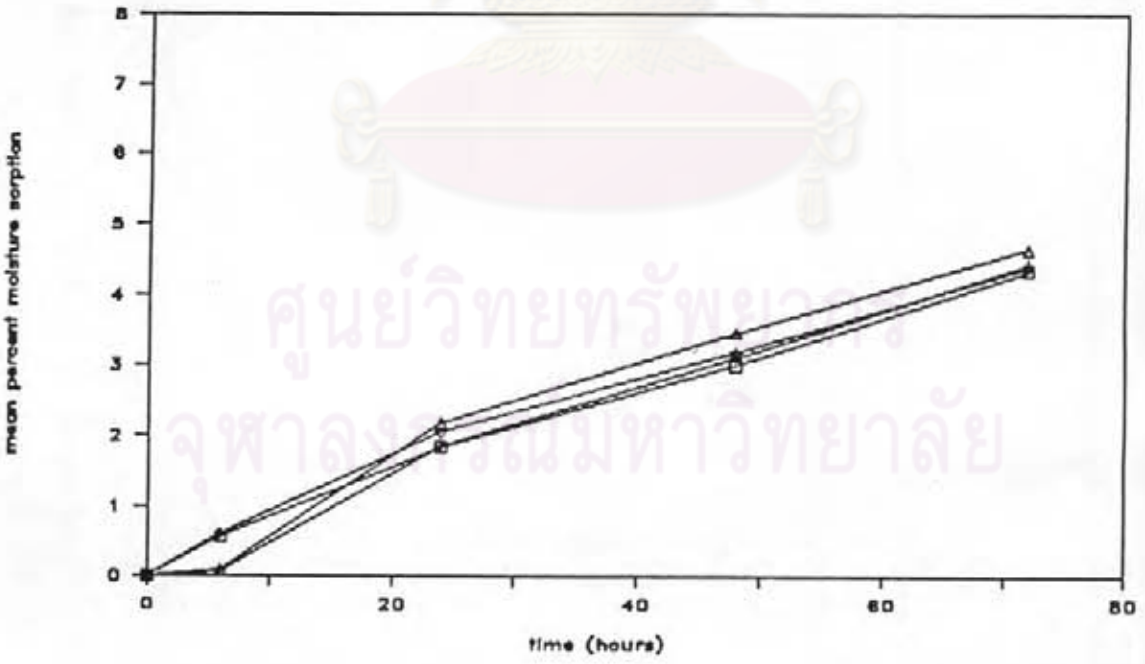

Figure 13. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 6% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

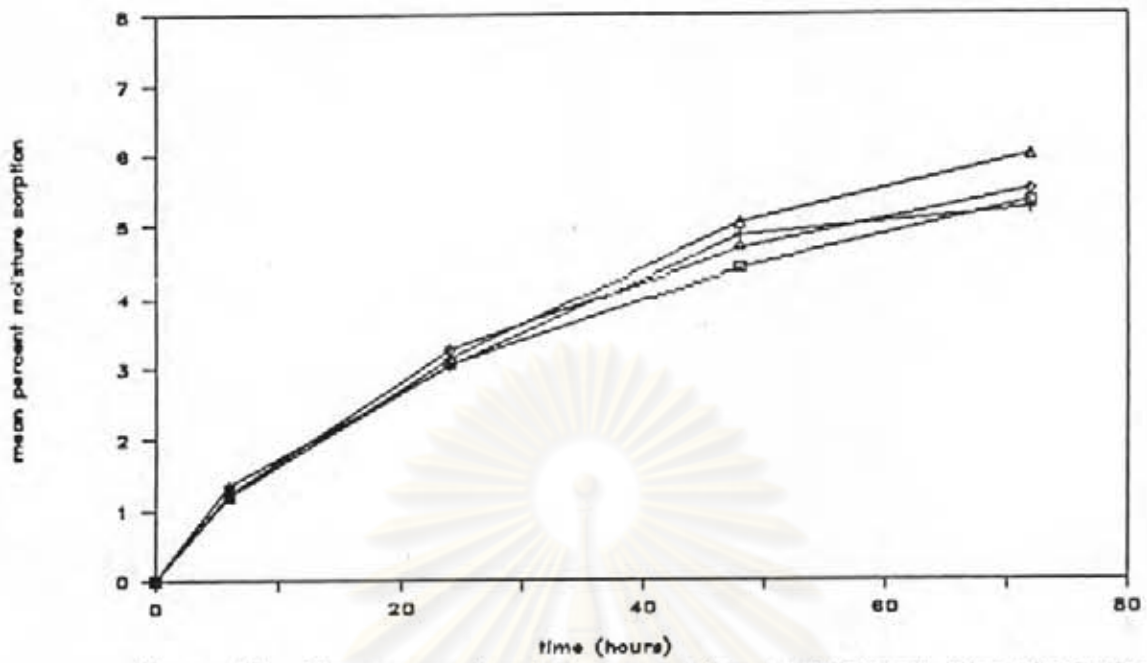

Figure 14. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 9% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

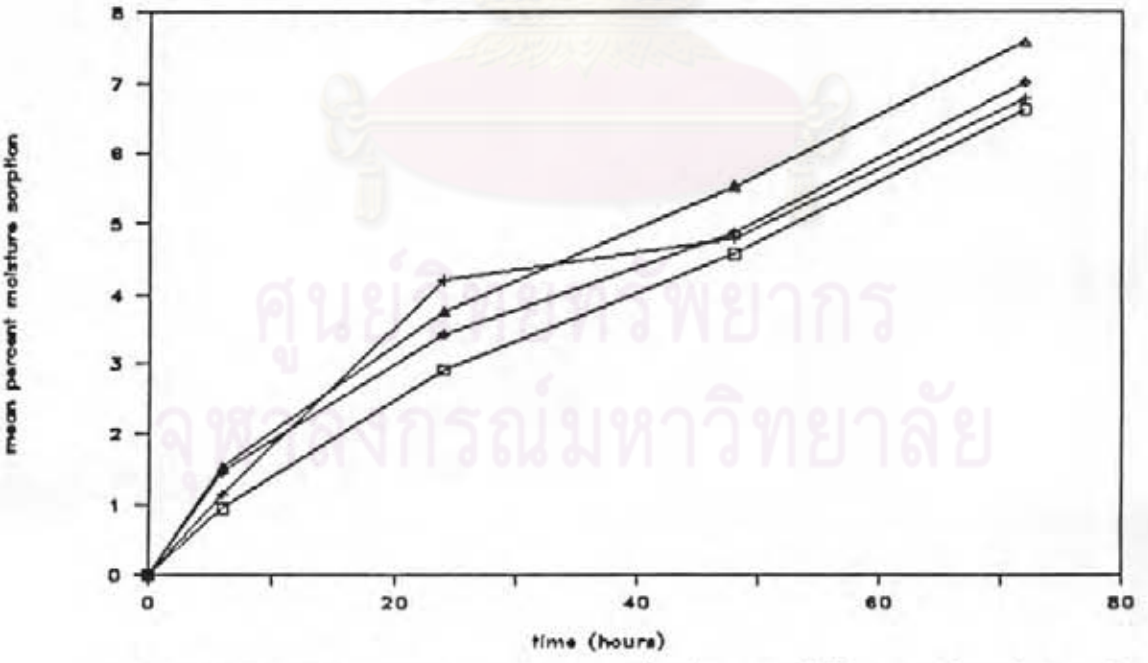

Figure 15. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 12% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

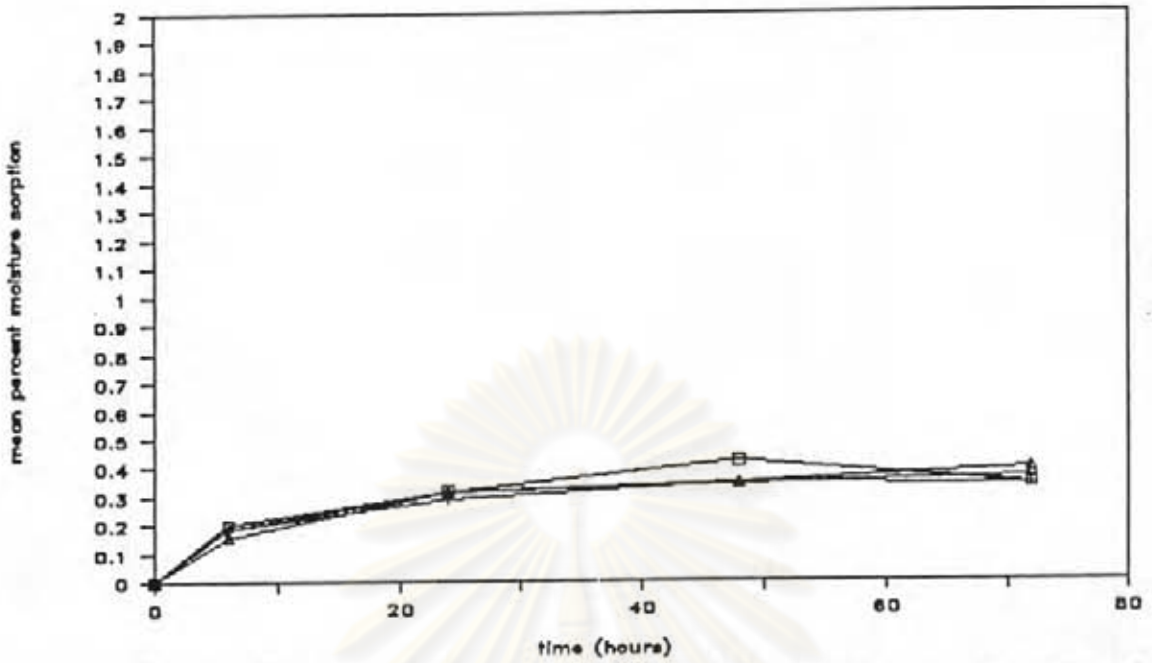

Figure 16. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 3% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

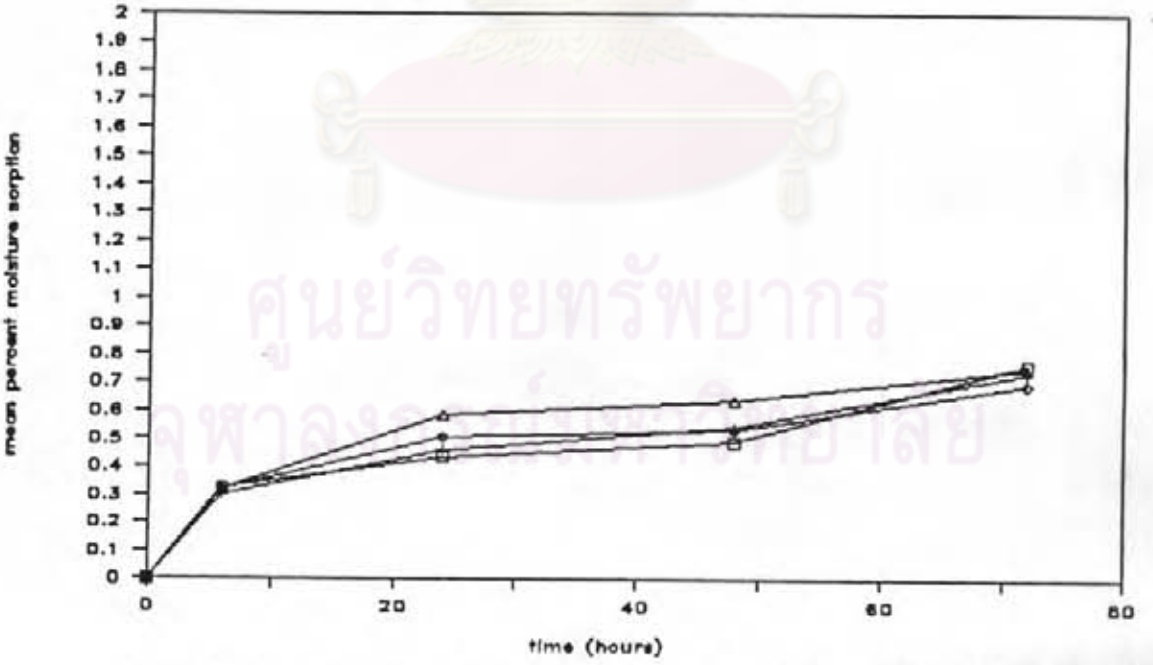

Figure 17. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 6% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

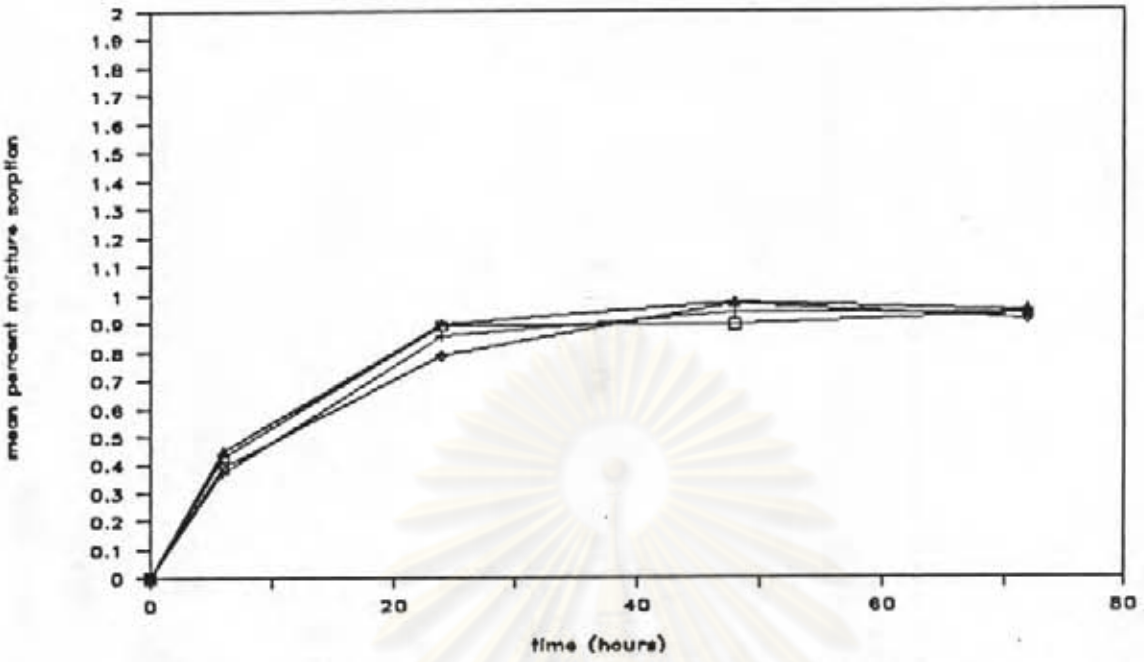

Figure 18. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 9% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

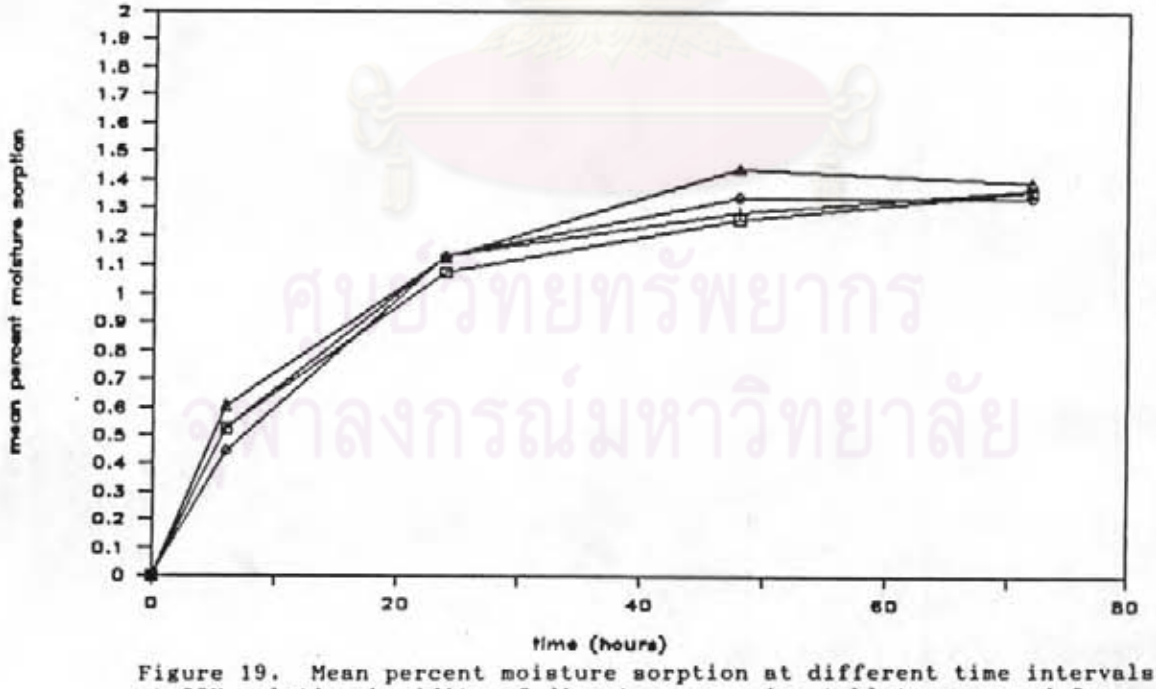

Figure 19. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 12% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

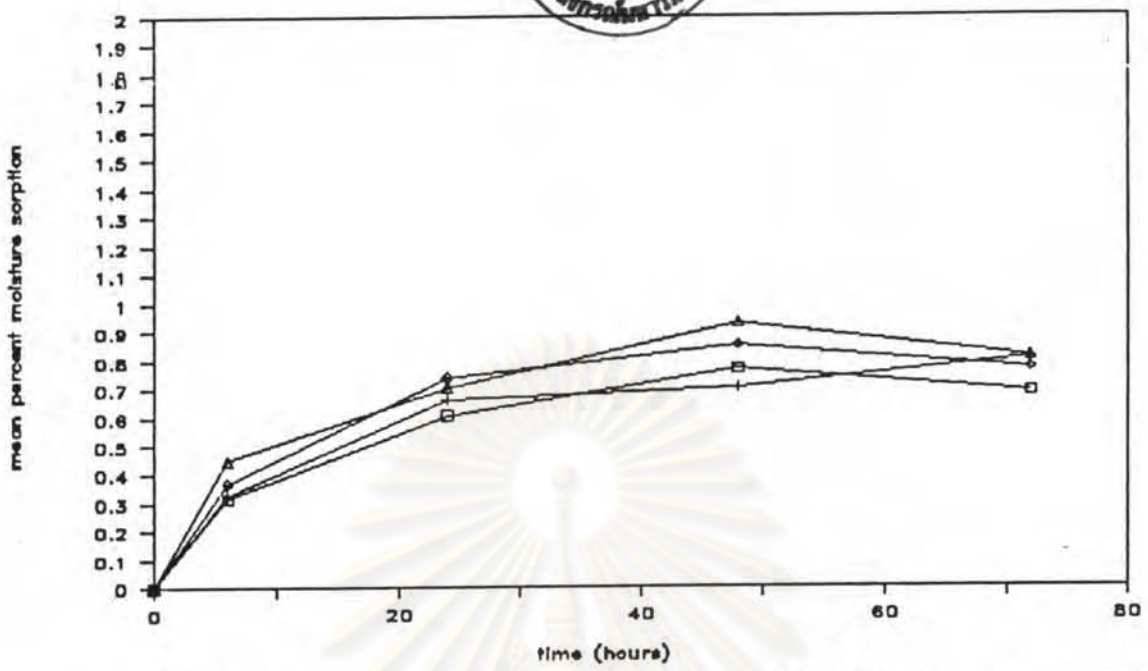

Figure 20. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 3% corn starch compressed with different compressional forces: ▫ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds

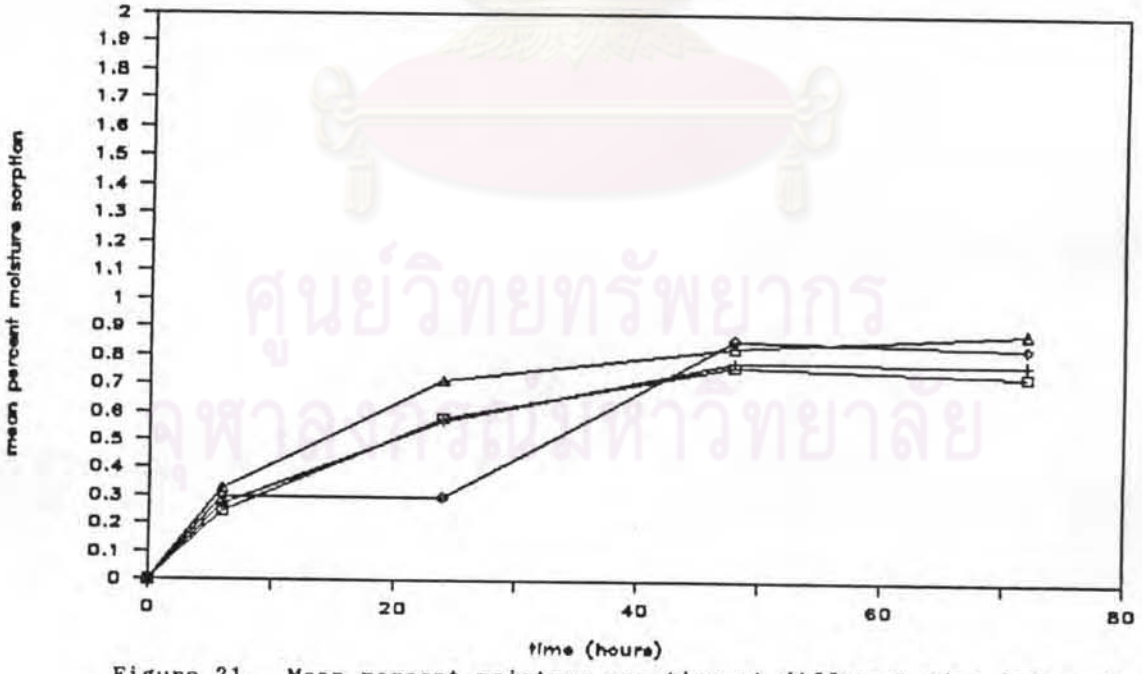

Figure 21. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 6% corn starch compressed with different compressional forces: ▫ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

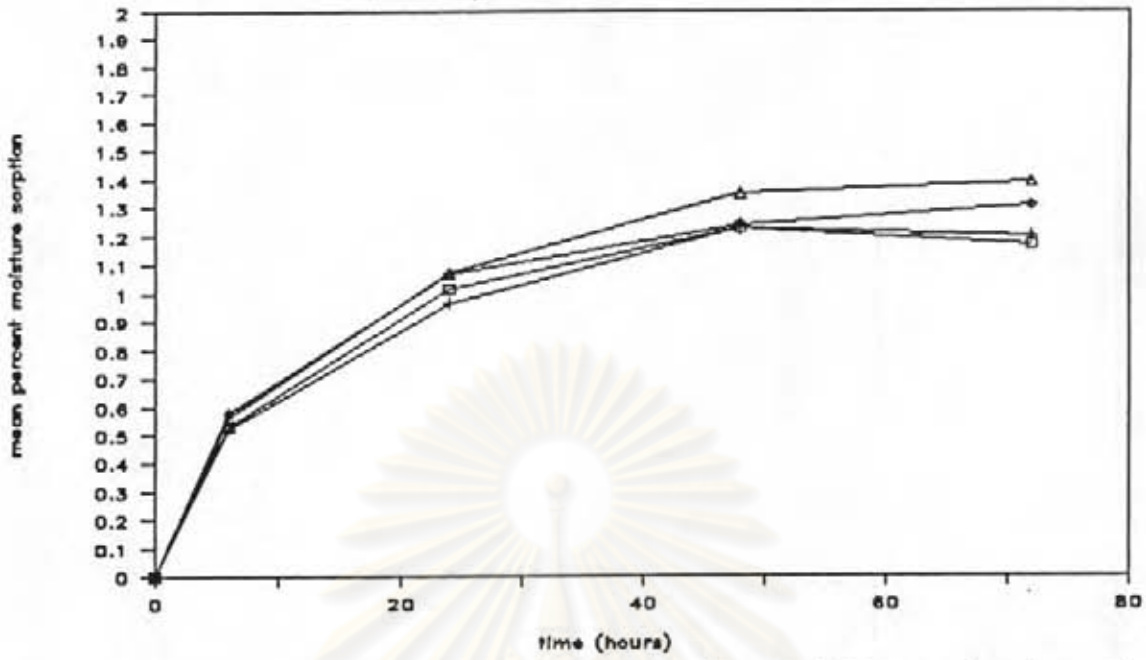

Figure 22. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 9% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

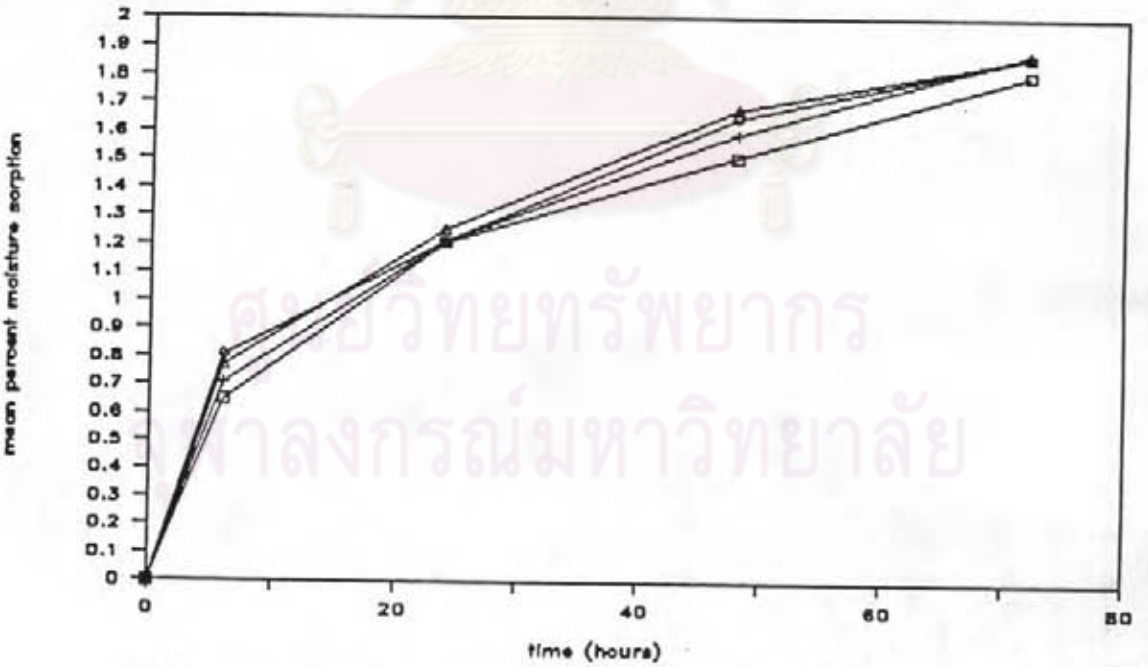

Figure 23. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 12% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

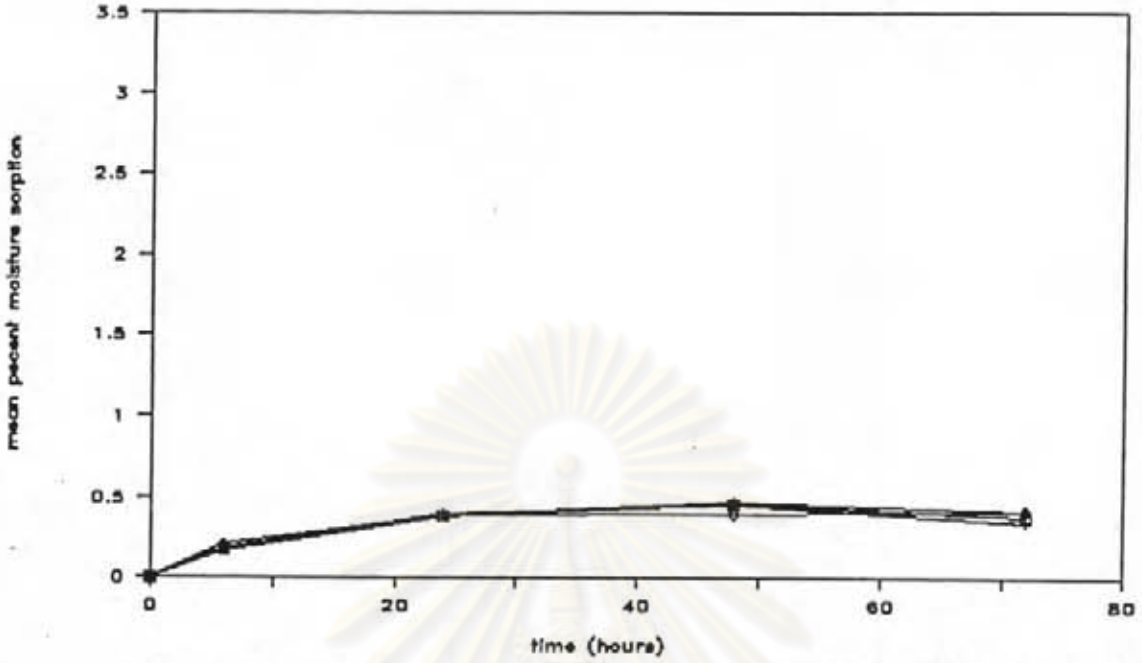

Figure 24. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 1% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

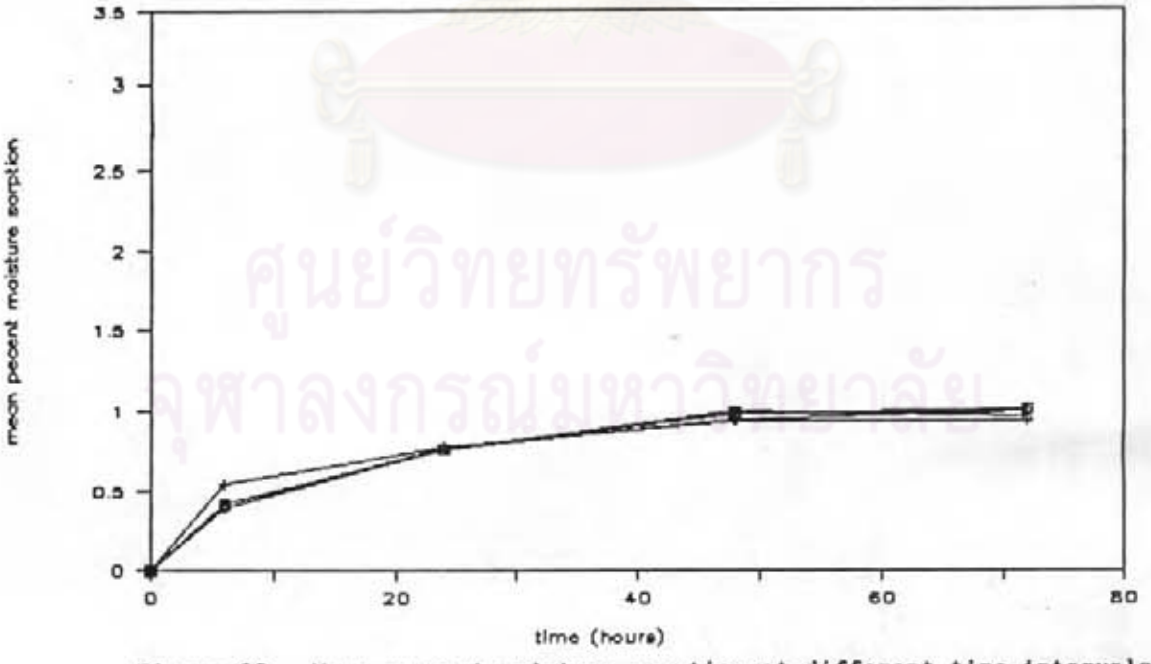

Figure 25. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 3% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

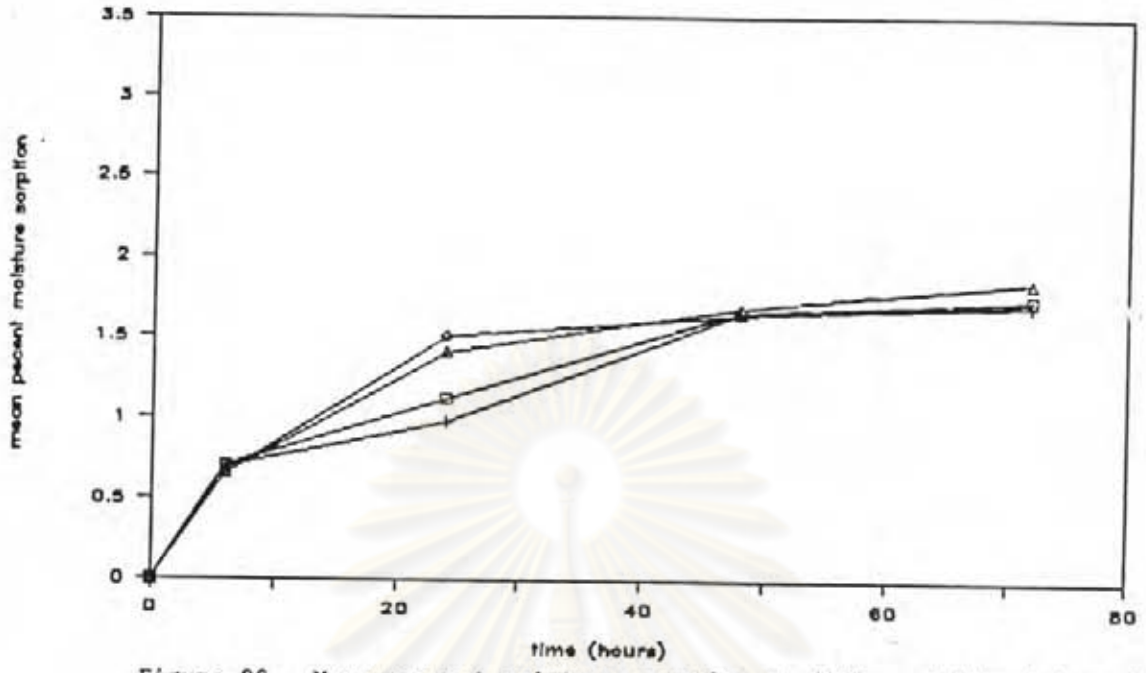

Figure 26. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 5% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

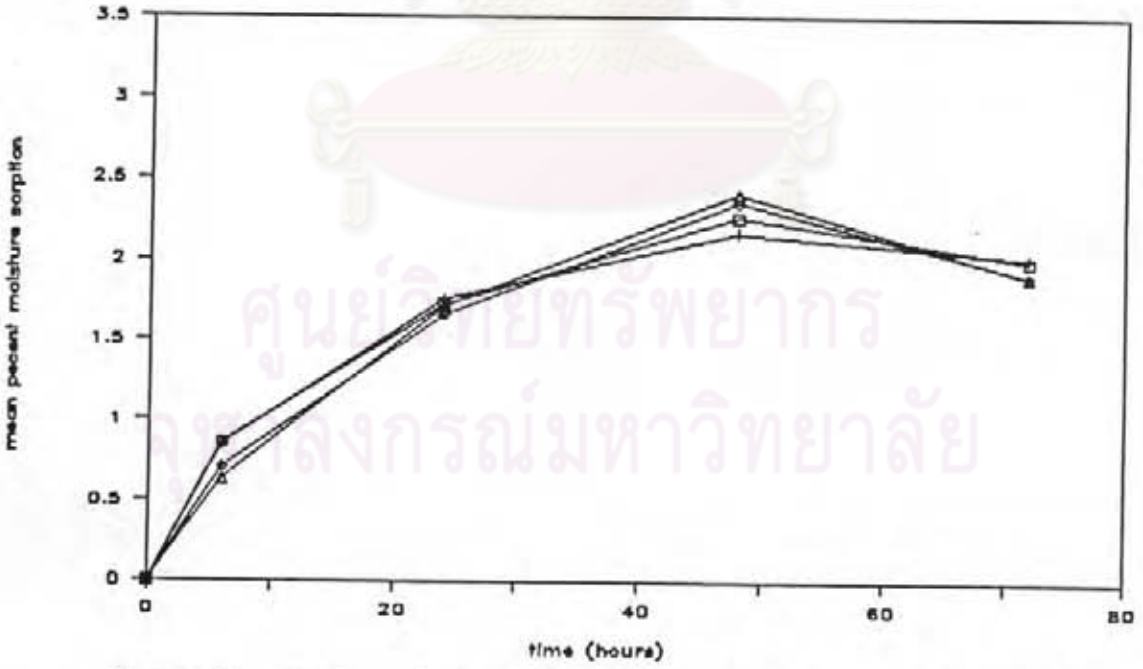

Figure 27. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 7% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

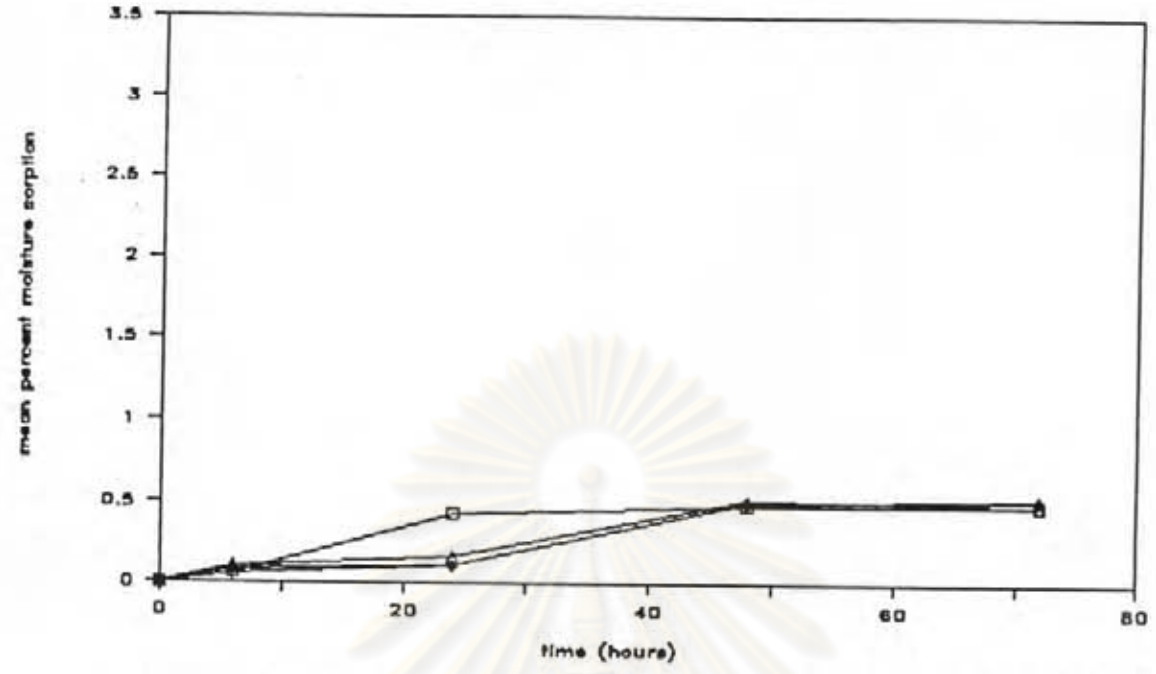

Figure 28. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 1% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

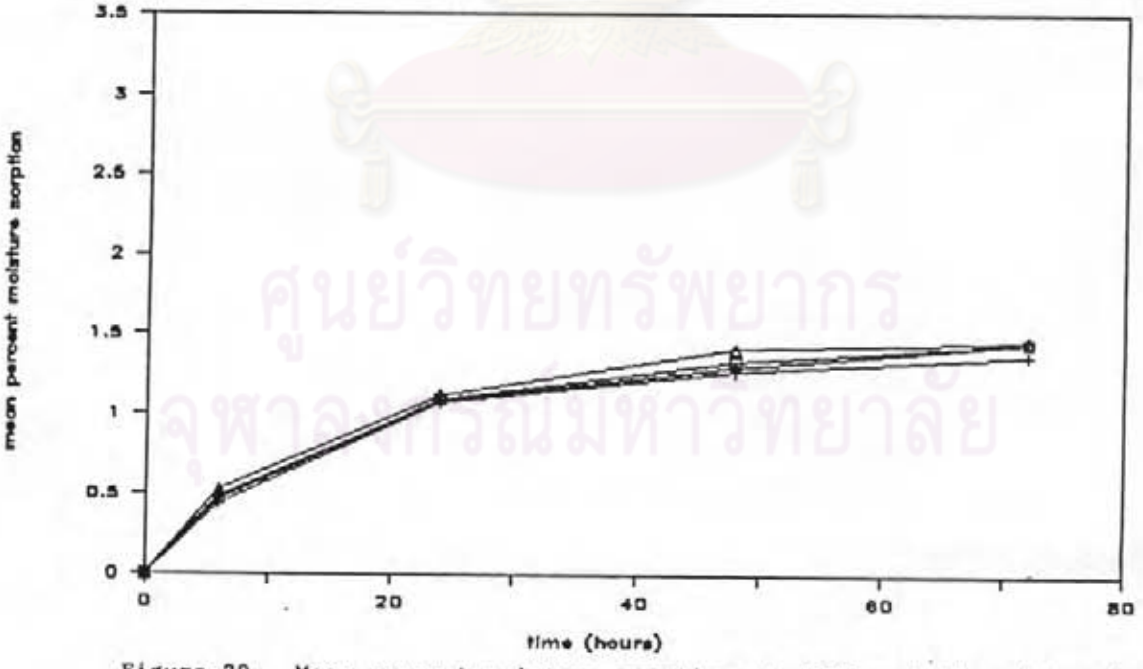

Figure 29. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 3% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

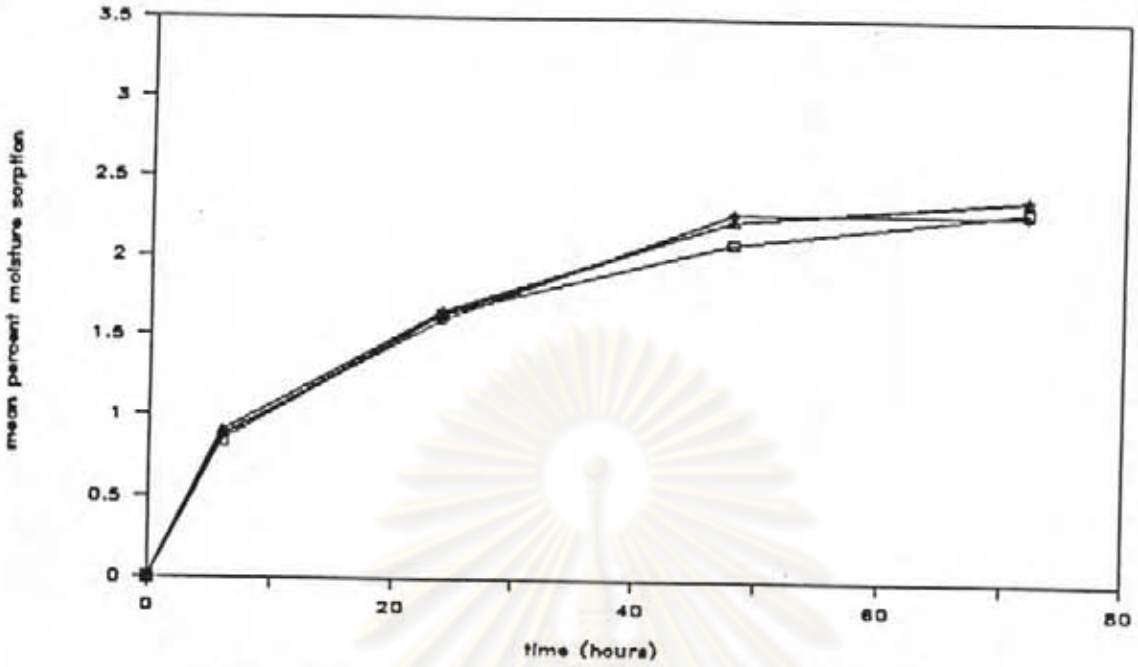

Figure 30. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 5% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

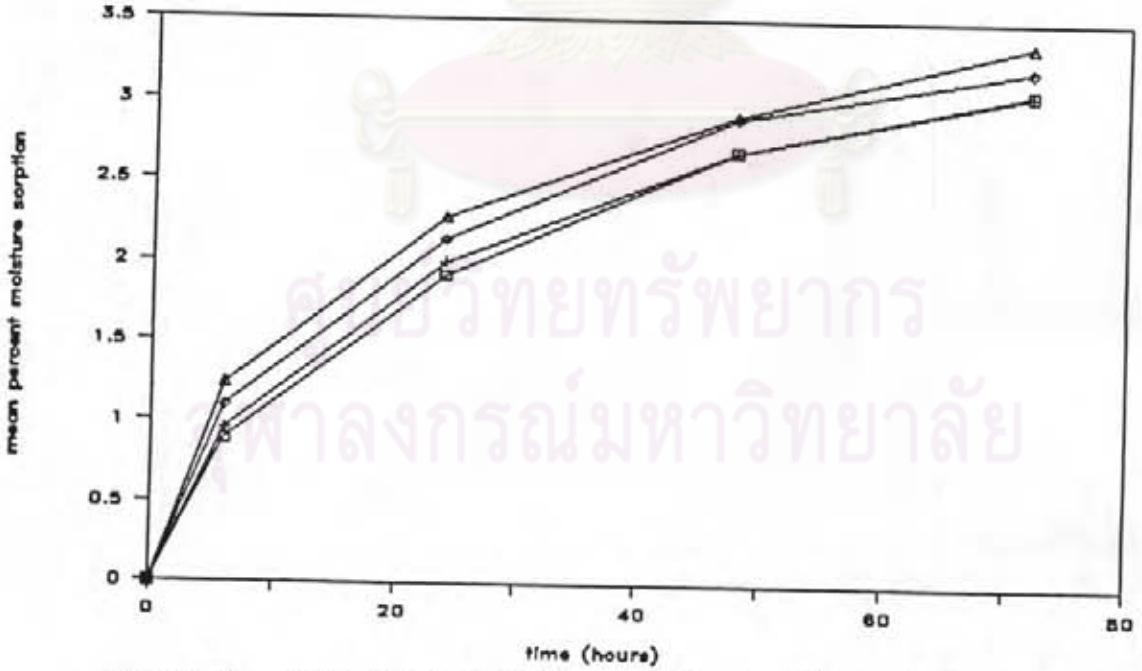

Figure 31. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 7% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

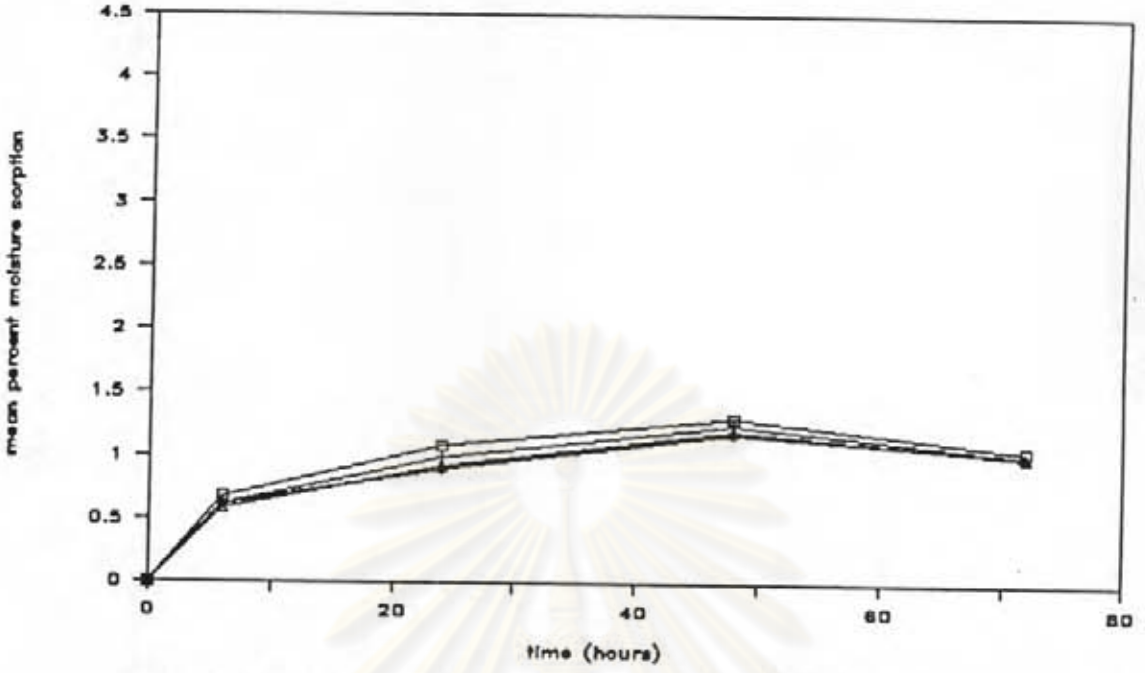

Figure 32. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 20% microcrystalline cellulose compressed with different compressional forces:
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

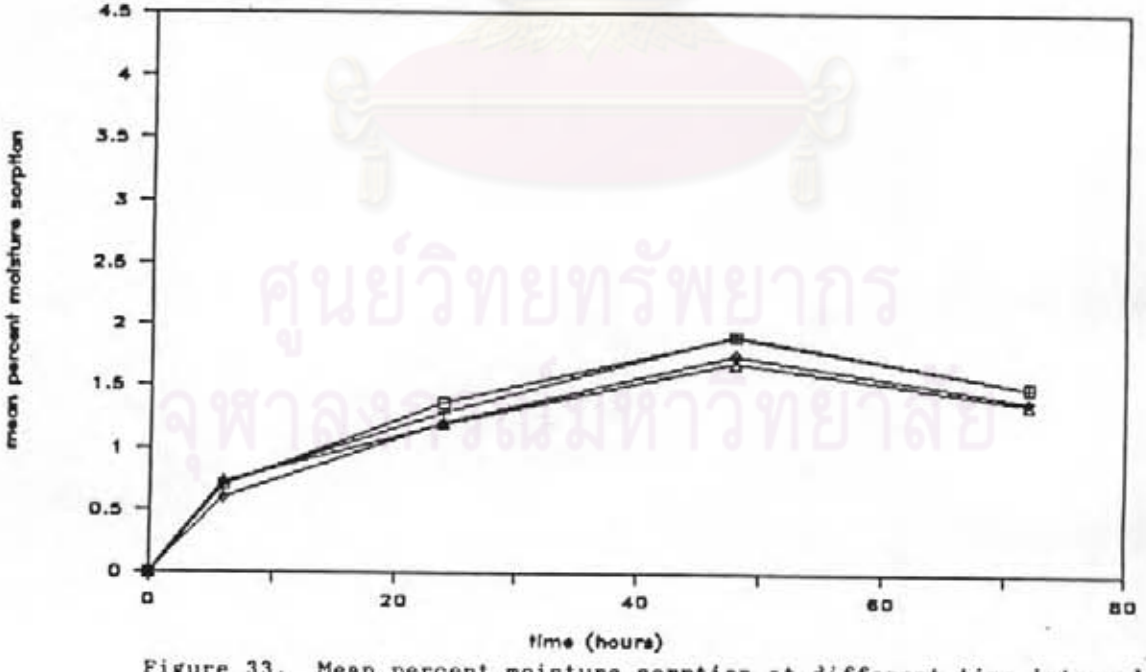

Figure 33. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 30% microcrystalline cellulose compressed with different compressional forces:
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

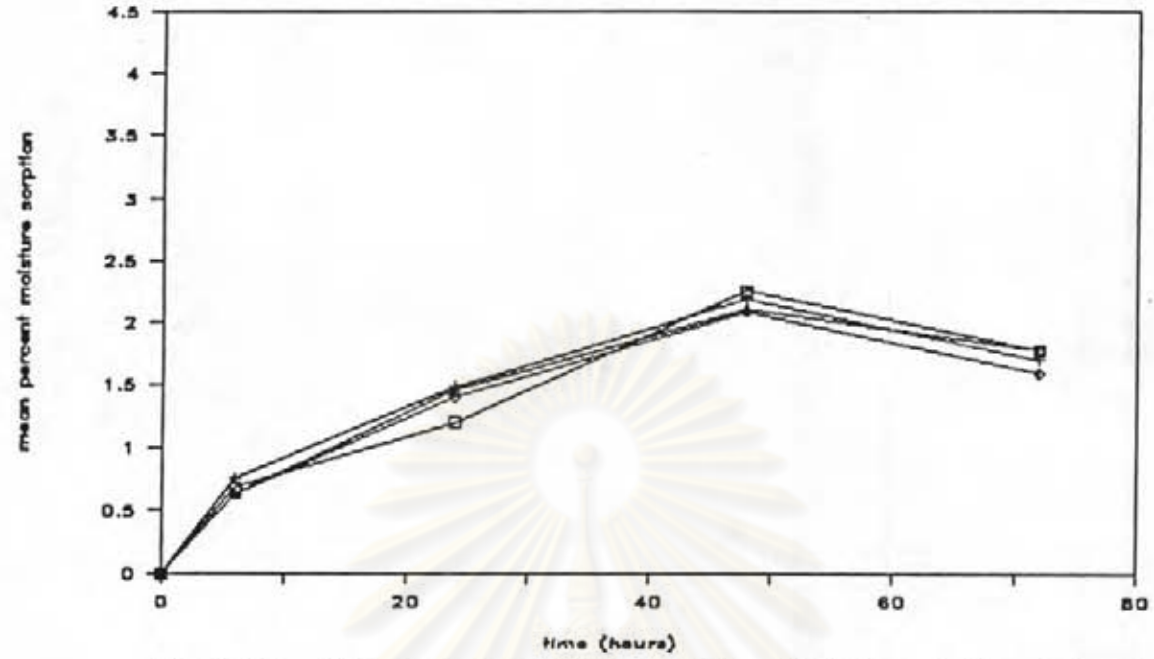

Figure 34. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 40% microcrystalline cellulose compressed with different compressional forces:
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

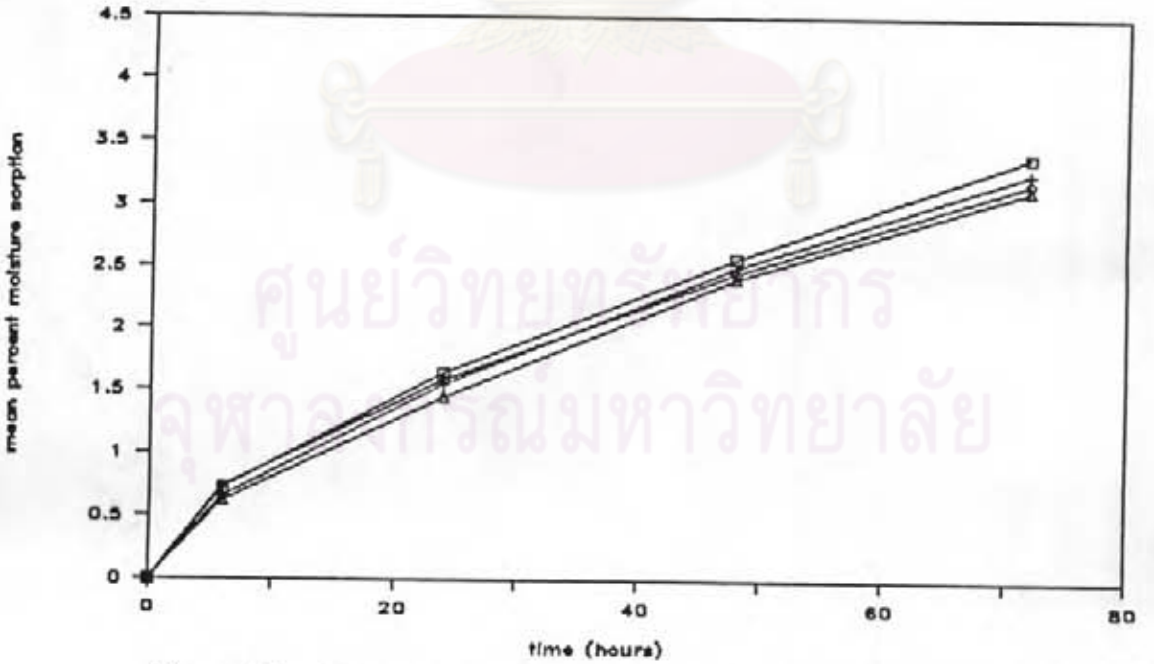

Figure 35. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from dicalcium phosphate dihydrate containing 50% microcrystalline cellulose compressed with different compressional forces:
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

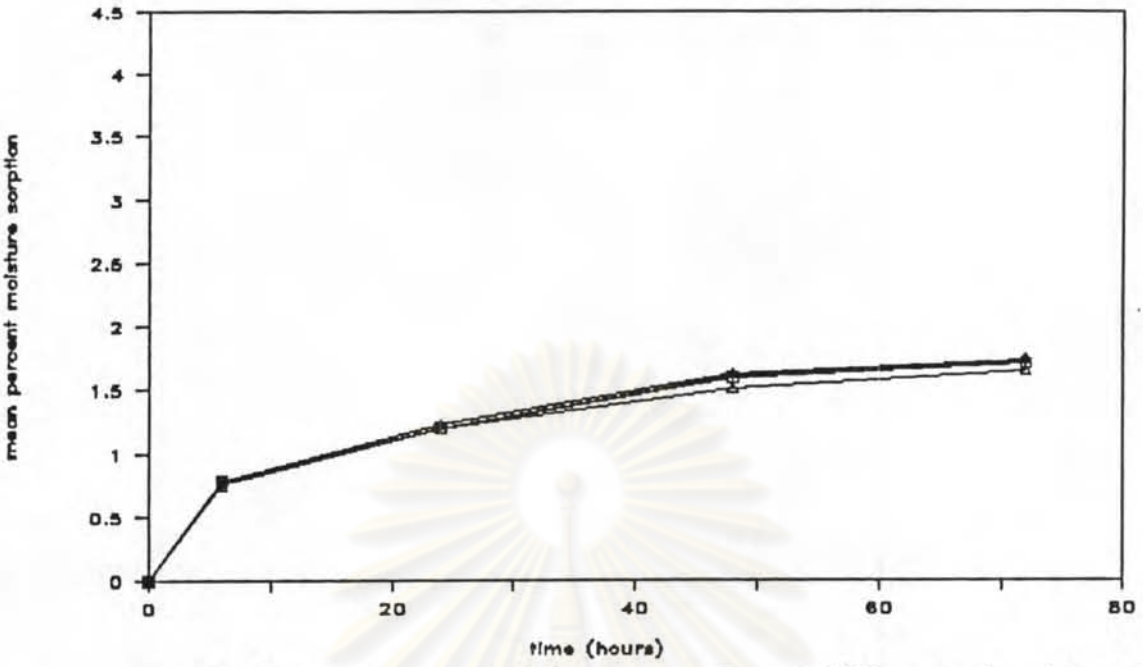

Figure 36. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 20% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

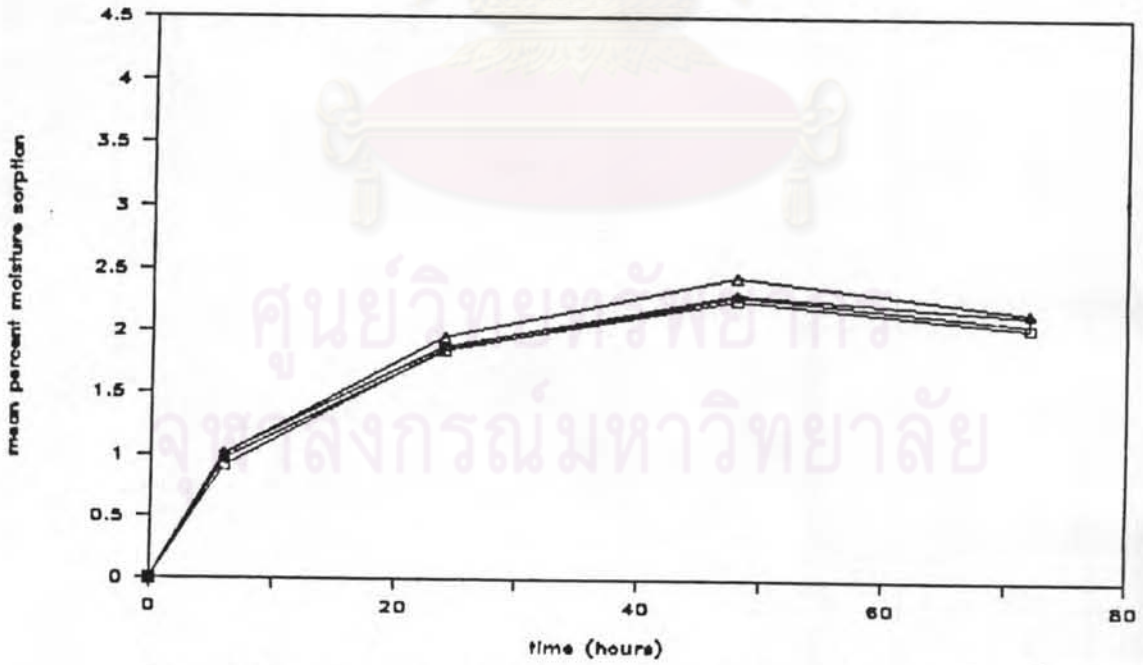

Figure 37. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from ∝-lactose monohydrate containing 30% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

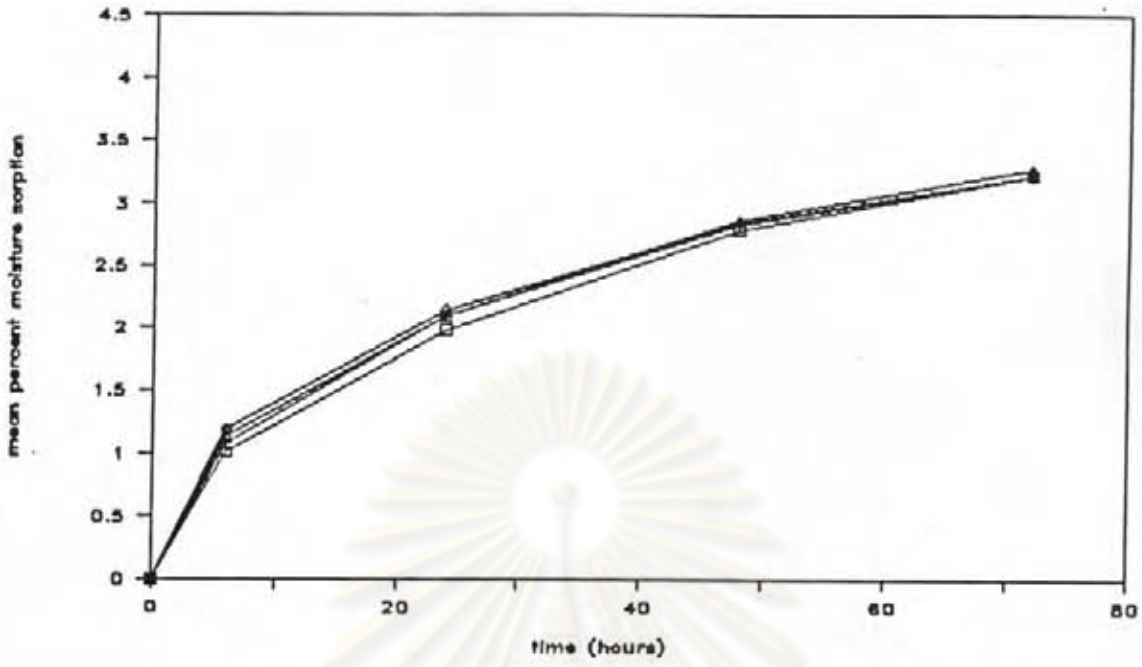

Figure 38. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 40% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

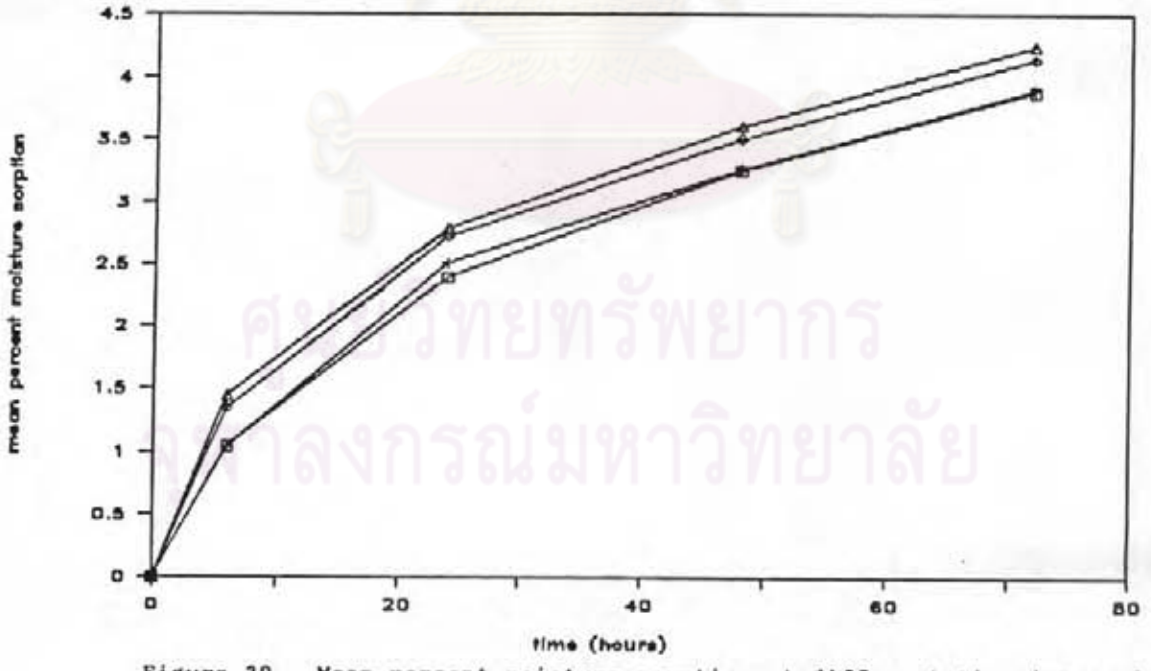

Figure 39. Mean percent moisture sorption at different time intervals at 98% relative humidity of direct compression tablets prepared from α-lactose monohydrate containing 50% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

Table 14 Regression Analysis for First Order Moisture Sorption Rate for Different Formulation After Storage at 98% Relative Humidity.

FORMULATION	FORCE	R SQUARE	X COEFF.
EMCOMPRESS + 3% STARCH	1200	0.9436	0.0236 *
	1800	0.9664	0.0321 *
	2400	0.9330	0.0230
	3000	0.9094	0.0180
EMCOMPRESS + 6% STARCH	1200	0.7718	0.0080
	1800	0.8944	0.0111
	2400	0.8085	0.0123
	3000	0.9009	0.0166
EMCOMPRESS + 9% STARCH	1200	0.8036	0.0307
	1800	0.9980	0.0453 *
	2400	0.9956	0.0298 *
	3000	0.9999	0.0455 *
EMCOMPRESS + 12% STARCH	1200	0.9890	0.0234
	1800	0.9842	0.0256
	2400	0.9987	0.0344 *
	3000	0.9869	0.0269 *
EMCOMPRESS + 1% KOLLDION CL	1200	0.9999	0.0327 *
	1800	0.9999	0.0378 *
	2400	0.7983	0.0257
	3000	0.9991	0.0317 *
EMCOMPRESS + 3% KOLLDION CL	1200	0.9809	0.0330
	1800	0.9488	0.0499
	2400	0.9976	0.0261
	3000	0.9796	0.0248 *
EMCOMPRESS + 5% KOLLDION CL	1200	0.9611	0.0259
	1800	0.9137	0.0303
	2400	0.9616	0.0279
	3000	0.9909	0.0221
EMCOMPRESS + 7% KOLLDION CL	1200	0.9921	0.0254 *
	1800	0.9972	0.0296 *
	2400	0.9980	0.0219 *
	3000	0.9999	0.0226 *
EMCOMPRESS + 20% AVICEL PH101	1200	0.9654	0.0303 *
	1800	0.9601	0.0274 *
	2400	0.9102	0.0238 *
	3000	0.9474	0.0250 *

Table 14 con't

EMCOMPRESS + 30% AVICEL PH101	1200	0.9842	0.0221 *
	1800	0.9645	0.0192 *
	2400	0.9853	0.0204 *
	3000	0.9449	0.0210 *
EMCOMPRESS + 40% AVICEL PH101	1200	0.9375	0.0128 *
	1800	0.9821	0.0198 *
	2400	0.9937	0.0196 *
	3000	0.9972	0.0210 *
TABLETTOSE + 3% STARCH	1200	0.9903	0.0274 *
	1800	0.8903	0.0183
	2400	0.9989	0.0365 *
	3000	0.9435	0.0240 *
TABLETTOSE + 6% STARCH	1200	0.9994	0.0253 *
	1800	0.9937	0.0233 *
	2400	0.4807	0.0059 *
	3000	0.9915	0.0251
TABLETTOSE + 9% STARCH	1200	0.9941	0.0311 *
	1800	0.9856	0.0271 *
	2400	0.9921	0.0264
	3000	0.9878	0.0312
TABLETTOSE + 12% STARCH	1200	0.9780	0.0157
	1800	0.9832	0.0161
	2400	0.9765	0.0180
	3000	0.9859	0.0195
TABLETTOSE + 1% KOLLIDON CL	1200	0.9640	0.0413 *
	1800	0.8291	0.0259
	2400	0.8224	0.0265
	3000	0.8340	0.0061 *
TABLETTOSE + 3% KOLLIDON CL	1200	0.9926	0.0236
	1800	0.9967	0.0228
	2400	0.9837	0.0198
	3000	0.9938	0.0301
TABLETTOSE + 5% KOLLIDON CL	1200	0.9960	0.0210
	1800	0.9879	0.0245
	2400	0.9730	0.0210 *
	3000	0.9885	0.0244
TABLETTOSE + 20% AVICEL PH101	1200	0.9804	0.0237
	1800	0.9842	0.0233
	2400	0.9834	0.0236
	3000	0.9853	0.0214
TABLETTOSE + 30% AVICEL PH101	1200	0.9968	0.0303 *
	1800	0.9917	0.0287 *
	2400	0.9899	0.0296 *
	3000	0.9929	0.0284 *

* result was analysed from the data within 24 hours.

moisture than the dicalcium phosphate dihydrate tablets.

Moisture sorption of all tablet which showed the maximum moisture sorption at 98% relative humidity after 72 hours followed the first order rate model. Table 14 showed the correlation coefficient and slope of the equation which represented the moisture sorption rate constant:

$$\log(1 - m_t / m_\infty) = - a \cdot t$$

where

m_t = moisture sorption at time t

m_∞ = maximum moisture sorption

a = moisture sorption rate constant

Figures 40 - 47 showed the percent moisture sorption of tablets against concentration of disintegrants which compressed with four levels of force after exposed to 98% relative humidity for 72 hours. The figures showed that increasing concentration of disintegrant resulted in increasing percent moisture sorption for all formulations.

After exposed to 98% relative humidity for 72 hours increase in moisture sorption was observed as the amount of disintegrants increased in both tablet systems. Direct relationship between amount of moisture sorption and the amount of disintegrants was found in these tablets. The plot of the mean percent moisture sorption of disintegrants which calculated from the average moisture sorption of

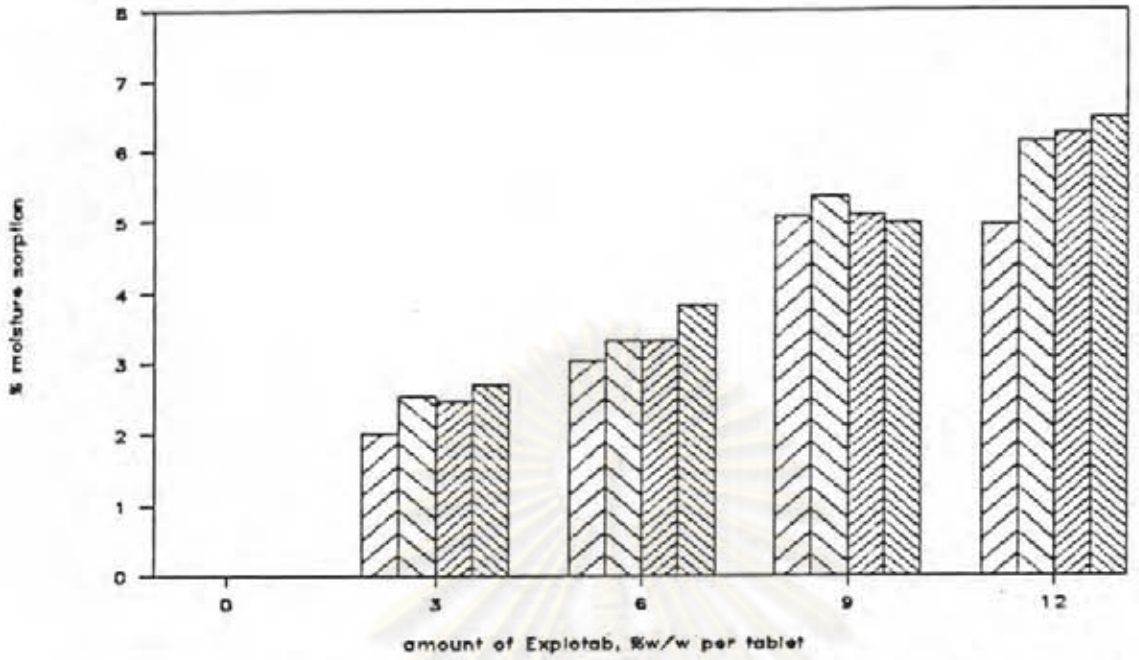

Figure 40. Absorption efficiencies of dicalcium phosphate dihydrate tablets containing sodium starch glycolate (Explotab) at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

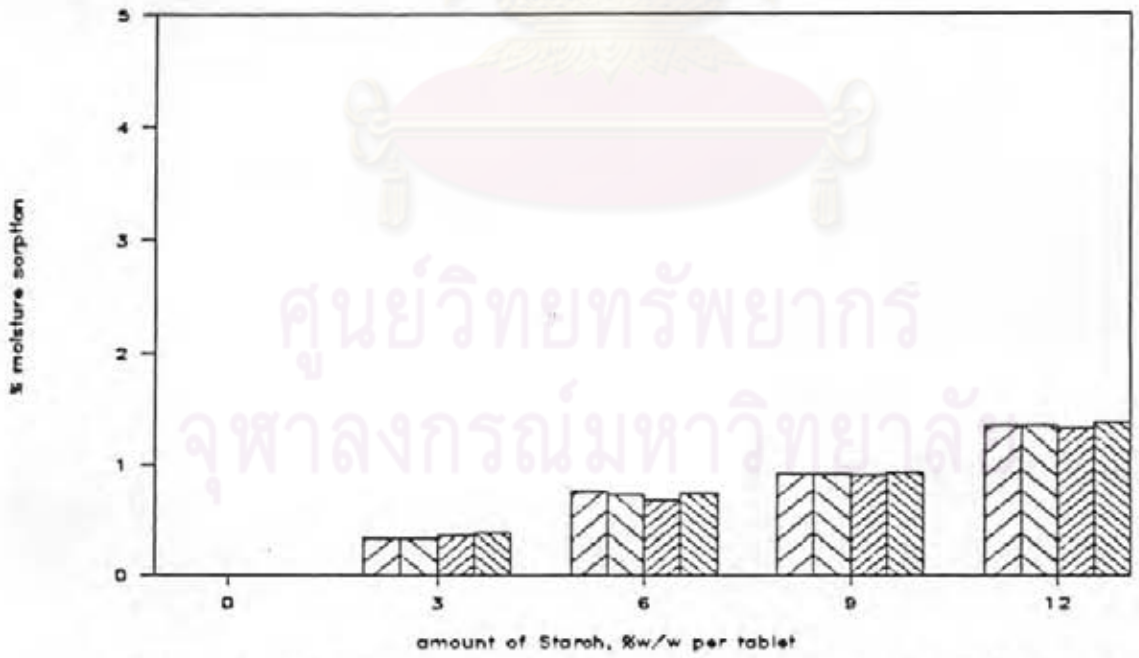

Figure 41. Absorption efficiencies of dicalcium phosphate dihydrate tablets containing corn starch at different concentration compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

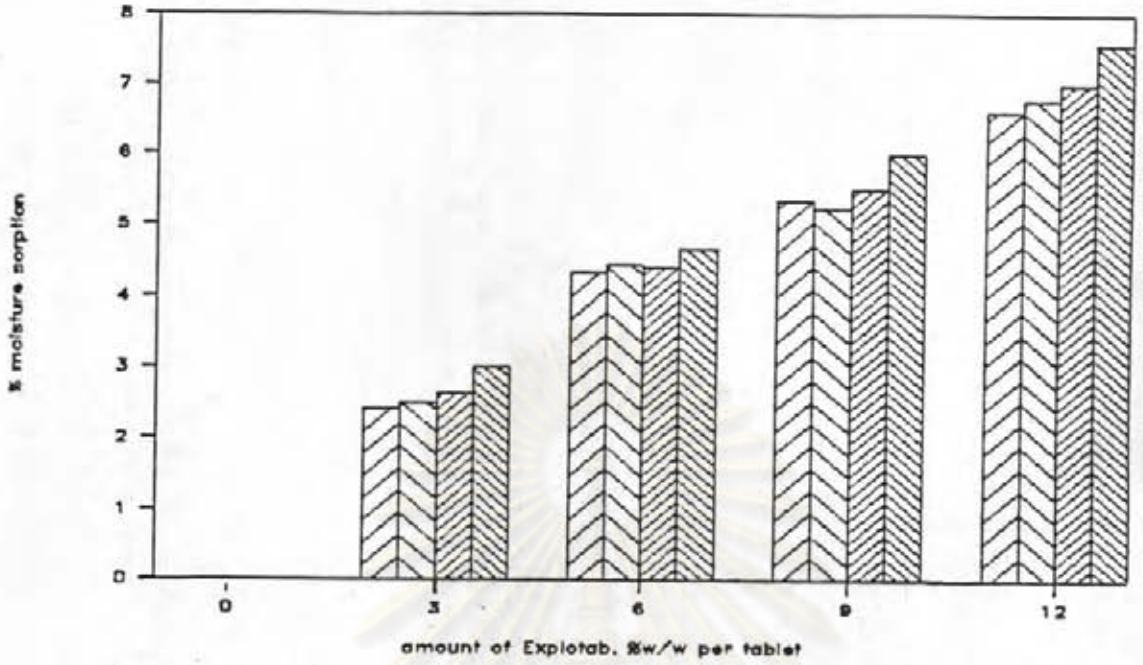

Figure 42. Absorption efficiencies of α-lactose monohydrate tablets containing sodium starch glycolate (Explotab) at different concentration compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

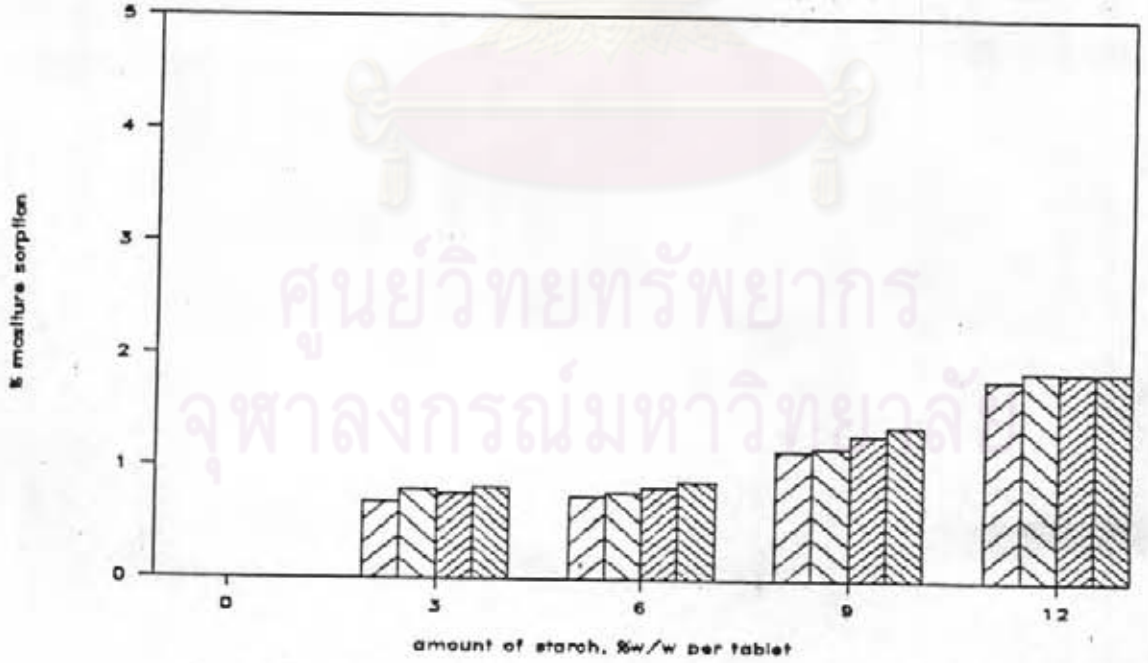

Figure 43. Absorption efficiencies of α-lactose monohydrate tablets containing corn starch at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

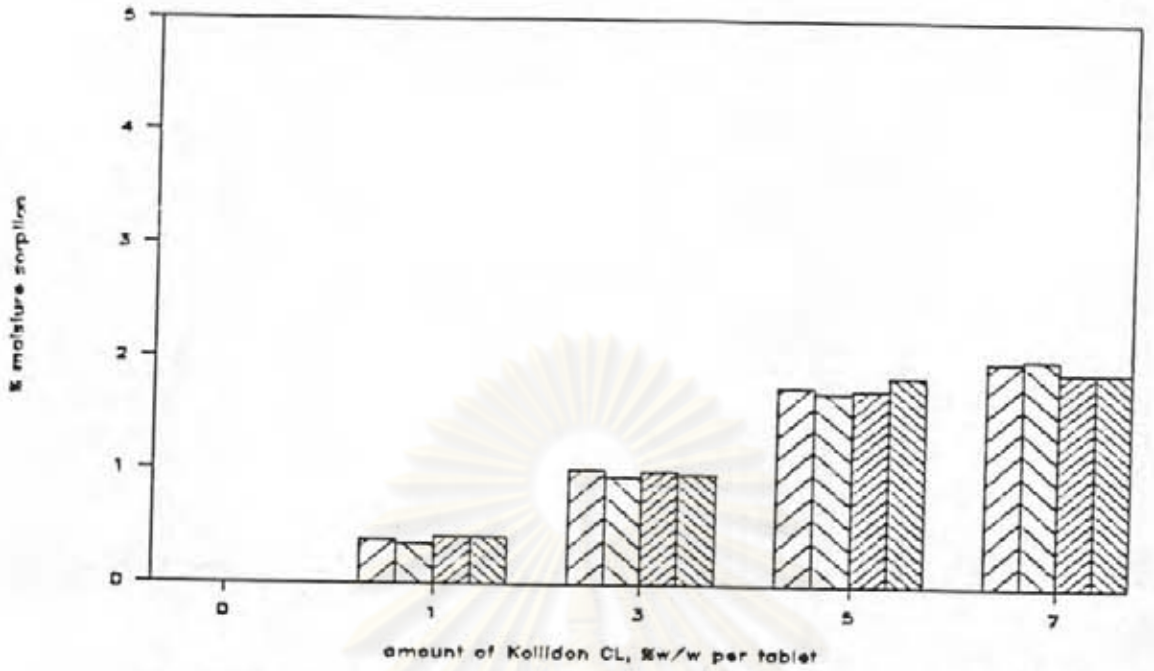

Figure 44. Absorption efficiencies of dicalcium phosphate dihydrate tablets containing cross linked polyvinylpyrrolidone (Kollidone CL) at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours:
1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

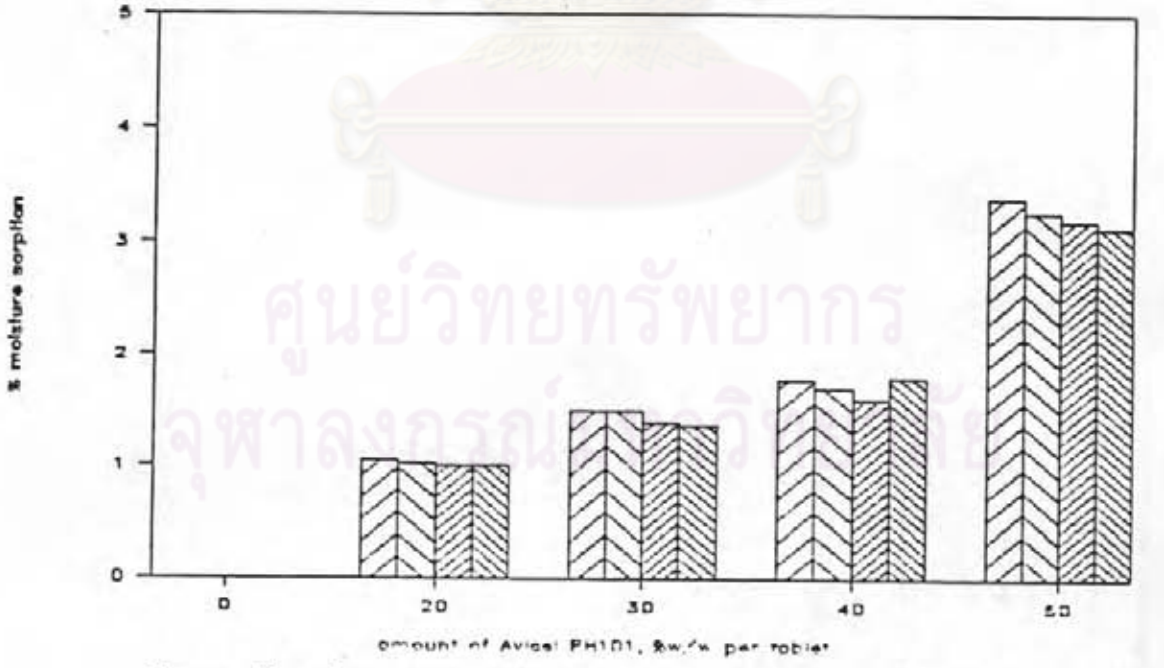

Figure 45. Absorption efficiencies of dicalcium phosphate dihydrate tablets containing microcrystalline cellulose (Avicel PH101) at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours:
1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

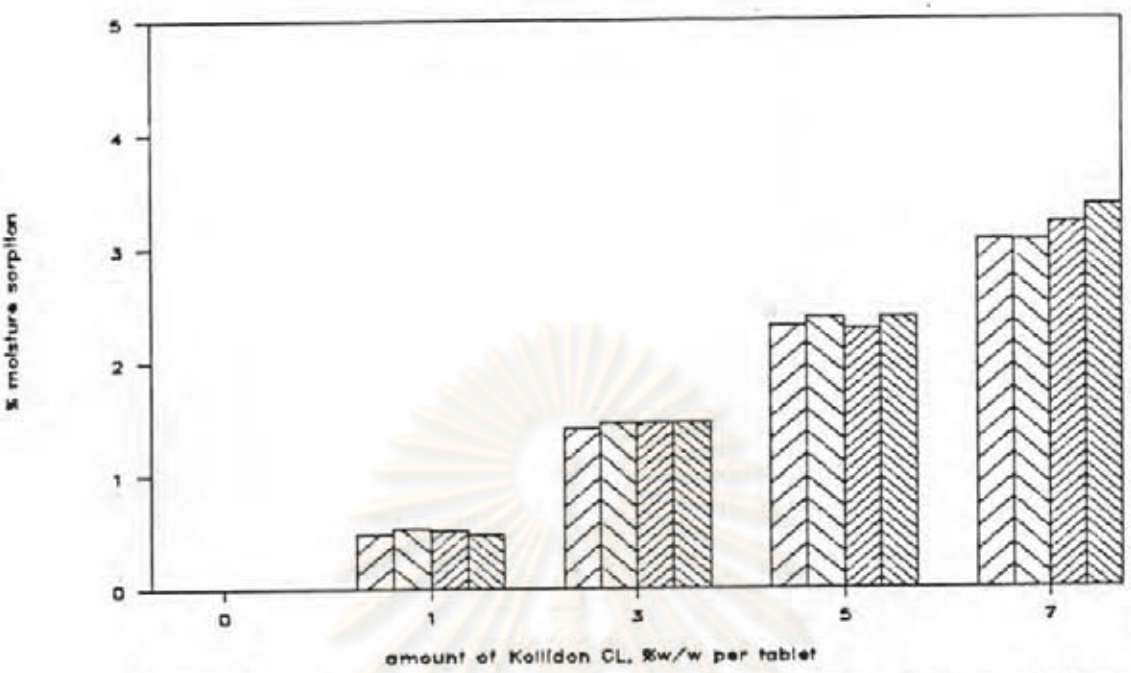

Figure 46. Absorption efficiencies of α-lactose monohydrate tablets containing cross linked polyvinylpyrrolidone (Kollidon CL) at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

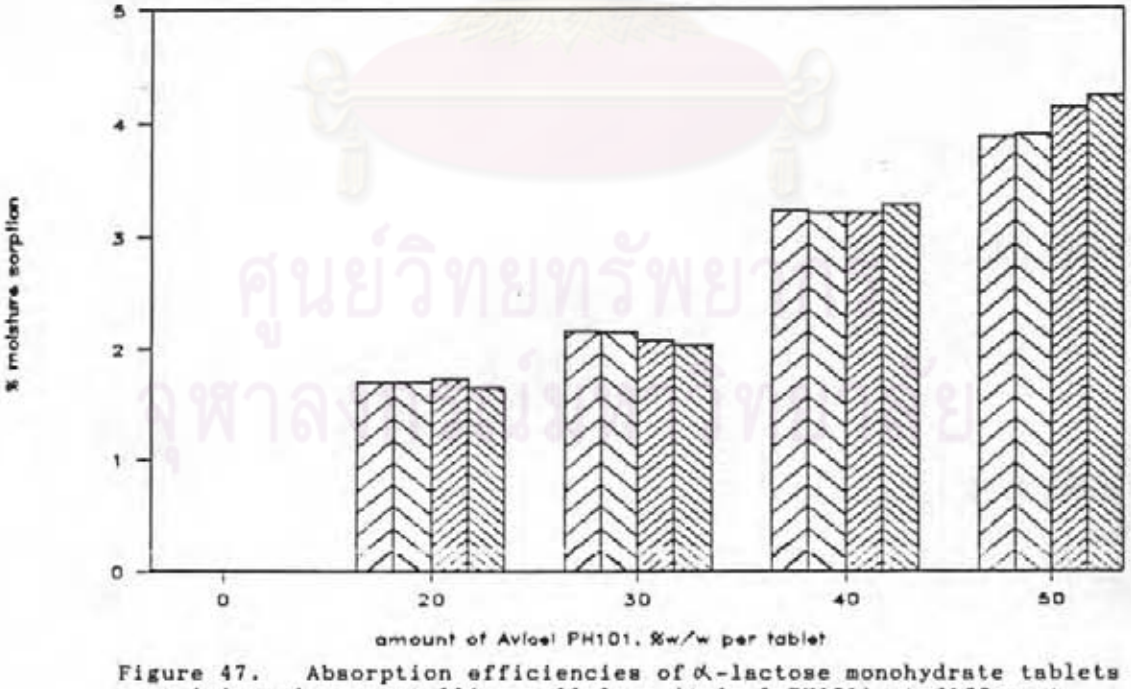

Figure 47. Absorption efficiencies of α-lactose monohydrate tablets containing microcrystalline cellulose (Avicel PH101) at different concentrations compressed with different compressional force levels after 98% relative humidity exposure for 72 hours: 1200 pounds, 1800 pounds, 2400 pounds, 3000 pounds.

tablet compressed at various forces as a function of amount of disintegrants were performed as shown in Figures 48 - 55. The linear regression line analysis by least squares fitted method was applied to analyse the relationship of the plot. It was seen that a good linear relationship between mean percent moisture sorption and amount of disintegrants was found for all formulations as shown in Table 15. This relationship obeyed Langmuir's adsorption theory which indicated that adsorption of moisture is directly proportional to the amount of adsorbent. It also appeared that the slope of the relationship in Table 15 was not significant difference as increased compressional forces when the same type and amount of disintegrant was used. This meant that compressional forces exerts no influence on moisture sorption.

Most formulations showed no significant difference in moisture sorption with compressional forces ($\alpha = 0.05$) except for tablets which contained 7% cross linked polyvinylpyrrolidone in the formulations with either diluents and the α-lactose monohydrate tablets which included 6%, 9% and 12% corn starch in the formulations.

When exposed at 67% and 98% relative humidities, tablets containing 7% cross linked polyvinylpyrrolidone and compressed at higher compressional forces could pick up more moisture. Similar results were

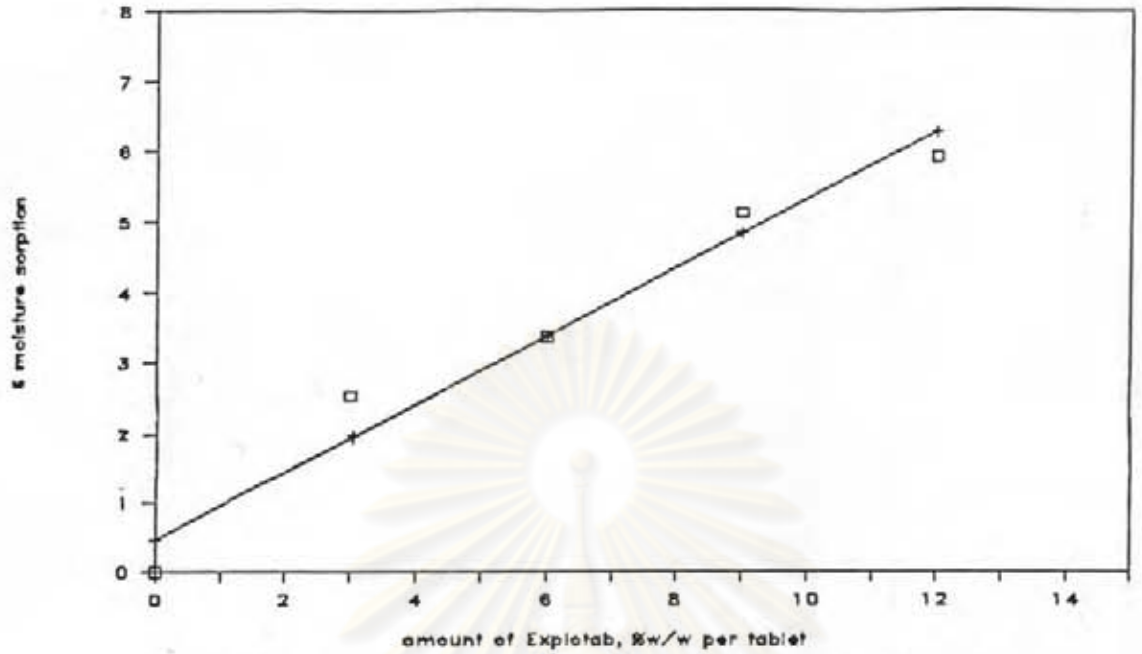

Figure 48. Mean percent moisture sorption of dicalcium phosphate dihydrate tablets compressed with various compressional forces containing different amounts of sodium starch glycolate (Explotab) after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

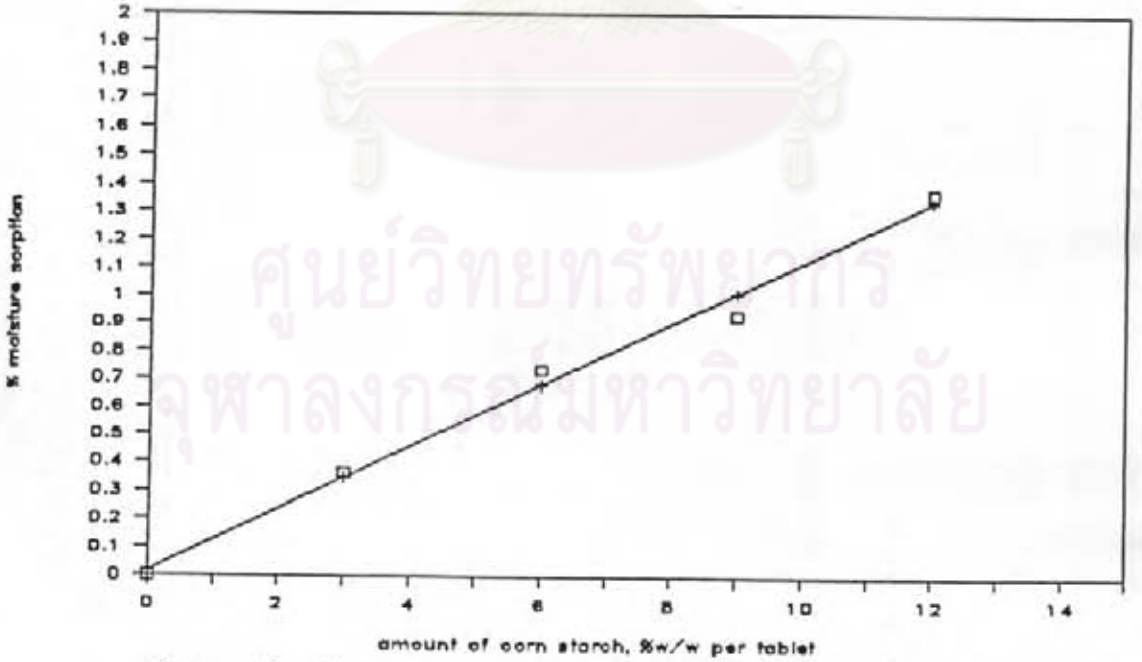

Figure 49. Mean percent moisture sorption of dicalcium phosphate dihydrate tablets compressed with various compressional forces containing different amounts of corn starch after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

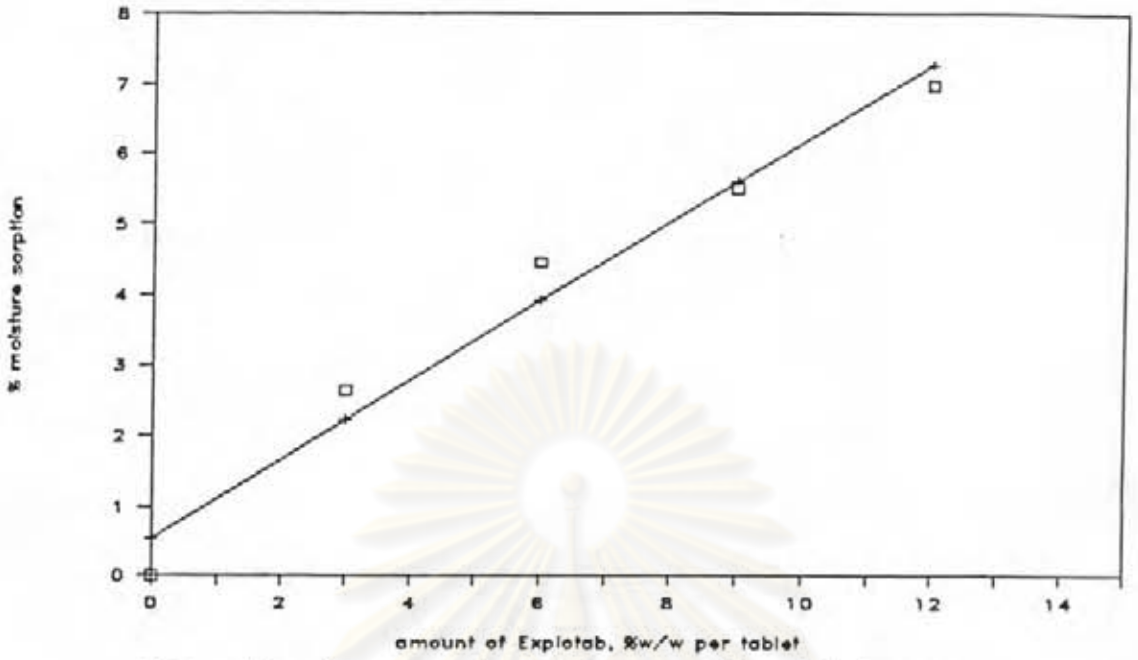

Figure 50. Mean percent moisture sorption of α-lactose monohydrate tablets compressed with various compressional forces containing different amounts of sodium starch glycolate (Explotab) after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

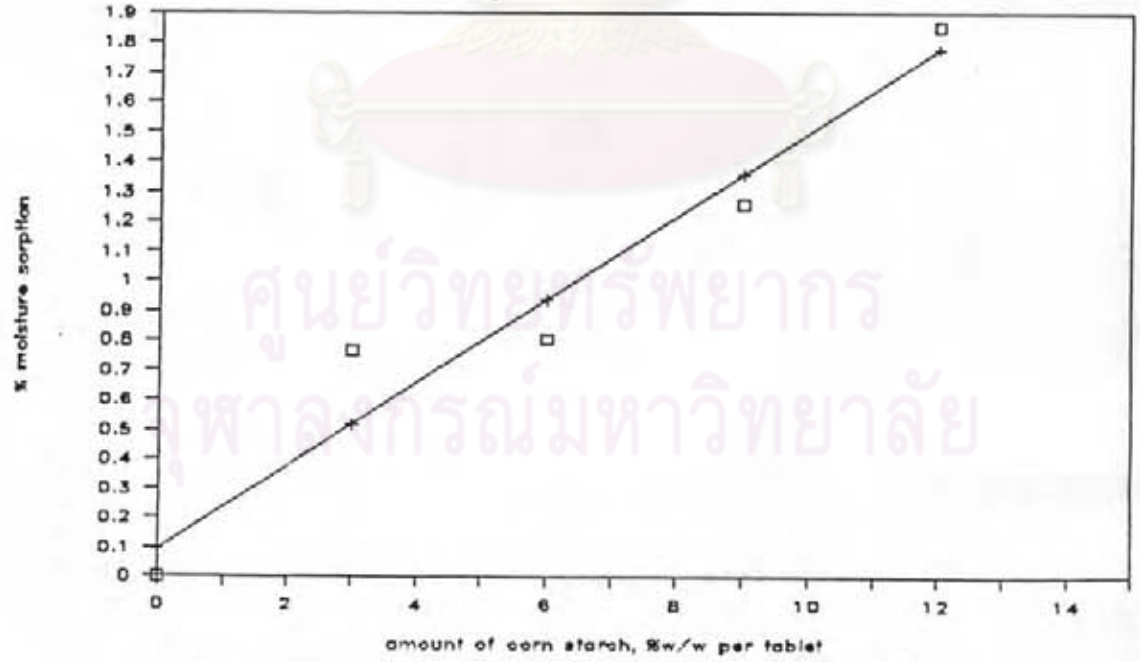

Figure 51. Mean percent moisture sorption of α-lactose monohydrate tablets compressed with various compressional forces containing different amounts of corn starch after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

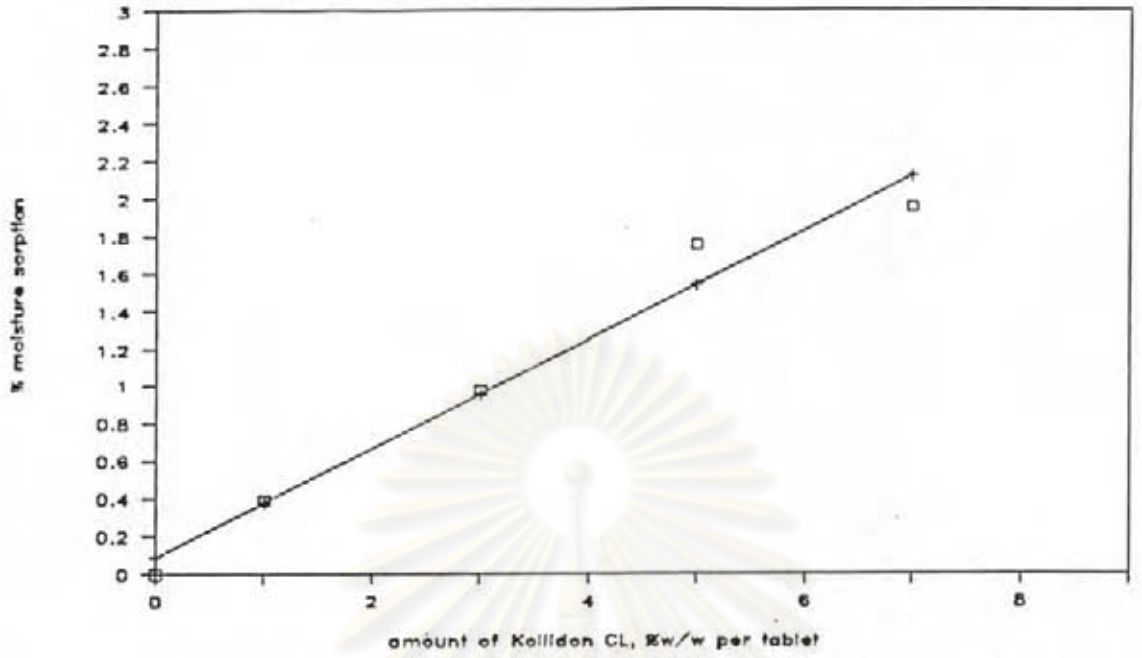

Figure 52. Mean percent moisture sorption of dicalcium phosphate dihydrate tablets compressed with various compressional forces containing different amounts of cross linked polyvinylpyrrolidone (Kolidon CL) after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

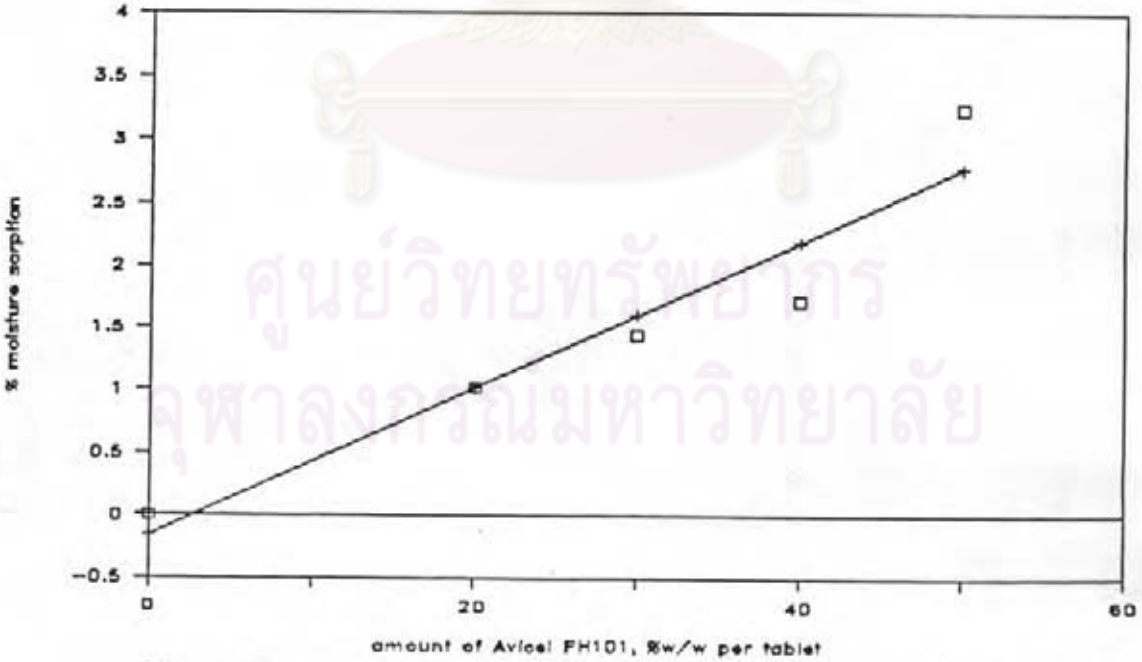

Figure 53. Mean percent moisture sorption of dicalcium phosphate dihydrate tablets compressed with various compressional forces containing different amounts of microcrystalline cellulose (Avicel PH101) after storage at 98% relative humidity for 72 hours.
□ data from the experiment, + data from regression analysis

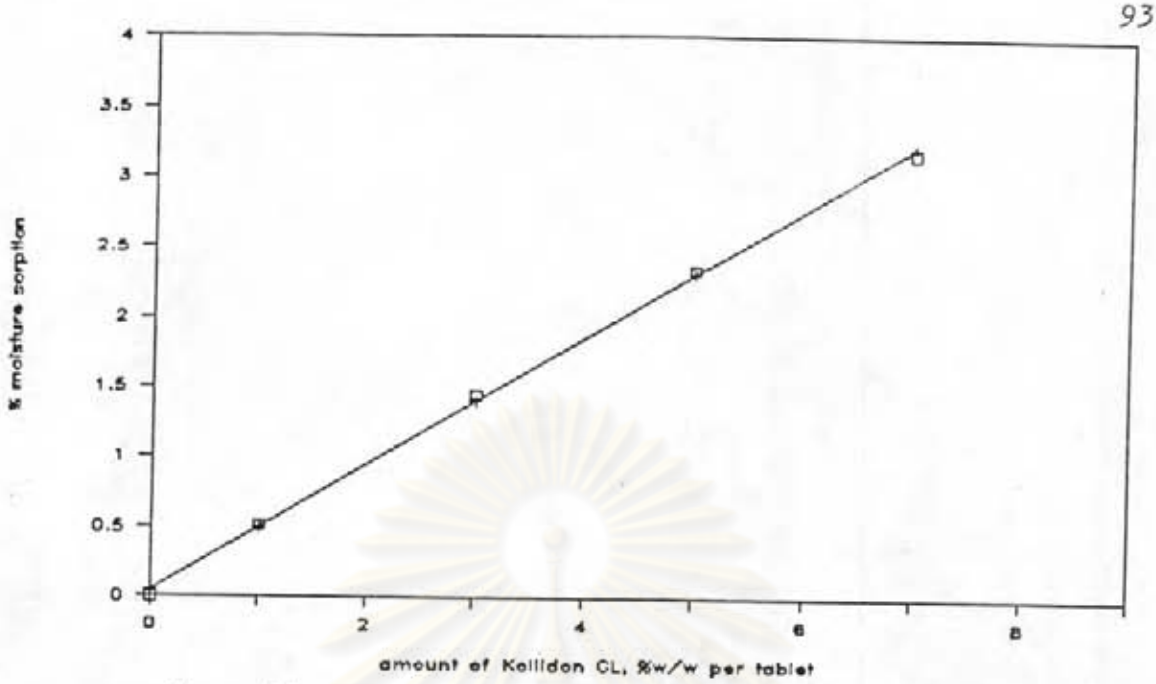

Figure 54. Mean percent moisture sorption of α-lactose monohydrate tablets compressed with various compressional forces containing different amounts of cross linked polyvinylpyrrolidone (Kollidon CL) after storage at 98% relative humidity for 72 hours. □ data from the experiment, + data from regression analysis

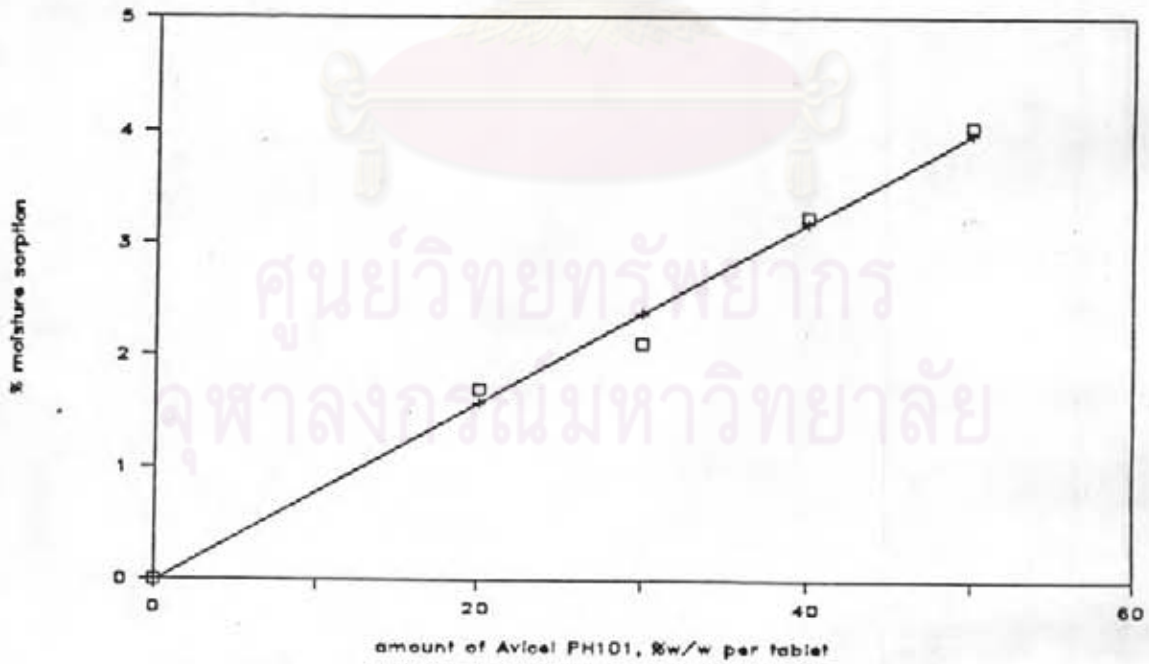

Figure 55. Mean percent moisture sorption of α-lactose monohydrate tablets compressed with various compressional forces containing different amounts of microcrystalline cellulose (Avicel PH101) after storage at 98% relative humidity for 72 hours. □ data from the experiment, + data from regression analysis

Table 15 Regression Analysis between Percent Moisture Sorption and Amount of Disintegrants in Tablets of Different Formulations.

FORMULATION	FORCE	R SQUARE	X COEFF.
EMCOMPRESS + EXPLOTAB	1200	0.9276	0.4301
	1800	0.9645	0.5025
	2400	0.9758	0.5028
	3000	0.9664	0.5058
EMCOMPRESS + STARCH	1200	0.9877	0.1103
	1800	0.9913	0.1109
	2400	0.9925	0.1074
	3000	0.9886	0.1111
EMCOMPRESS + KOLLIDON CL	1200	0.9763	0.2936
	1800	0.9850	0.2967
	2400	0.9663	0.2796
	3000	0.9460	0.2861
EMCOMPRESS + AVICEL PH101	1200	0.9089	0.0612
	1800	0.9103	0.0588
	2400	0.8921	0.0568
	3000	0.9314	0.0574
TABLETTOSE + EXPLOTAB	1200	0.9699	0.5379
	1800	0.9660	0.5418
	2400	0.9731	0.5609
	3000	0.9709	0.6030
TABLETTOSE + STARCH	1200	0.9443	0.1360
	1800	0.9168	0.1381
	2400	0.9513	0.1424
	3000	0.9527	0.1437
TABLETTOSE + KOLLIDON CL	1200	0.9982	0.4392
	1800	0.9951	0.4399
	2400	0.9991	0.4519
	3000	0.9999	0.4774
TABLETTOSE + AVICEL PH101	1200	0.9932	0.0776
	1800	0.9926	0.0778
	2400	0.9856	0.0811
	3000	0.9829	0.0836

observed with α-lactose monohydrate tablets containing 6% 9% and 12% corn starch. Fisher's least significant difference was applied to differentiate moisture sorption between compressional force of those formulations as shown in Table 16.

Tablets adsorbed more moisture when exposed at higher relative humidity after 72 hours except α-lactose monohydrate tablets containing 1% and 3% cross linked polyvinylpyrrolidone, 3% and 6% corn starch, 20% microcrystalline cellulose and dicalcium phosphate dihydrate tablets containing 1% and 3% cross linked polyvinylpyrrolidone, all concentrations of corn starch and 20% microcrystalline cellulose which moisture sorption were not significantly change (α = 0.05). This data definitily showed that cross linked polyvinylpyrrolidone, corn starch and microcrystalline cellulose did not sensitive to moisture at low concentration.

(b) Density Change

The ratios of tablet density at various time t to initial tablet density after exposed to 98% relative humidity were shown in Figures 56-81. All formulations showed significantly decrease in density against time (α = 0.05), except dicalcium phosphate dihydrate tablets which contained 3% corn starch in the formulation.

Table 16 Fisher's Least Significant Different Analysis for Moisture Sorption after 72 hours Exposure.
0 = no different * = different

FORMULATION	FORCE	1200	1800	2400	3000
TABLETTOSE + 6% STARCH	1200	0	0	0	*
	1800	0	0	0	*
	2400	0	0	0	0
	3000	0	0	0	0
TABLETTOSE + 9% STARCH	1200	0	0	*	*
	1800	0	0	0	*
	2400	0	0	0	0
	3000	0	0	0	0
TABLETTOSE + 12% STARCH	1200	0	*	*	*
	1800	0	0	0	0
	2400	0	0	0	0
	3000	0	0	0	0
TABLETTOSE + 7% KOLLIDON CL	1200	0	*	*	*
	1800	0	0	0	*
	2400	0	0	0	0
	3000	0	0	0	0
EMCOMPRESS + 7% KOLLIDON CL	1200	0	*	*	*
	1800	0	*	*	*
	2400	0	0	0	0
	3000	0	0	0	0

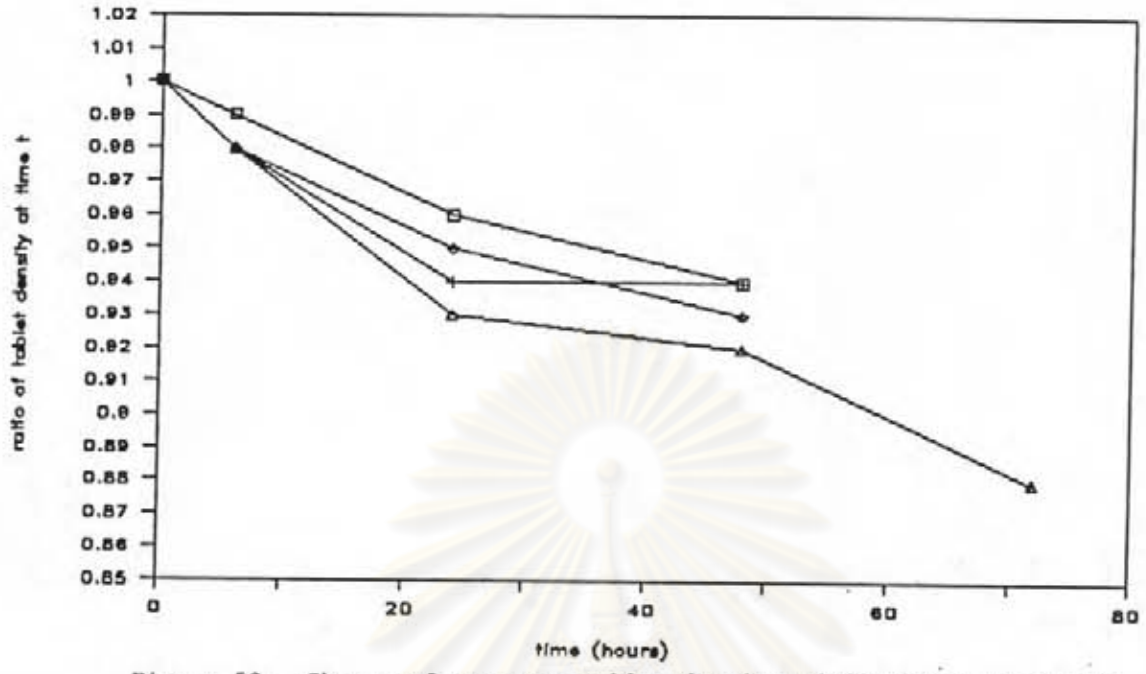

Figure 56. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 3% sodium starch glycolate compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, □ 3000 pounds.

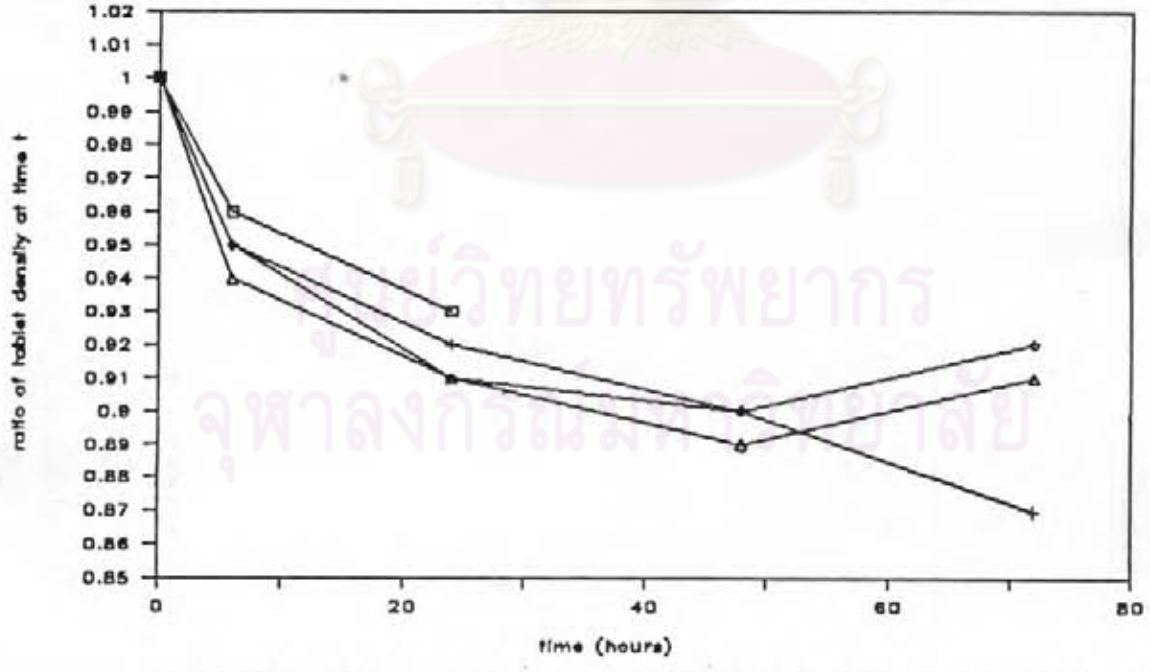

Figure 57. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 6% sodium starch glycolate compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, □ 3000 pounds.

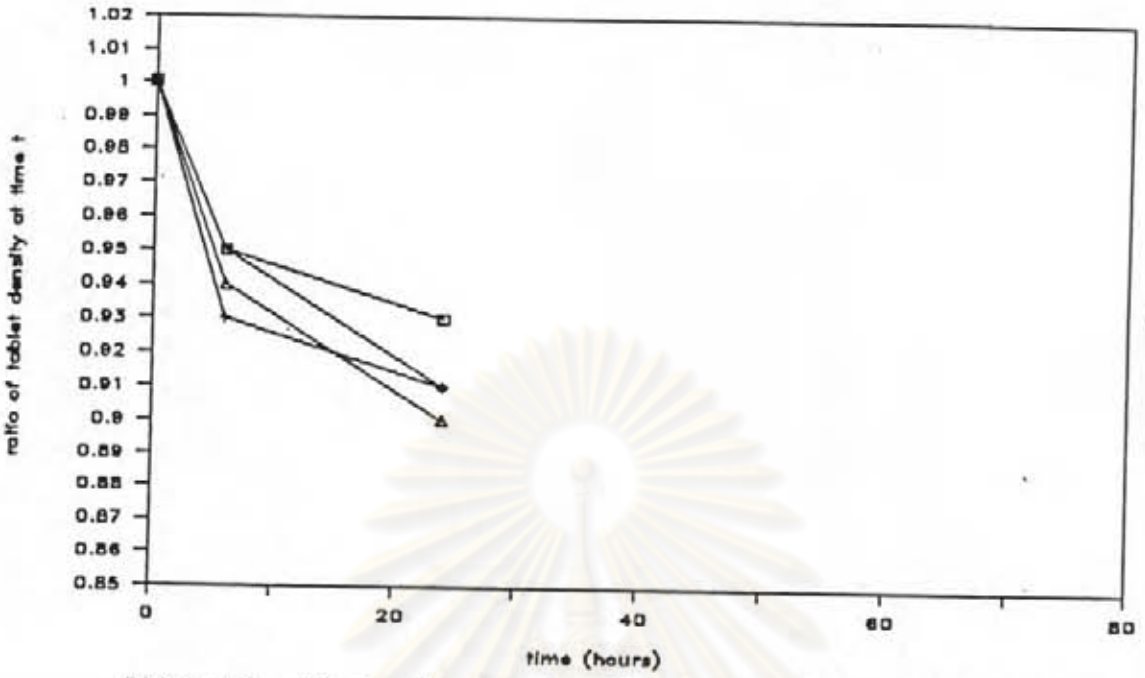

Figure 58. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 9% sodium starch glycolate compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

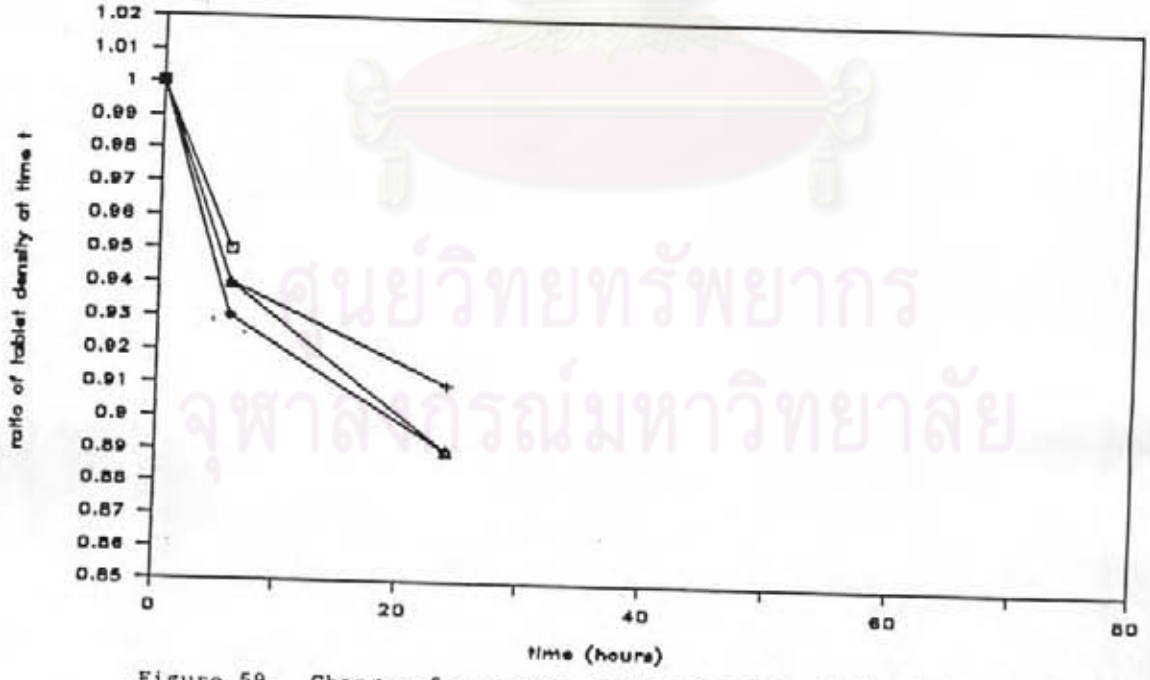

Figure 59. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 12% sodium starch glycolate compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

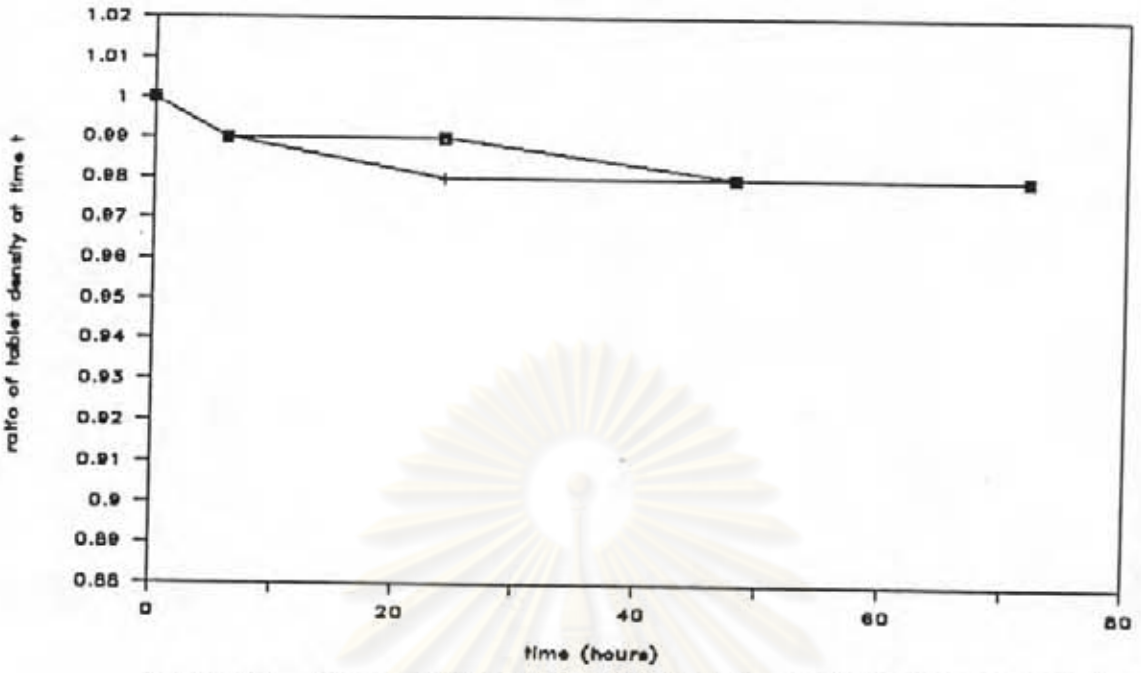

Figure 60. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 3% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

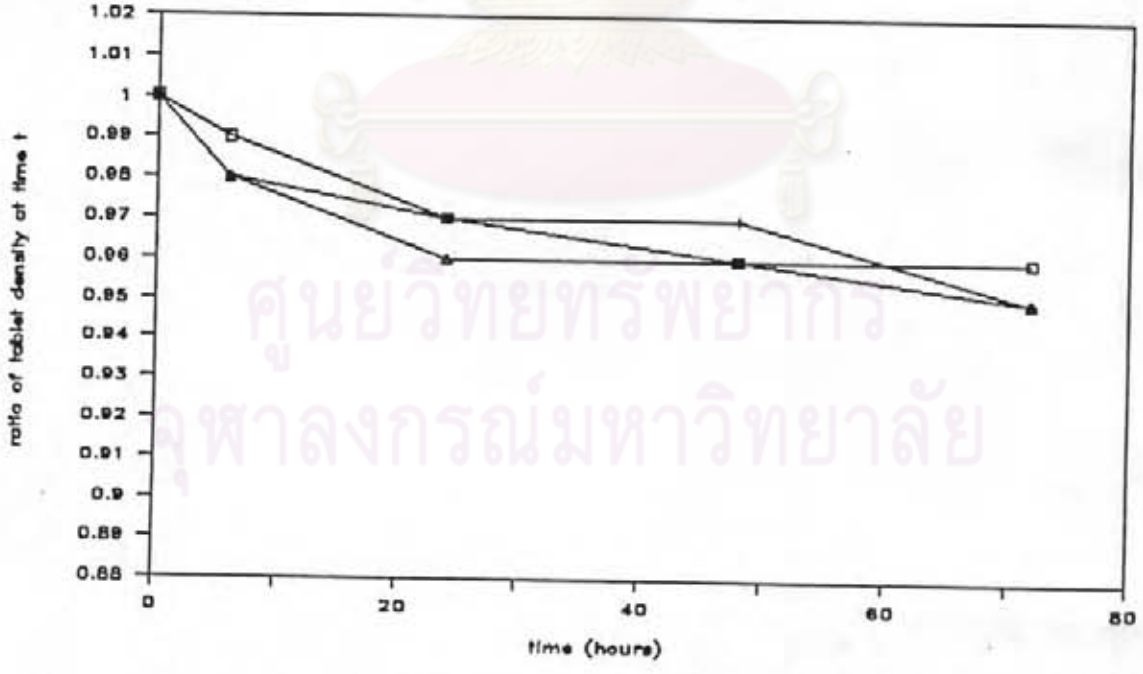

Figure 61. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 6% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

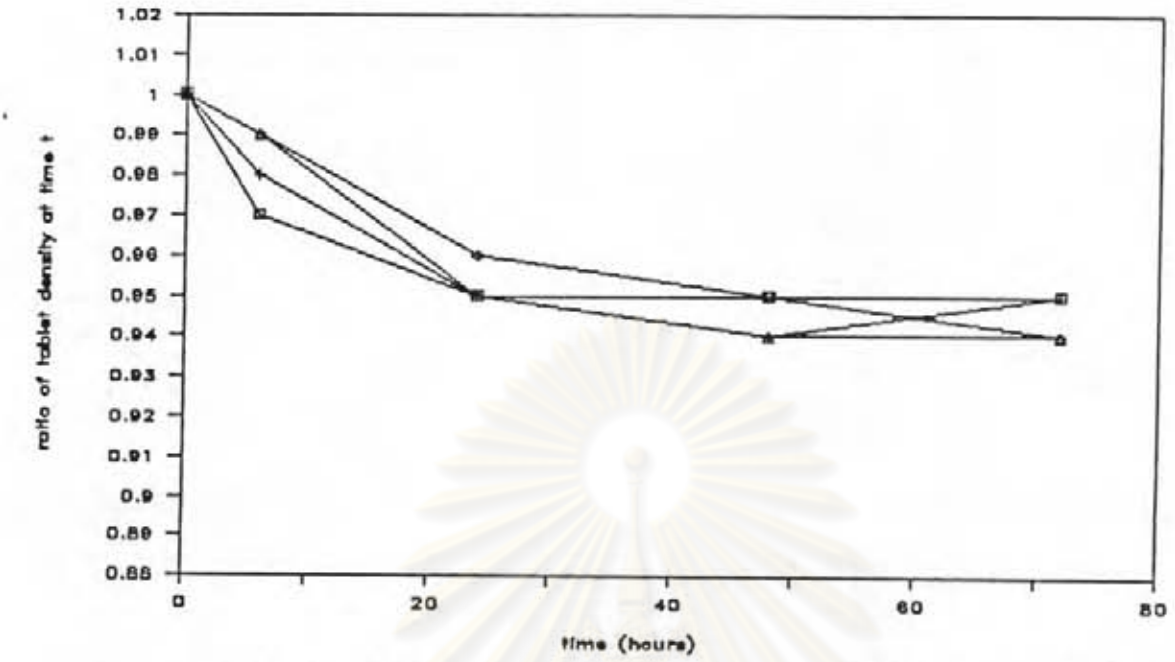

Figure 62. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 9% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

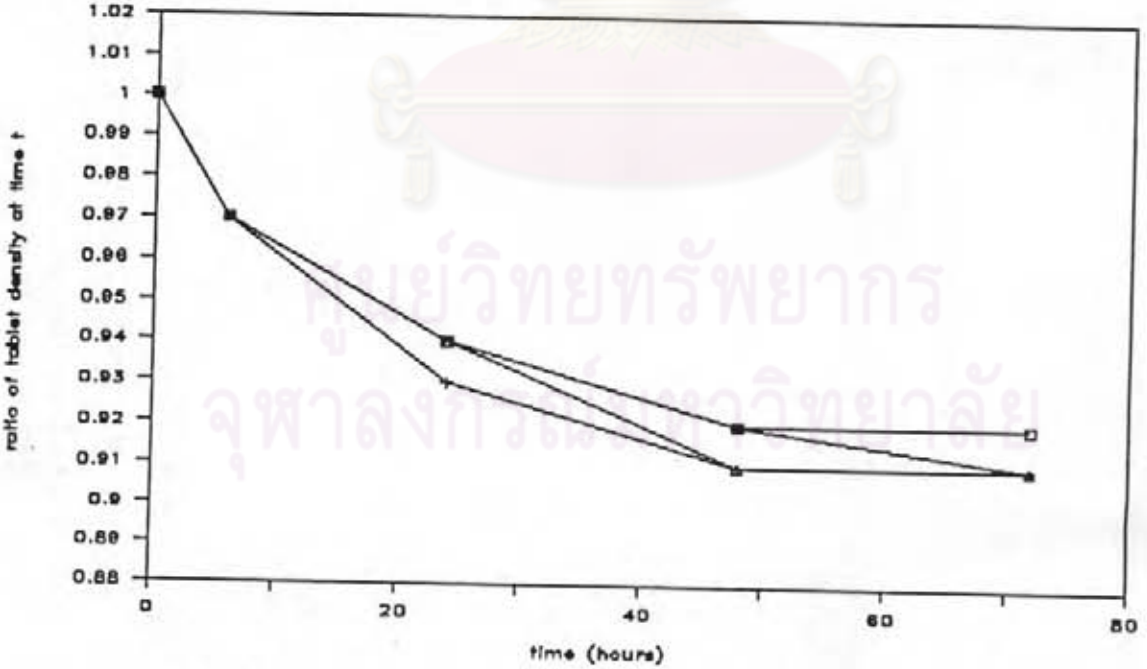

Figure 63. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 12% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

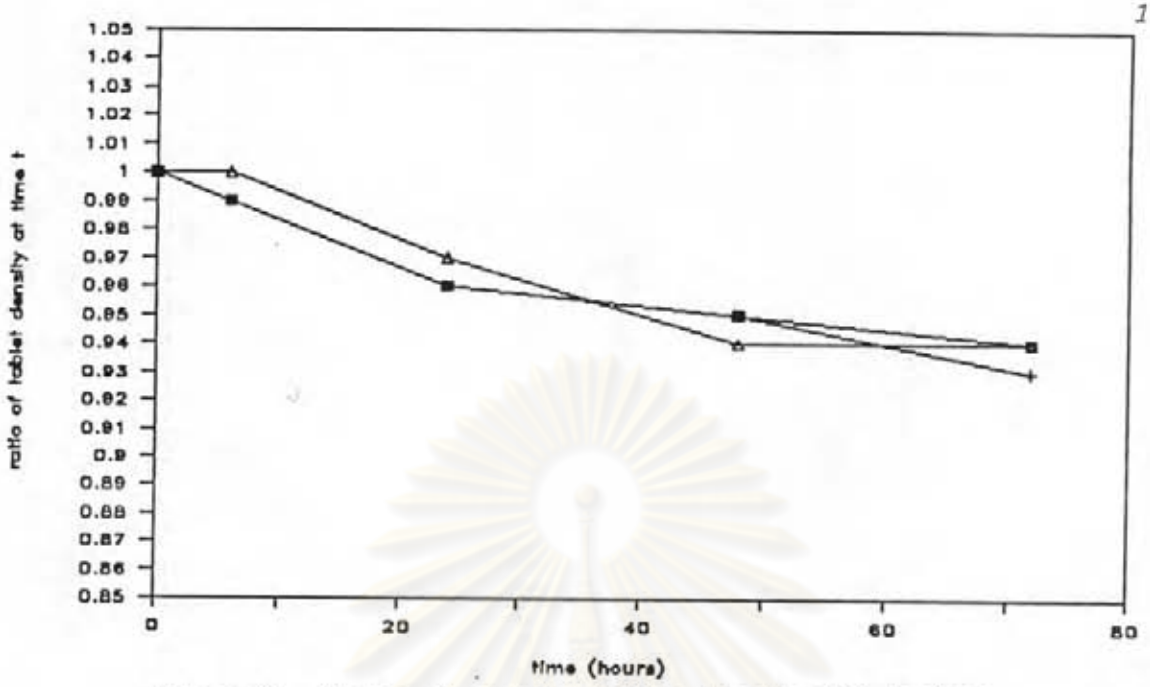

Figure 64. Change of apparent tablet density of α-lactose monohydrate tablets containing 3% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◇ 2400 pounds, △ 3000 pounds.

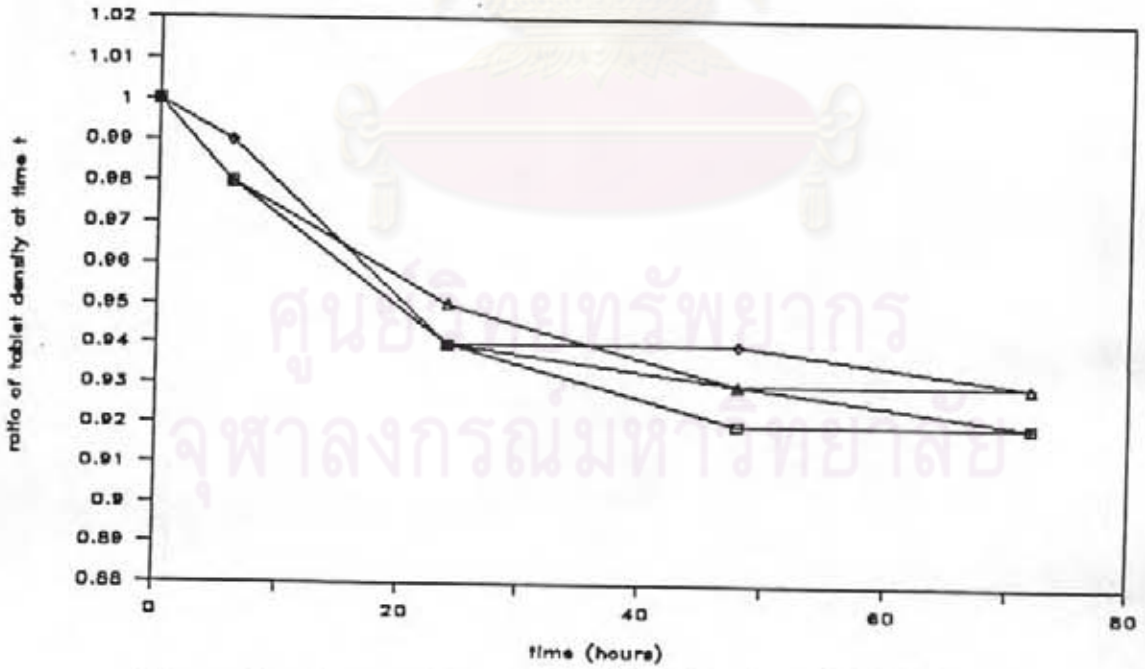

Figure 65. Change of apparent tablet density of α-lactose monohydrate tablets containing 6% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◇ 2400 pounds, △ 3000 pounds.

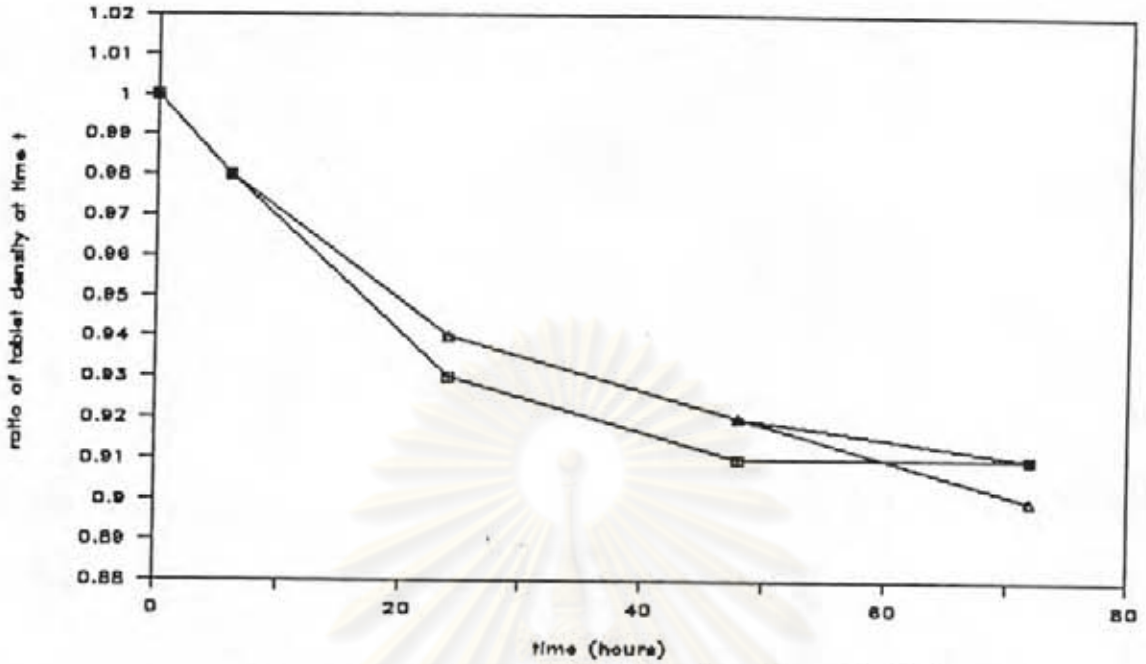

Figure 66. Change of apparent tablet density of α-lactose monohydrate tablets containing 9% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

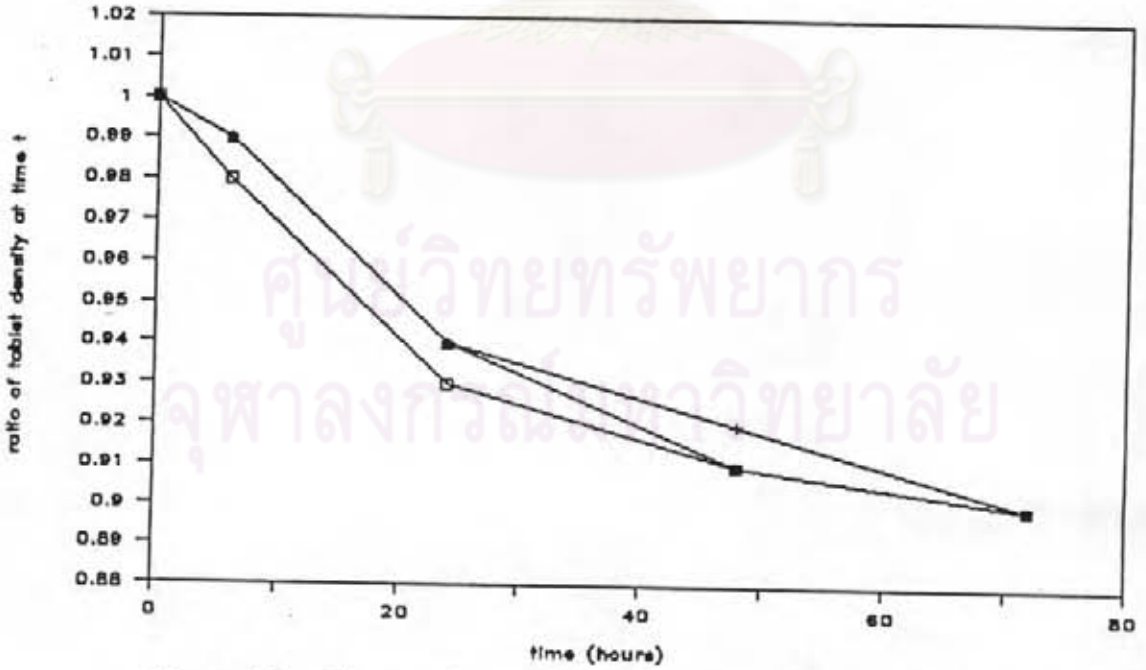

Figure 67. Change of apparent tablet density of α-lactose monohydrate tablets containing 12% corn starch compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

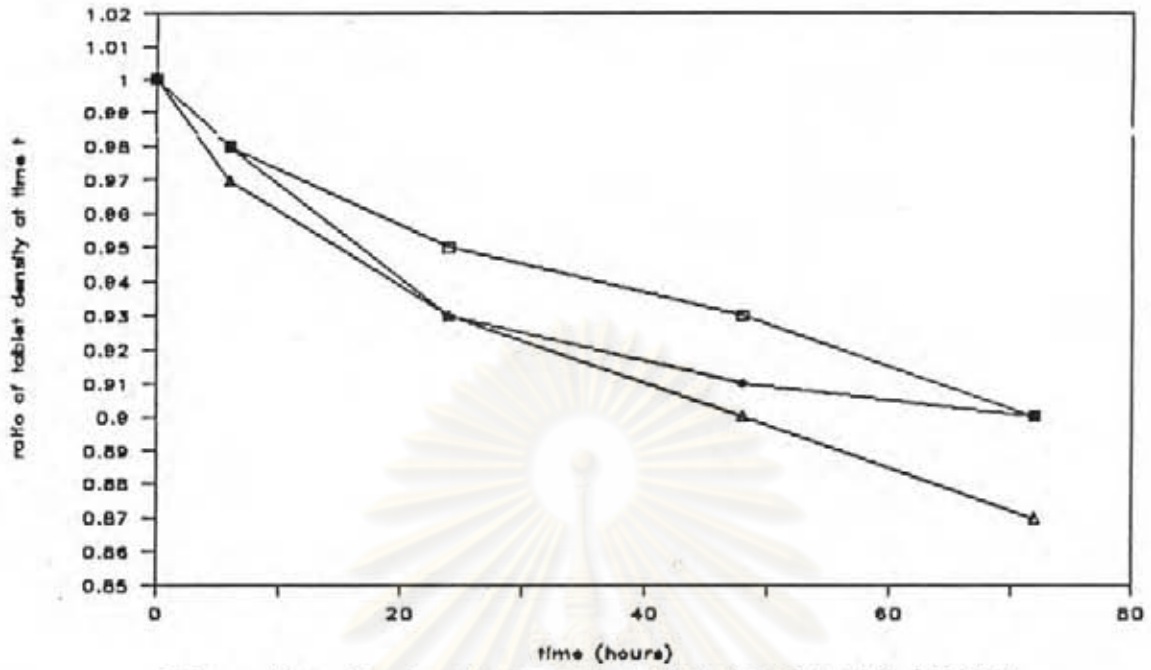

Figure 68. Change of apparent tablet density of α-lactose monohydrate tablets containing 3% sodium starch glycolate different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

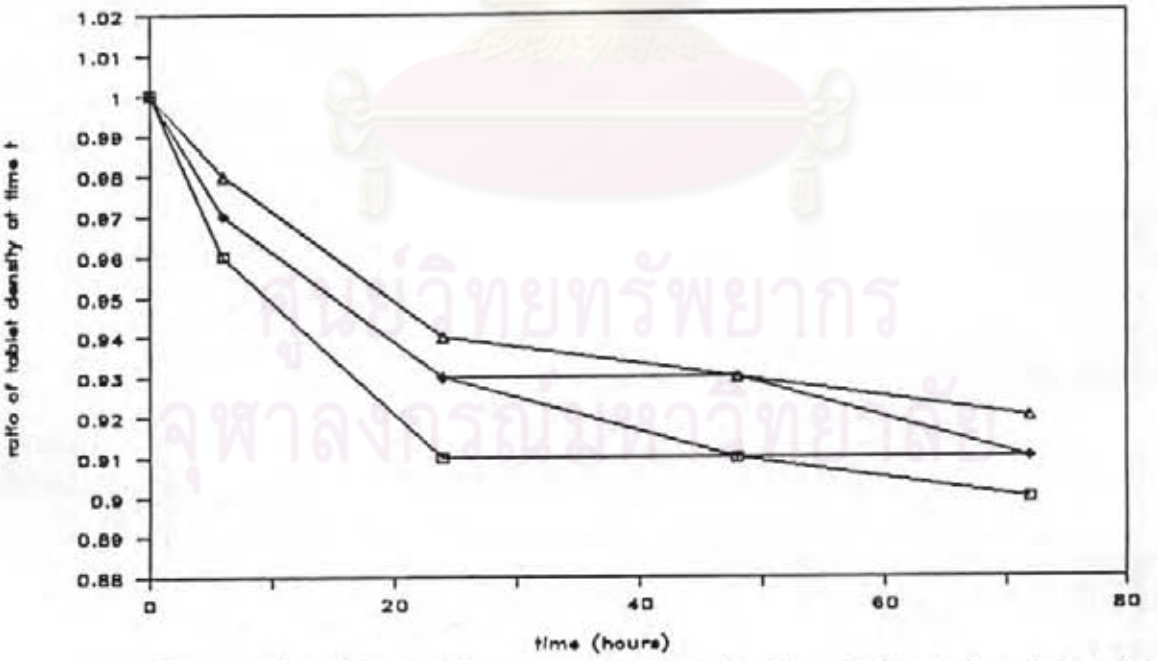

Figure 69. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 1% cross linked polyvinylpyrrolidone compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

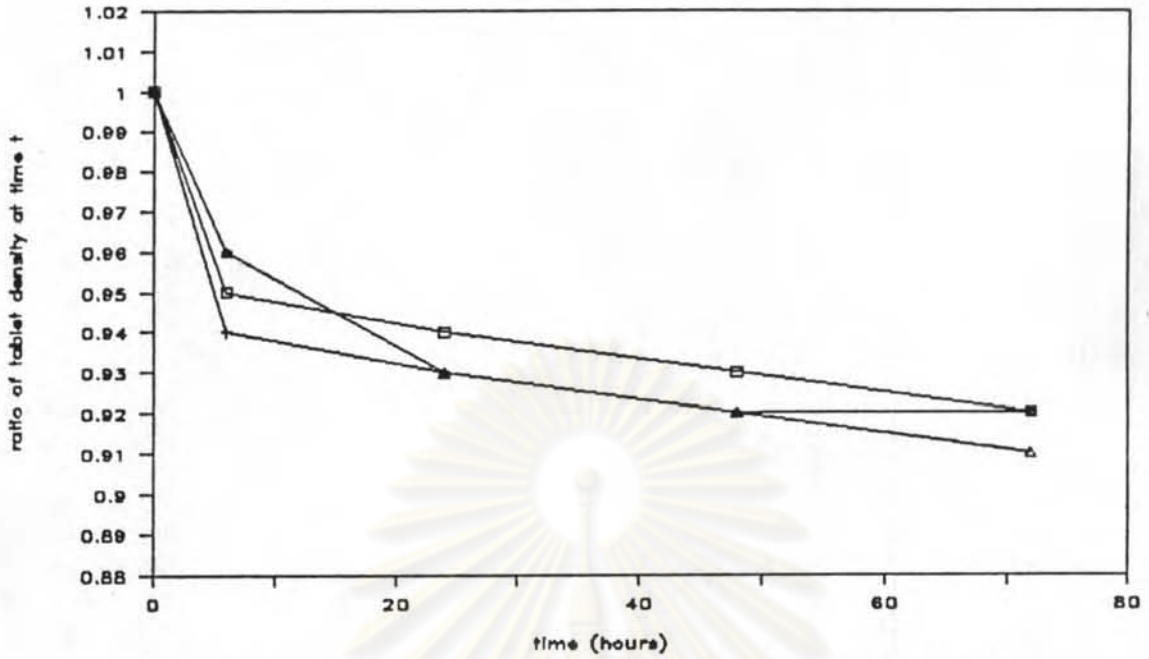

Figure 70. Change of apparent tablet density of α-lactose monohydrate tablets containing 1% cross linked polyvinylpyrrolidone compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

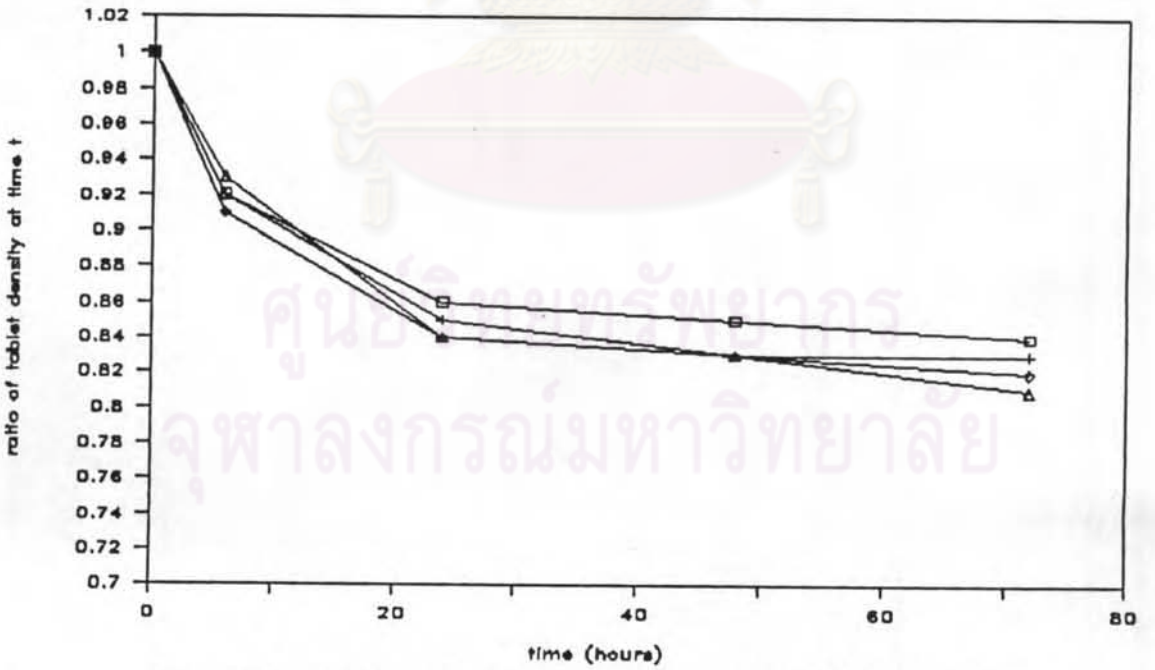

Figure 71. Change of apparent tablet density of α-lactose monohydrate tablets containing 3% cross linked polyvinylpyrrolidone compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

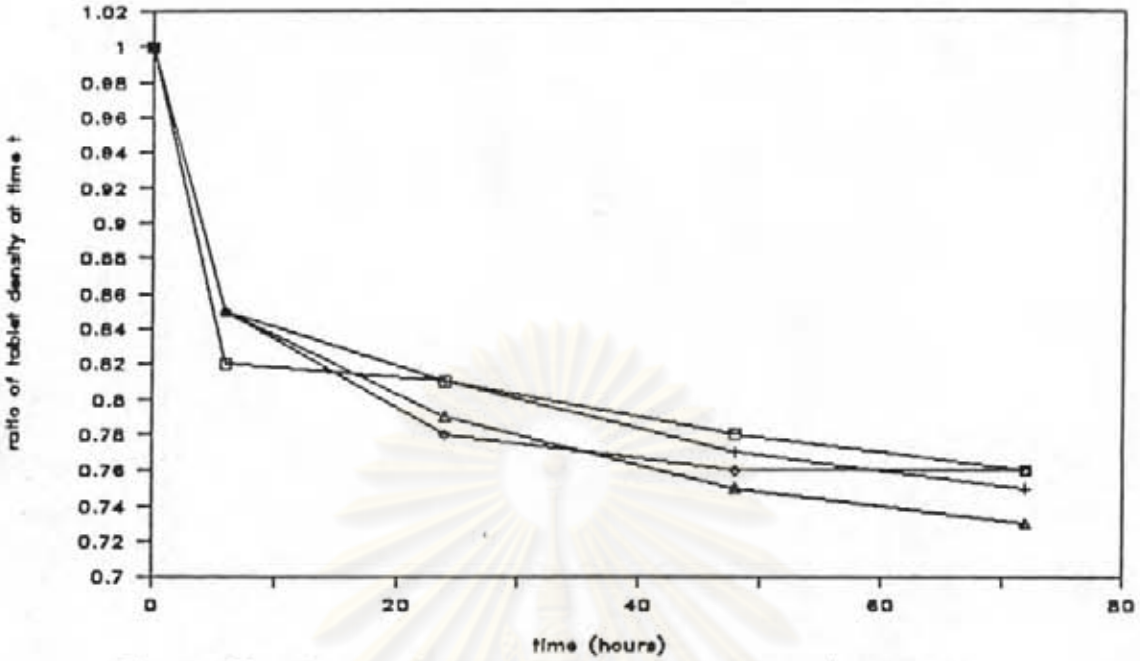

Figure 72. Change of apparent tablet density of α-lactose monohydrate tablets containing 5% cross linked polyvinylpyrrolidone compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

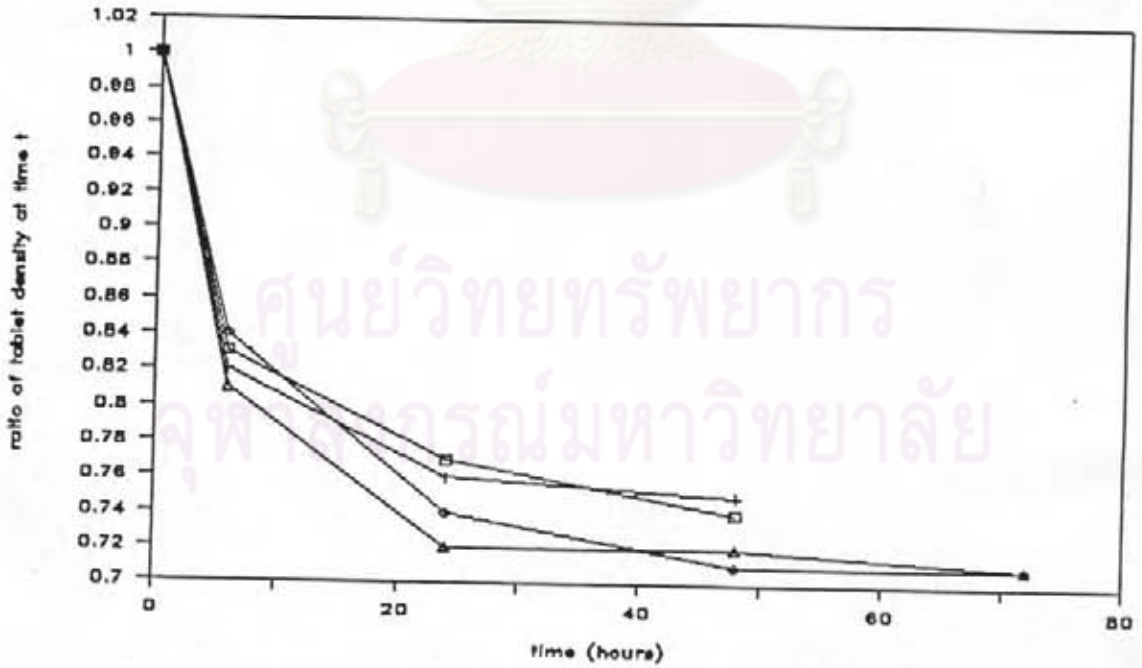

Figure 73. Change of apparent tablet density of α-lactose monohydrate tablets containing 7% cross linked polyvinylpyrrolidone compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

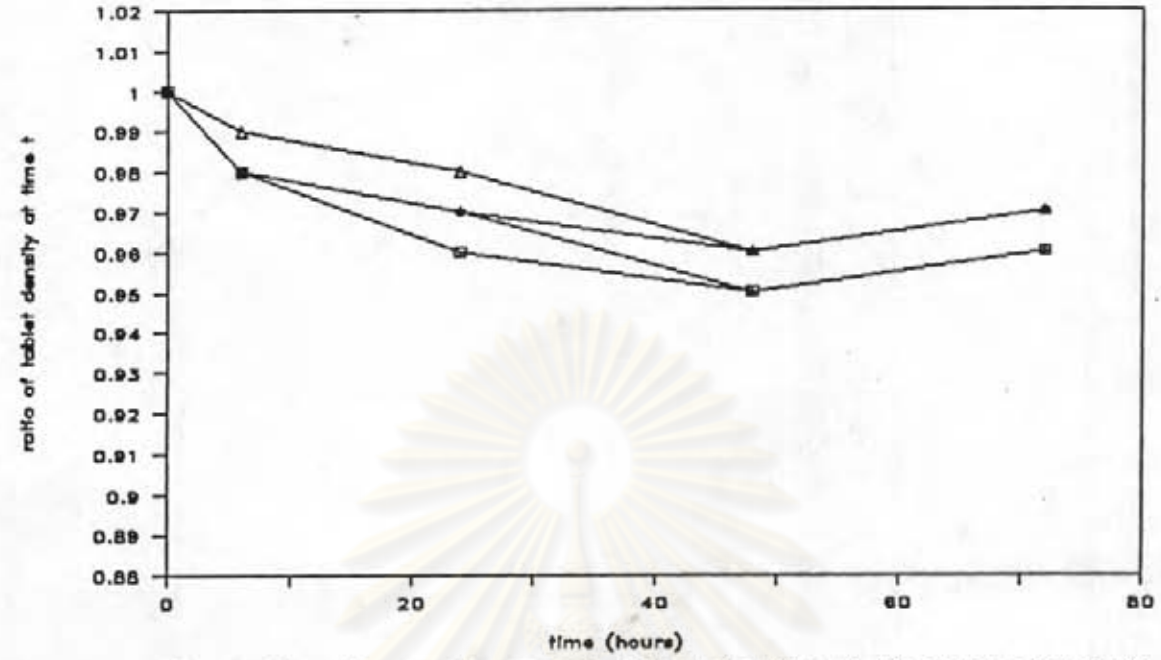

Figure 74. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 20% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

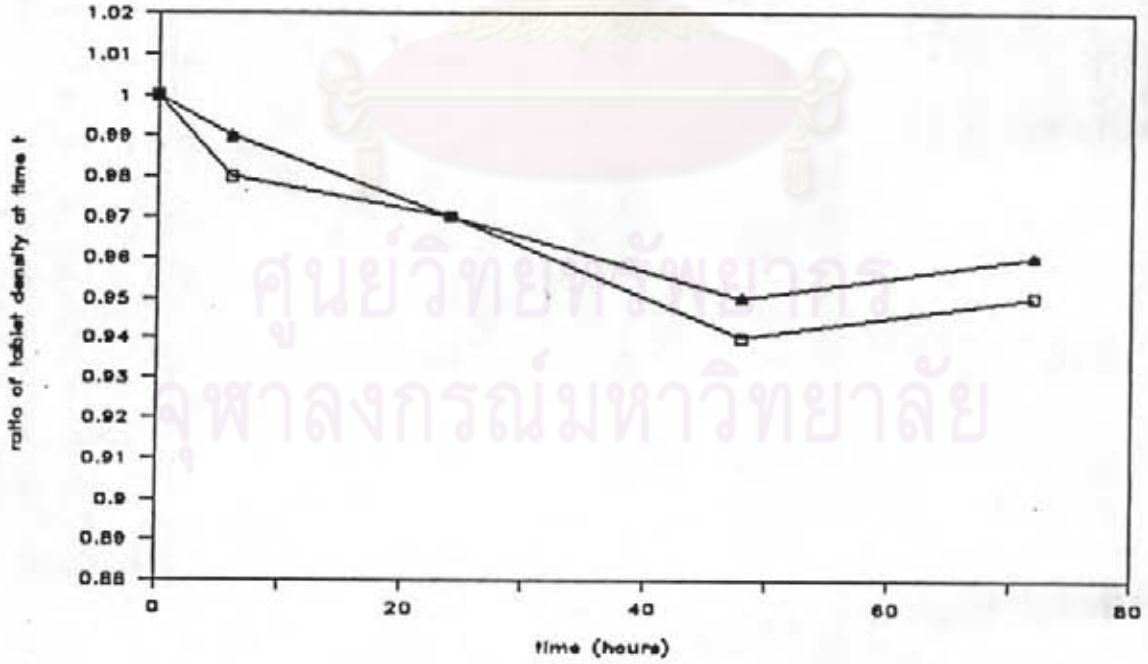

Figure 75. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 30% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

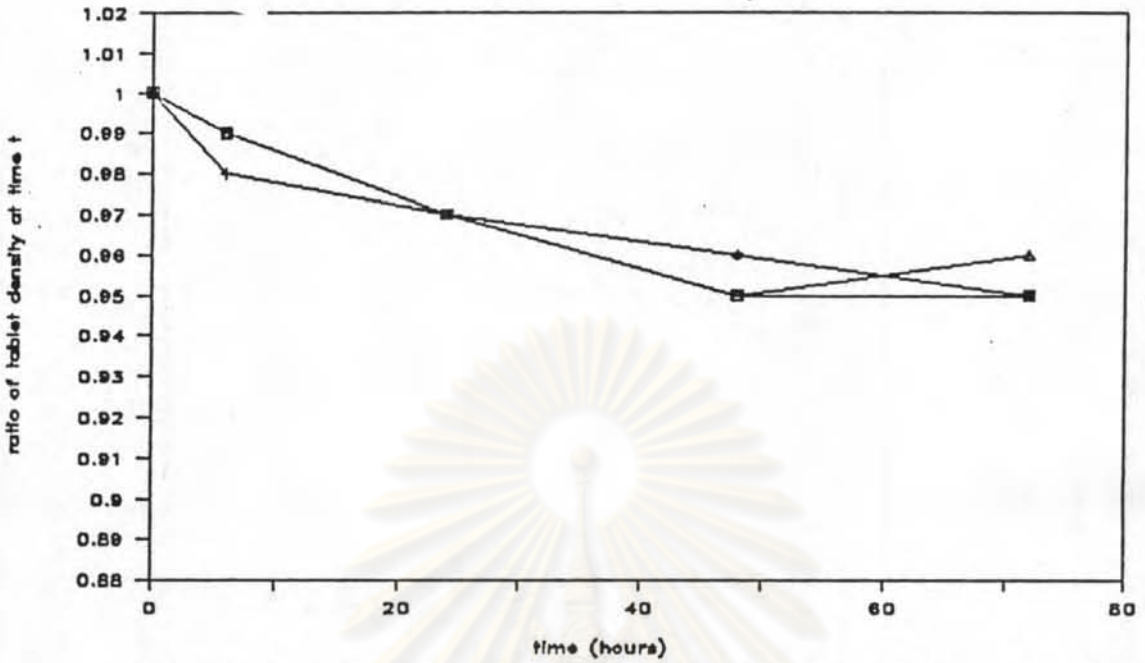

Figure 76. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 40% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

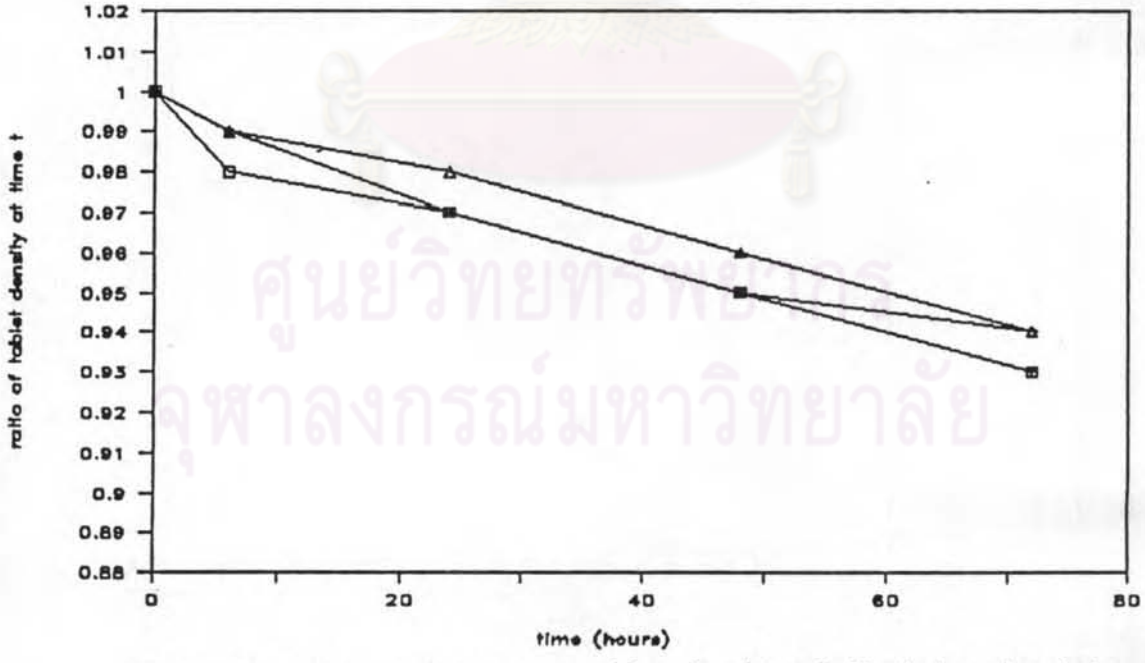

Figure 77. Change of apparent tablet density of dicalcium phosphate dihydrate tablets containing 50% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity.
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

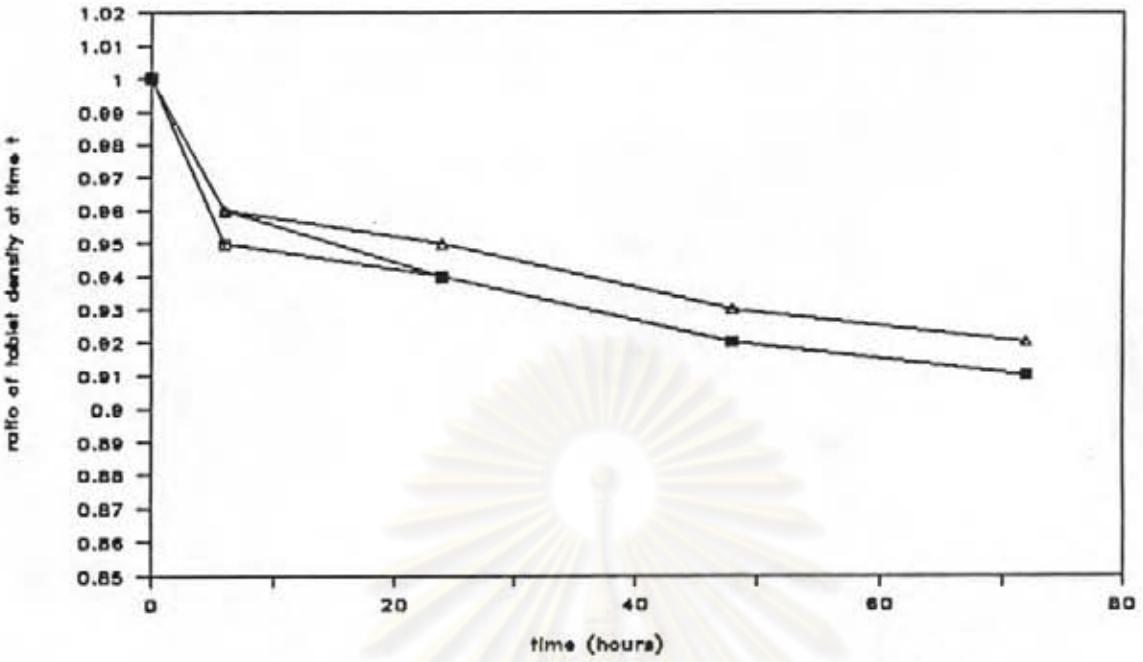

Figure 78. Change of apparent tablet density of α-lactose monohydrate tablets containing 20% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. o 1200 pounds, + 1800 pounds, ◊ 2400 pounds, Δ 3000 pounds.

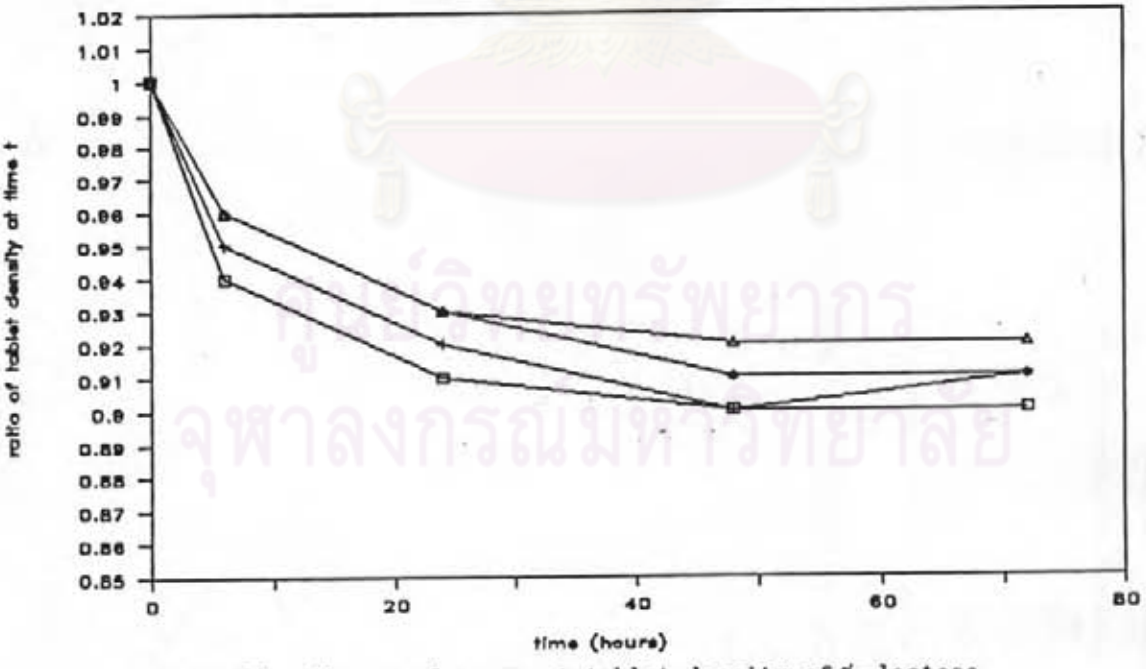

Figure 79. Change of apparent tablet density of α-lactose monohydrate tablets containing 30% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. o 1200 pounds, + 1800 pounds, ◊ 2400 pounds, Δ 3000 pounds.

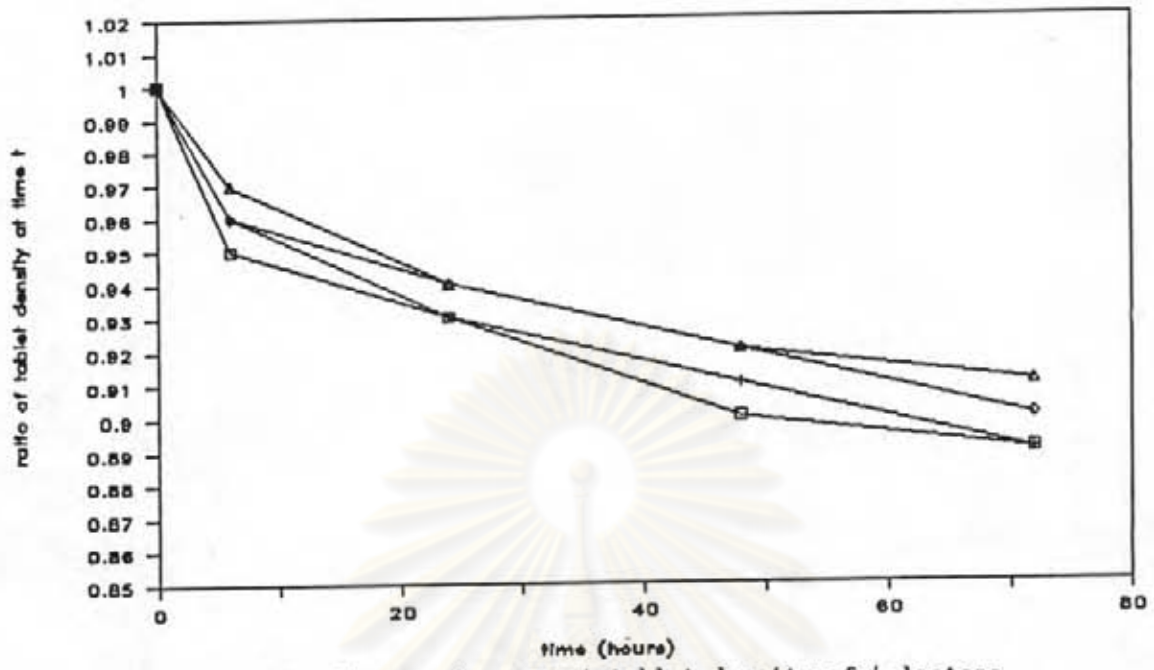

Figure 80. Change of apparent tablet density of α-lactose monohydrate tablets containing 40% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

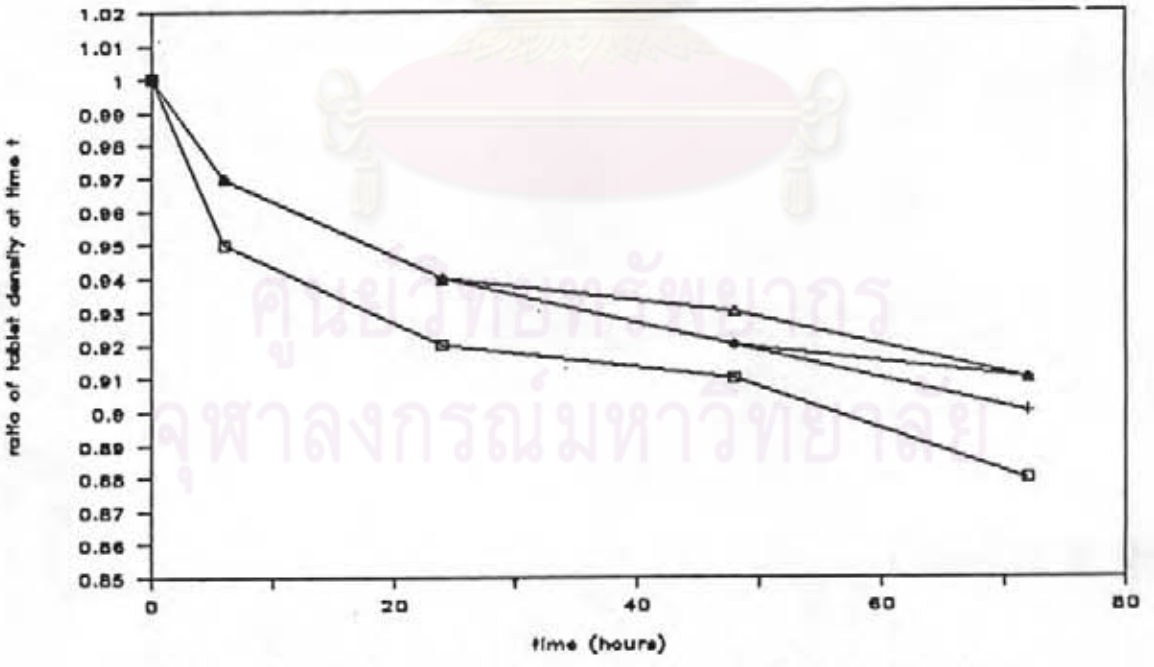

Figure 81. Change of apparent tablet density of α-lactose monohydrate tablets containing 50% microcrystalline cellulose compressed with different compressional forces at 98% relative humidity. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

The ratios also decreased as the concentrations of disintegrant increased. It also appeared that tablets containing sodium starch glycolate showed the highest decrease in the ratios following by the tablets containing cross linked polyvinylpyrrolidone, microcrystalline cellulose and corn starch respectively.

Comparison between two systems, soluble α-lactose monohydrate and insoluble dicalcium phosphate dihydrate, the soluble system showed higher decrease in the ratios than the insoluble system when contained the same type amount of disintegrant.

In addition, tablets after exposed to 98% relative humidity for 72 hours showed evicence that the ratios of density change were not siginficantly different when different compressional forces were used ($\alpha = 0.05$).

An interesting observation were made in the case of dicalcium phosphate dihydrate tablets containing 6% sodium starch glycolate, 20% and 30% microcrystalline cellulose when they were exposed to 98% relative humidity for more than 48 hours, that is they showed slightly increasing in the ratios beyond 48 hours as shown in Figure 57, 74 and 75 respectively. The data from the experiment showed that these tablets absorbed more moisture but did not change their dimension, thus their density did not decrease.

(c) Hardness

It was appeared that the effect of compressional force on tablet hardness was as expected, that is increased as increased compressional force.

It was obsreved that tablet hardness decreased when increased concentration of disintegrant. However, the reversal was observed from tablets containing different amount of microcrystalline cellulose. The highest hardness was obtained for the tablet containing the highest amount of microcrystalline cellulose when the tablets was compressed at the same compressional force. This phenomenon is the binding of microcrystalline cellulose particles through hydrogen bonds (30).

Comparison between tablets containing the same type and concentration of disintegrant, the insoluble dicalcium phosphate dihydrate system showed higher hardness than the soluble α-lactose monohydrate system when compressed at the same compressional force.

All formulations showed a considerable decreased in hardness at 98% relative humidity exposure. The hardness continuously decreased as time passed. The results also showed that the hardness of tablets containing sodium starch glycolate and cross linked polyvinlypyrrolidone as disintegrants was markedly decreased beyond 24 hours, which

were unable to measure accurately. It could be explain that tablet hardness decrease after storage at high humdity resulted from a gain in the moisture contents (47). However, tablet hardness did not markedly change when exposed at lower humidity.

Relative Density

Relative density can be calculated from the following expression:

$$\text{Relative Density} = \frac{\text{apparent tablet density}}{\text{effective granule density}}$$

Effective granule density is defined as the mass of granules divided by the volume of the granule, including opened and closed pores, and apparent tablet density is deifned as the mass of tablets divided by the volume of the tablet. This means that relative density is indirect proportion to porosity.

Figures 82 - 89 depict the effect of compressional force on the relative density of dicalcium phosphate dihydrate and α-lactose monohydrate tablets containing various disintegrants. It is apparent that the relative density of all tablets slightly increased with increasing compressional force.

An increase in the amount of disintegrants, except

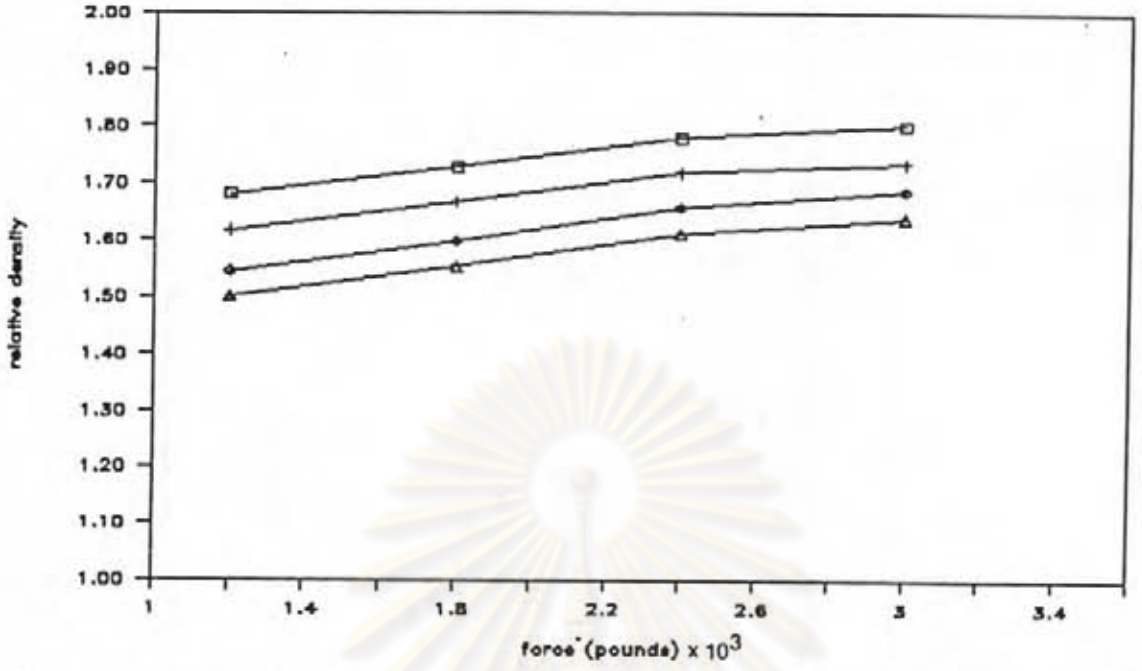

Figure 82. Effect of applied force on the relative density of tablets prepared from dicalcium phosphate dihydrate with □ 3%, + 6%, ◊ 9% and △ 12% sodium starch glycolate.

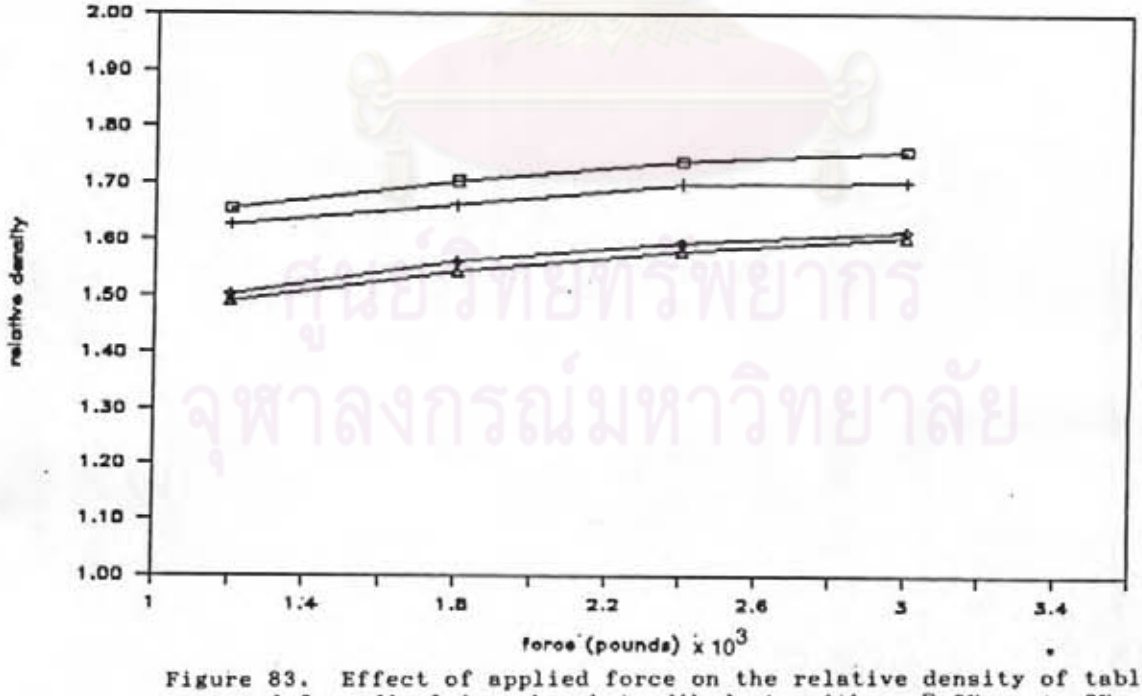

Figure 83. Effect of applied force on the relative density of tablets prepared from dicalcium phosphate dihydrate with □ 3%, + 6%, ◊ 9% and △ 12% corn starch.

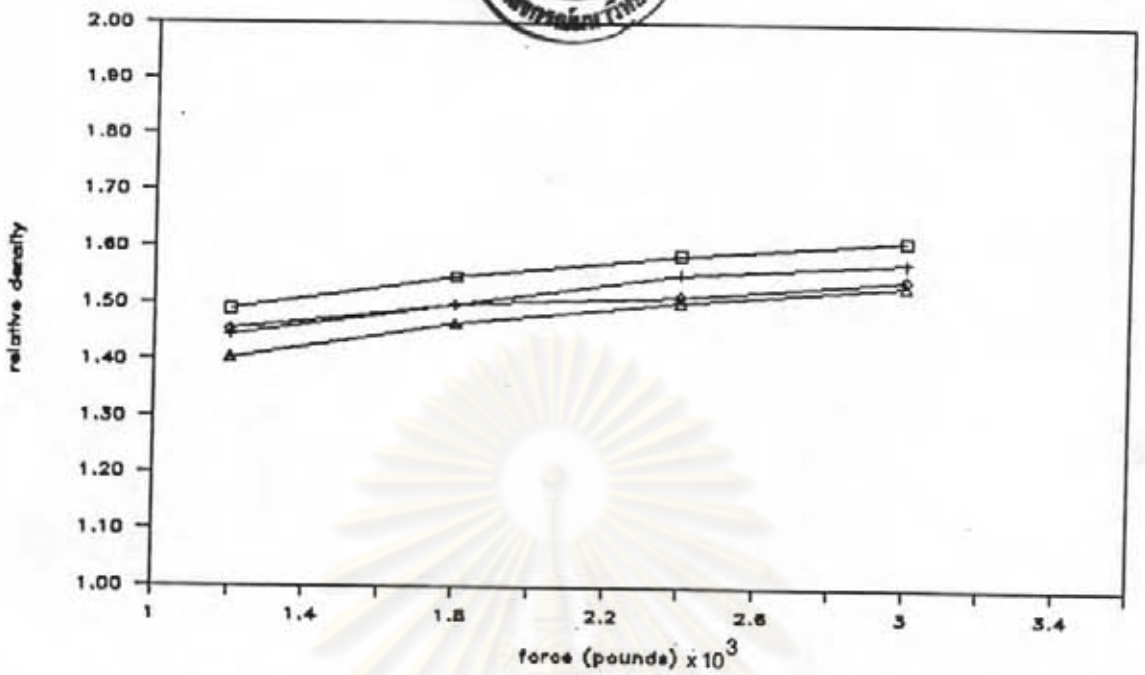

Figure 84. Effect of applied force on the relative density of tablets prepared from α-lactose monohydrate with □ 3%, + 6%, ◊ 9%, and △ 12% sodium starch glycolate.

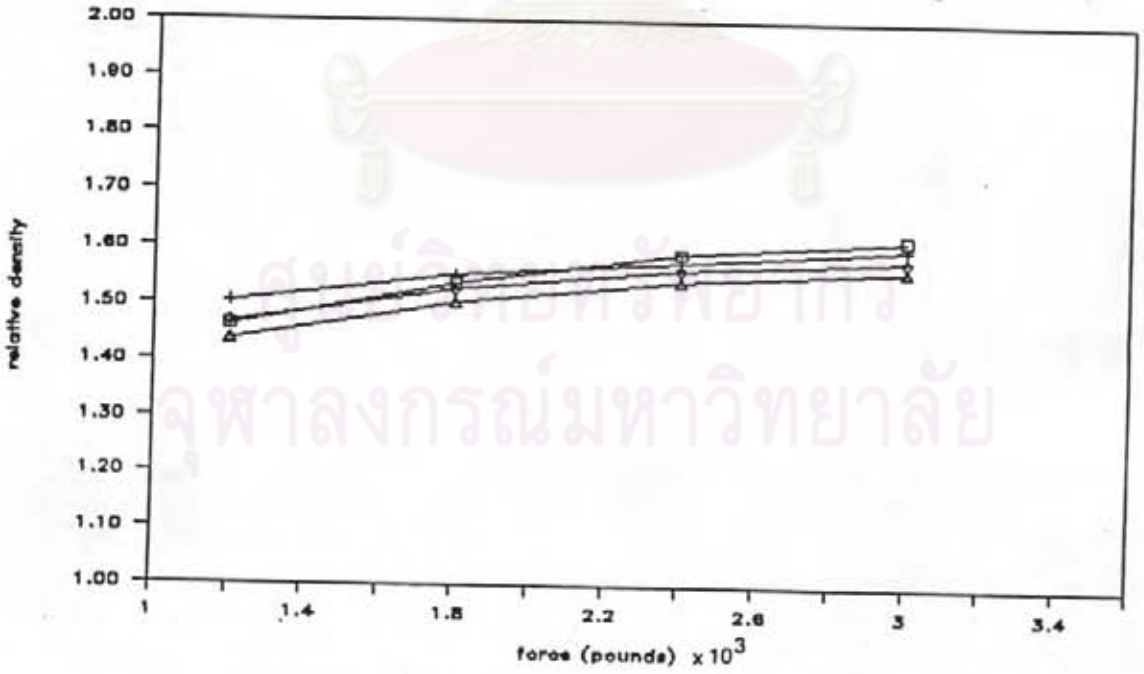

Figure 85. Effect of applied force on the relative density of tablets prepared from α-lactose monohydrate with □ 3%, + 6%, ◊ 9%, and △ 12% corn starch.

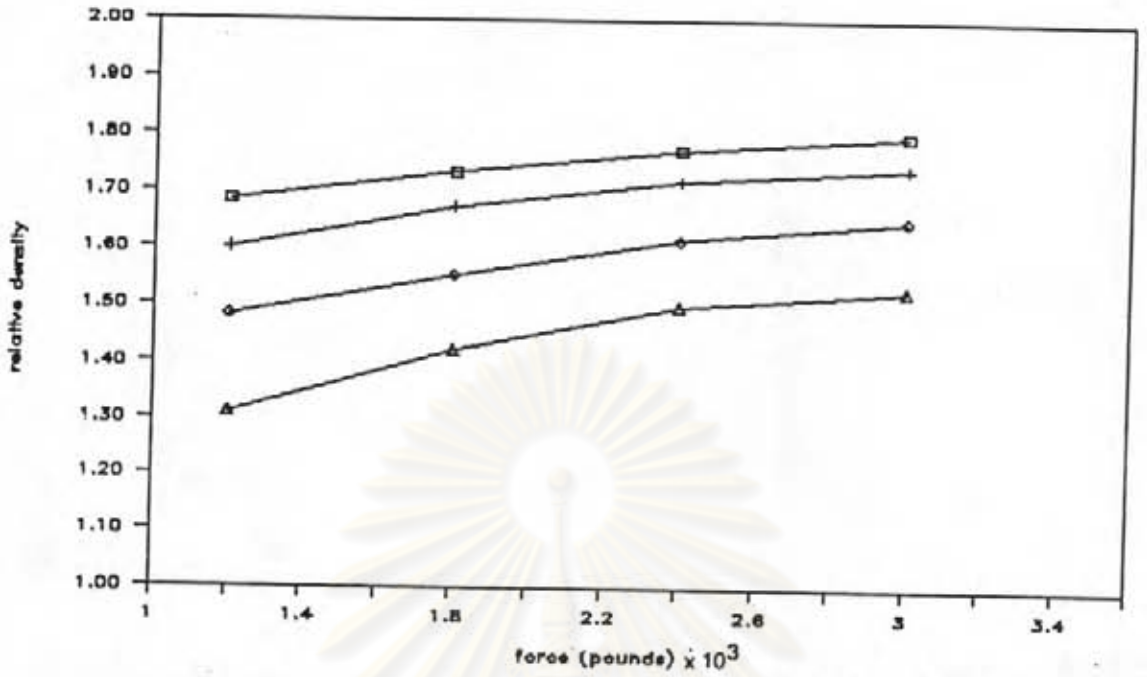

Figure 86. Effect of applied force on the relative density of tablets prepared from dicalcium phosphate dihydrate with □ 1%, + 3%, ◊ 5% and △ 7% cross linked polyvinylpyrrolidone.

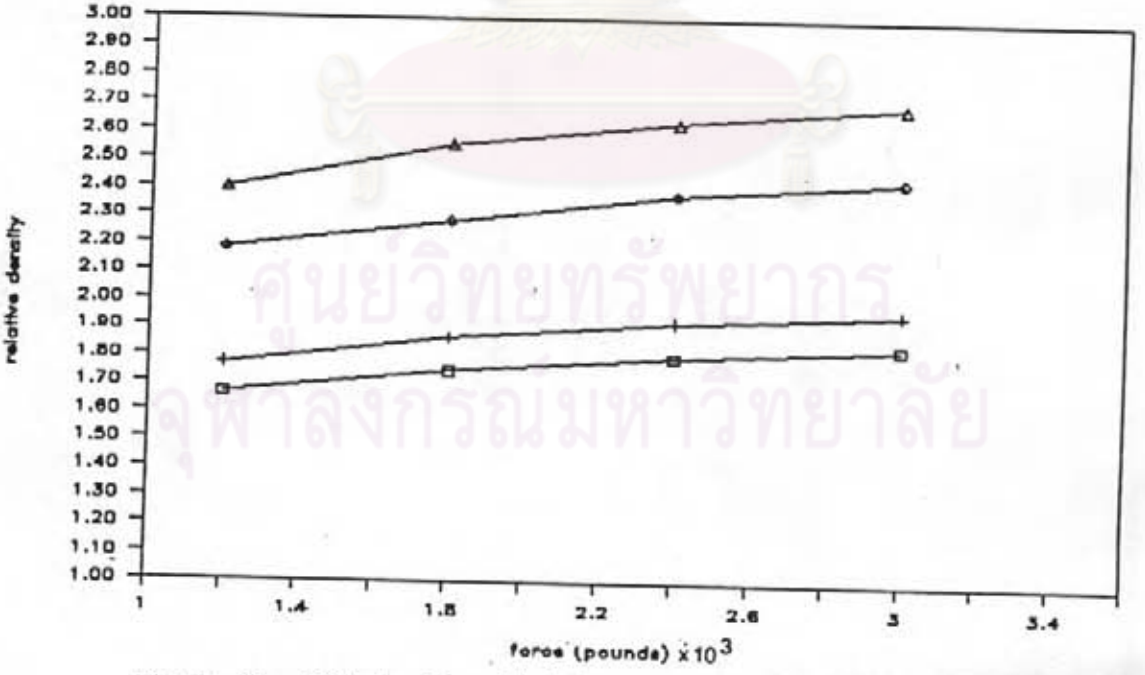

Figure 87. Effect of applied force on the relative density of tablets prepared from dicalcium phosphate dihydrate with □ 20%, + 30%, ◊ 40% and △ 50% microcrystalline cellulose.

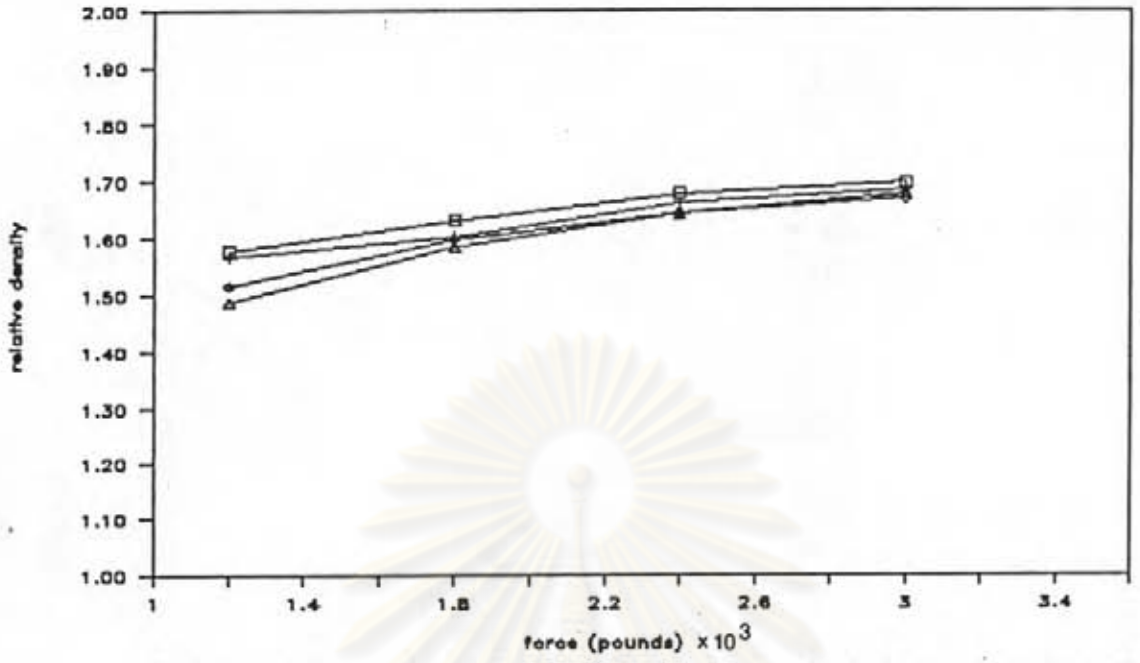

Figure 88. Effect of applied force on the relative density of tablets prepared from α-lactose monohydrate with □ 1%, + 3%, ◊ 5%, and △ 7% cross linked polyvinylpyrrolidone.

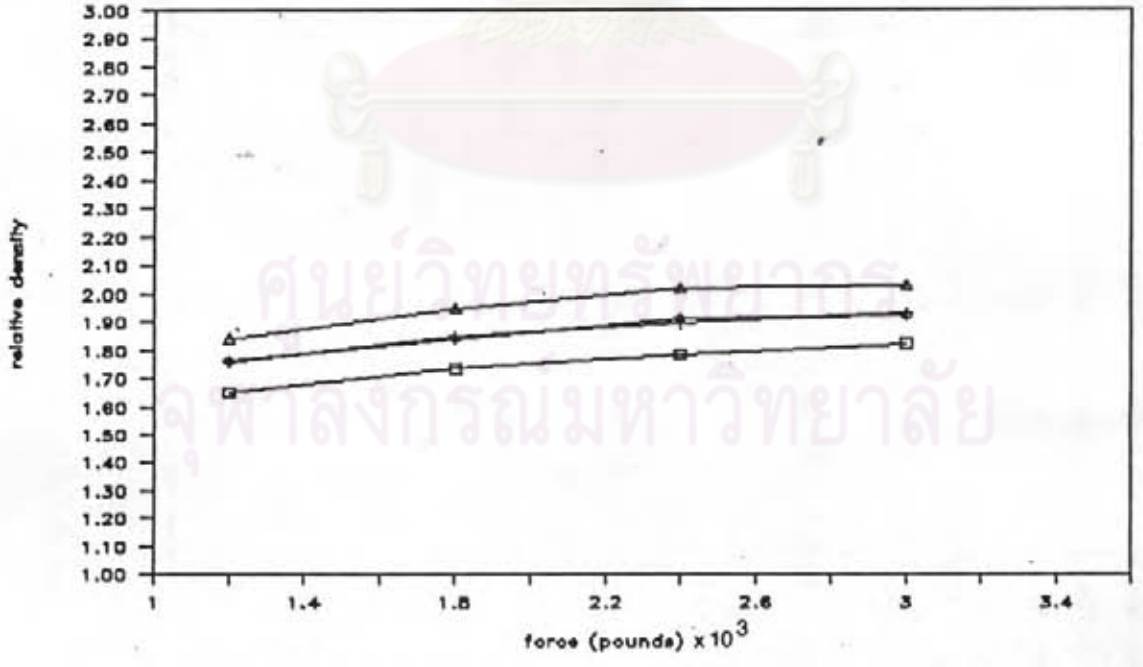

Figure 89. Effect of applied force on the relative density of tablets prepared from α-lactose monohydrate with □ 20%, + 30%, ◊ 40%, and △ 50% microcrystalline cellulose.

microcrystalline cellulose, produced a notable decrease in relative density with either diluent. Microcrystalline cellulose behaved differently from other disintegrants that is the relative density markedly decreased when increased concentration of microcrystalline cellulose in tablets . The decreasing in relative density of tablets due to the increase amount of microcryatalline cellulose in dicalcium phosphate system was higher than in α-lactose monohydrate system.

Increased relative density due to increasing concentration of disintegrants seemed to be higher than the increased due to increase compressional force for tablets made from both systems. This effect exerted more influence on α- lactose monohydrate system than dicalcium phosphate dihydrate system.

These results indicated that as increasing compressional force the porosity decreased for all formulations and as increasing concentration of disintegrants except microcrystalline cellulose, the porosity increased.

Water Uptake

Penetration of liquid into tablets is affected by many variables, an important of which is the excipients used in the formulation. This investigation was carried out to assess the effect of compressional force on water penetration into tablets. The penetration was classified according to

type of disintegant and diluent as follow:

A. Sodium starch glycolate

1. Water insoluble diluent

Effect of sodium starch glycolate on water penetration into tablets prepared form dicalcium phosphate dihydrate compressed with various compressional forces were demonstrated in Figures 90 - 93. These figures depicts the influence of compressional forces on the penetration rate of water into the tablet. It was clearly shown that an increase in compressional force produced a decrease in water uptake. This effect was prominent at higher concentration of sodium starch glycolate. This indicated that water uptake of dicalcium phosphate dihydrate tablets containing sodium starch glycolate as disintegrant corresponded with the calculated pore volume (26,45), which decreased as increased compressional force.

The penetration curves also showed that water upatake was markedly increased when increased amount of sodium starch glycolate, that is tablets containing 12% sodium starch glycolate uptook the highest amount of water as shown in Figure 93.

Maximum water uptake was found within 45 seconds when dicalcium phosphate dihydrate contained low concentration of sodium starch glycolate as shown in Figure

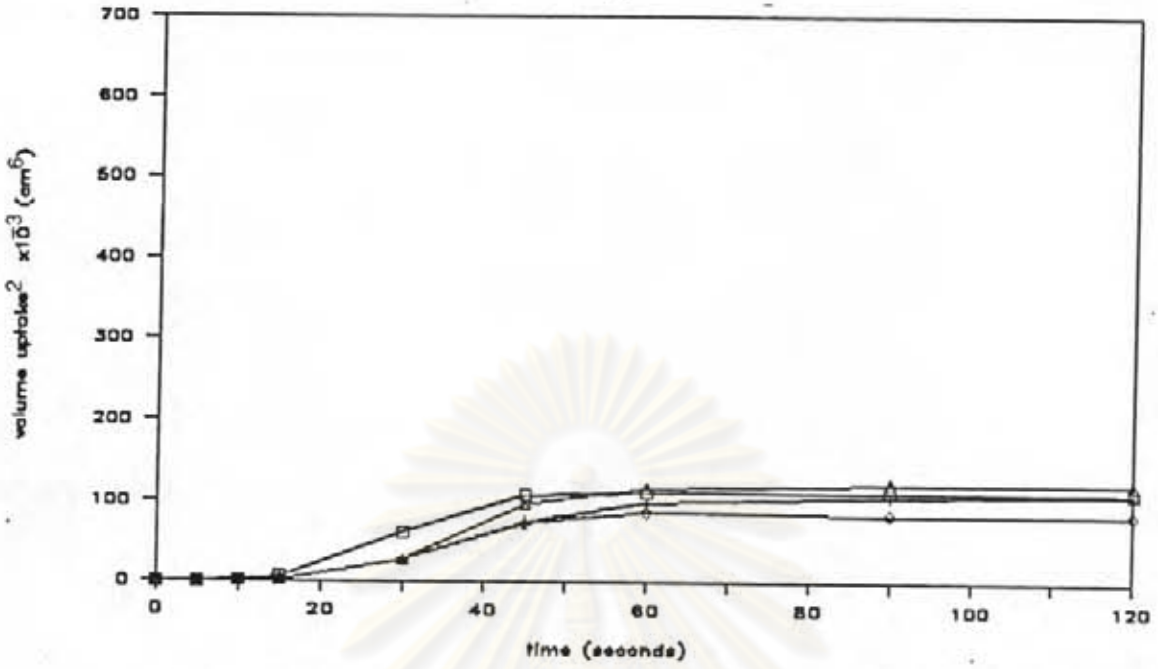

Figure 90. Water penetration into tablets made from dicalcium phosphate dihydrate with 3% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

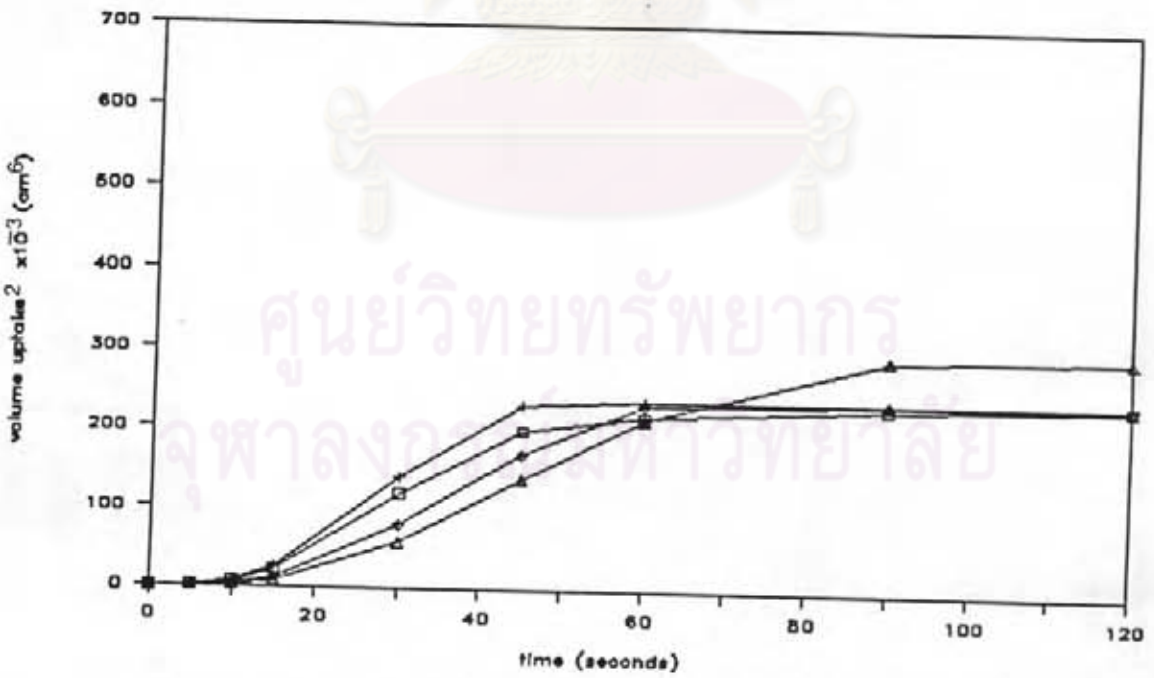

Figure 91. Water penetration into tablets made from dicalcium phosphate dihydrate with 6% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

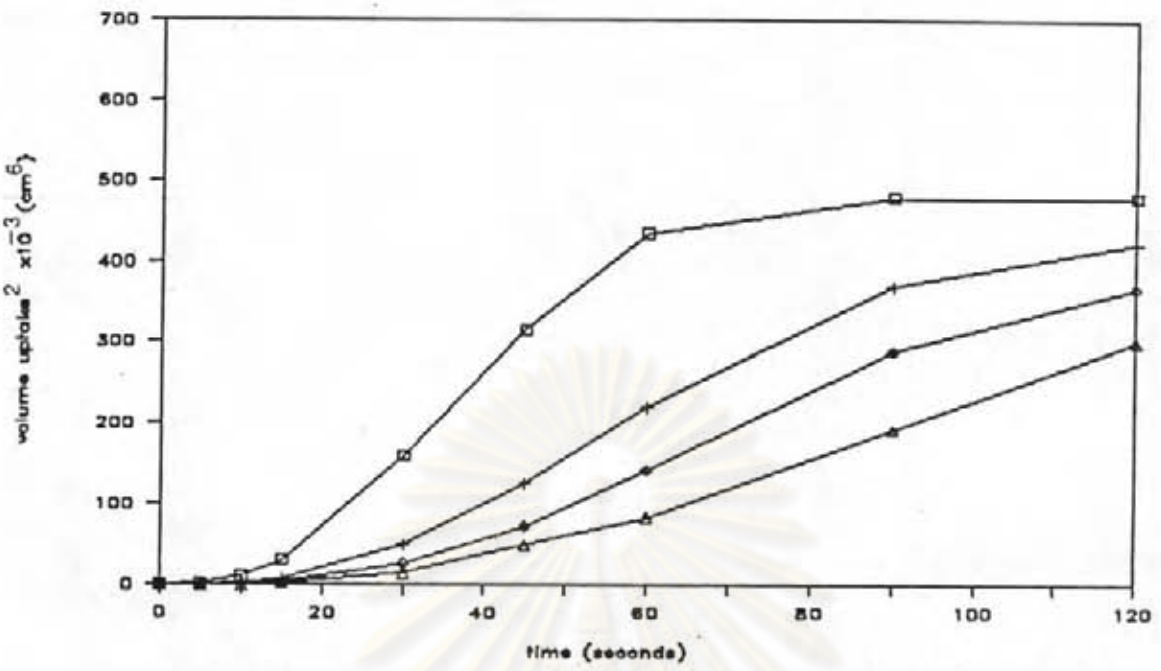

Figure 92. Water penetration into tablets made from dicalcium phosphate dihydrate with 9% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

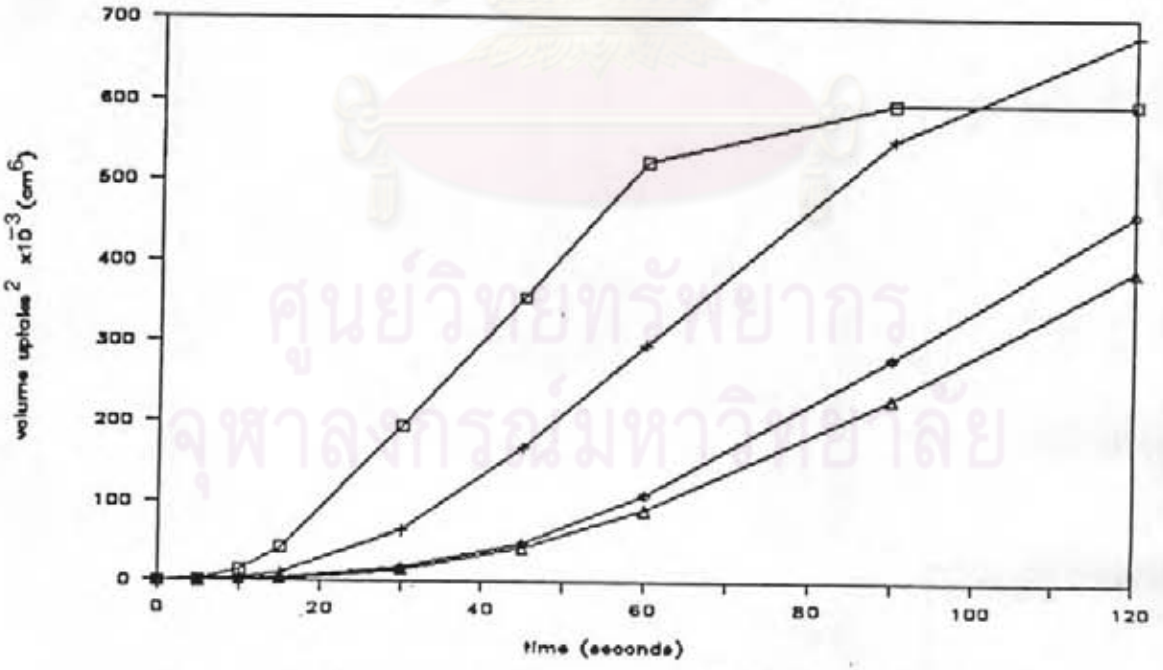

Figure 93. Water penetration into tablets made from dicalcium phosphate dihydrate with 12% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

90 and 91. This indicated that amount of the disintegrant containing in those tablets was lower than effective concentraion.

Opposition to tablets containing low concentration of sodium starch glycolate, dicalcium phosphate dihydrate tablets containing 9% and 12% of this disintegrant gradually uptook water as function of time upto 120 seconds or until the maximum amount of water could be taken. This effect was notable when compresed at high compressional force. This indicated that there was an arising resistance to water penetration inside tablets. This due to the gelatinization of sodium starch glycolate when hydrated in the smaller pore produced by highest compressional force then impeding the penetration process.

A distinct lag phase was also observed from the penetration curve of dicalcium phosphate dihydrate tablets containing all concentrations sodium starch glycolate as shown in Figures 90 - 93. The lag time was increased with both increasing concentration of sodium starch glycolate and compressional force. This indicates presence of an obstacle to water penetration linked to the increasing of surface condition of the tablets, i.e. surface tension or contact angle, as increasing concentration of disintegrant and compressional force.

2. Water soluble diulent

In case of ∝-lactose monohydrate system, sodium starch glycolate behaved different penetration process from dicalcium phosphate dihydrate system, that is an increase in comprssional force produced a very slightly increase in penetration as shown in Figures 94 - 97. It could be explained that the interparticular continuous contact between disintegrant particles inside the tablet when compressed with high compressional force, produced high affinity to draw water into the tablets independently of porosity. The other possible reason was the dissolution of ∝-lactose monohydrate providing wider pore thus the initial pore size did not oppose the penetration as in the water insoluble tablets.

However, the ∝-lactose monohydrate system did not showed extremely high penetration rates when compared with dicalcium phosphate dihydrate. This obstacle effect was probably due to increasing viscosity of penetrating liquid which was resulted from dissolution of ∝-lactose monohydrate and gelatinization of sodium starch glycolate. Dissolution, however impeding water penetration by increasing viscosity but also aiding by wider pore and larger pore volume which resulted in regular penetration rates.

An increase in volumetric water uptake was also found when increased concentration of sodium starch

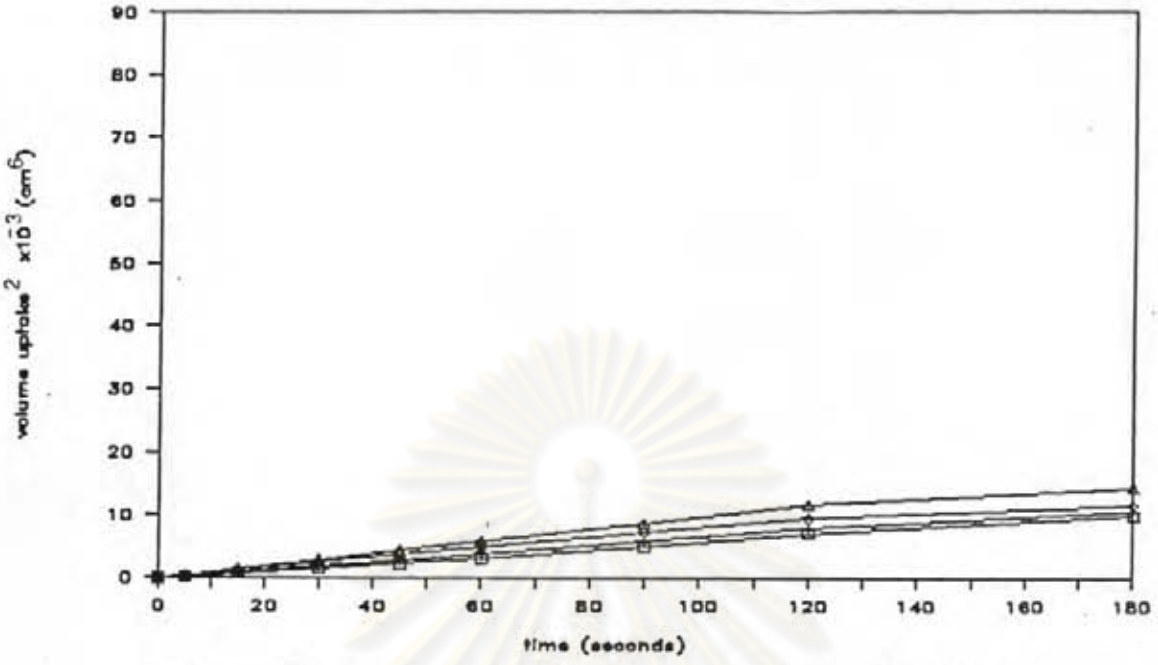

Figure 94. Water penetration into tablets made from α-lactose monohydrate with 3% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

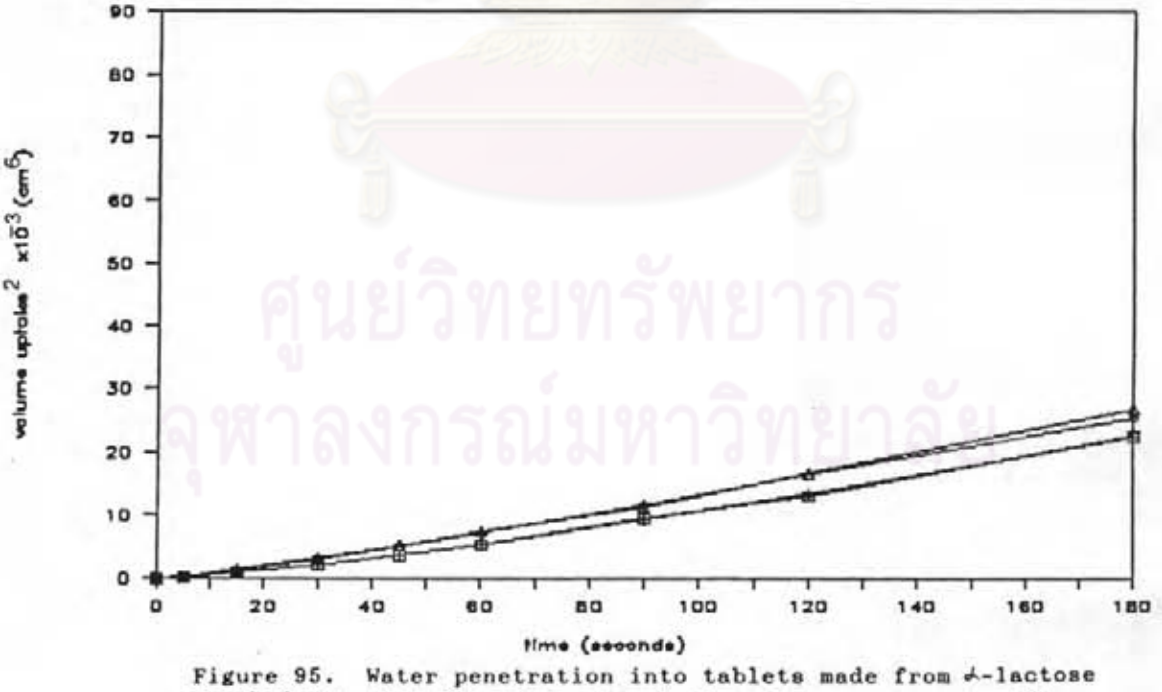

Figure 95. Water penetration into tablets made from α-lactose monohydrate with 6% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

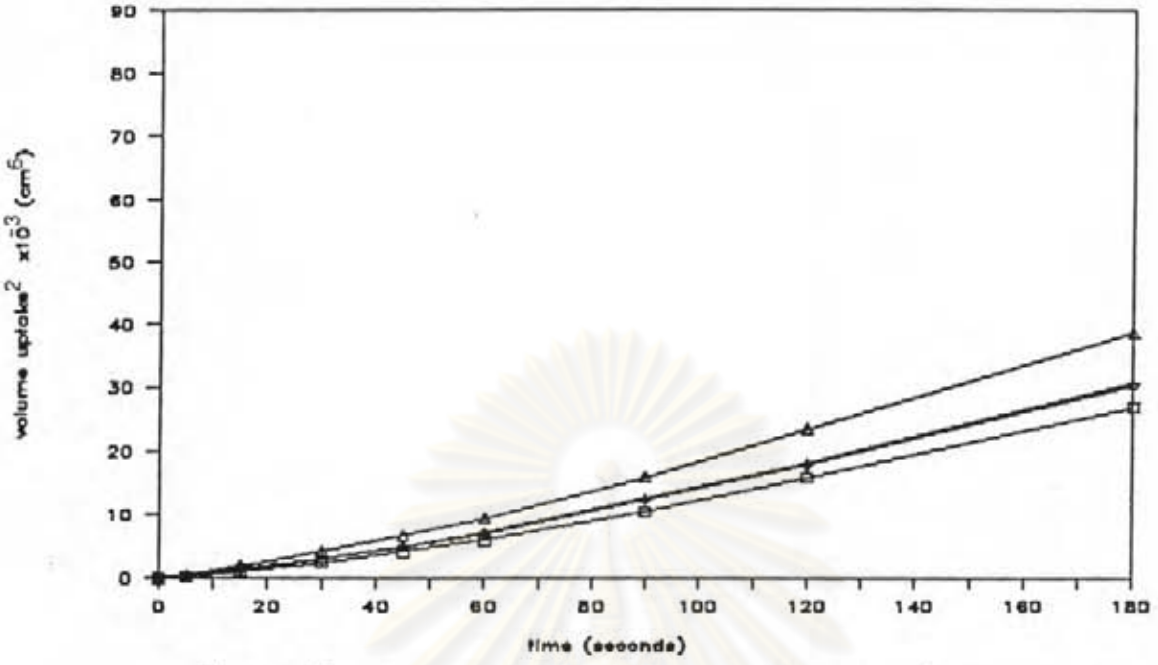

Figure 96. Water penetration into tablets made from α-lactose monohydrate with 9% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

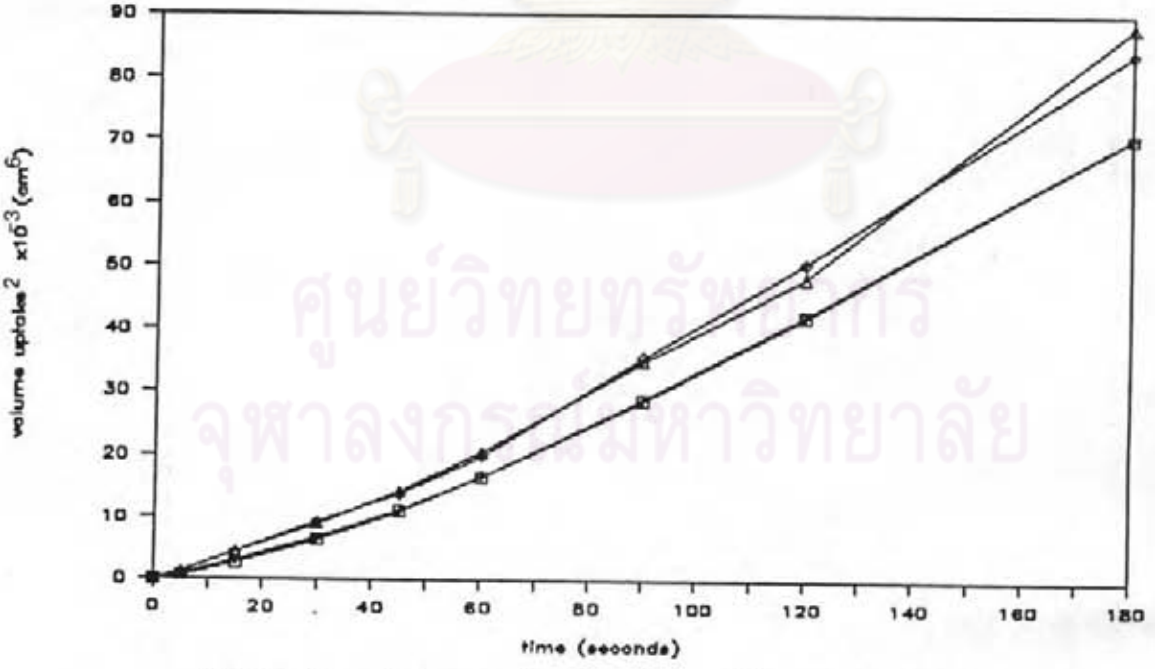

Figure 97. Water penetration into tablets made from α-lactose monohydrate with 12% sodium starch glycolate compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

glycolate in α-lactose monohydrate system which was similar to the results observed with dicalcium phosphate dihydrate tablets system.

It can be concluded that effect of compressional force on water penetration into tablet containing sodium starch glycolate as disintegrant depended on solubility of diluent, that is decreased with increased compressional force when dicalcium phosphate dihydrate was used and increased with increased compressional force when α-lactose monohyrate was used. Water uptake was also depended on amount of sodium starch glycolate.

B. Corn starch

1. Water insoluble diluent

The water penetrations into dicalcium phosphate dihydrate tablets containing corn starch when compressed with different compressional forces was demonstrated in Figure 98 - 101. The water penetration increased with increased compressional force. At higher amount of starch, this influence was clearly exhibited. This effect was opposite to the water uptake of the aforementioned tablets. This was caused by the creation of starch grains network in the tablets increased when increased compressional force which resulted high affinity of disintegrant to draw water into the pore with only slightly affected by smaller void space.

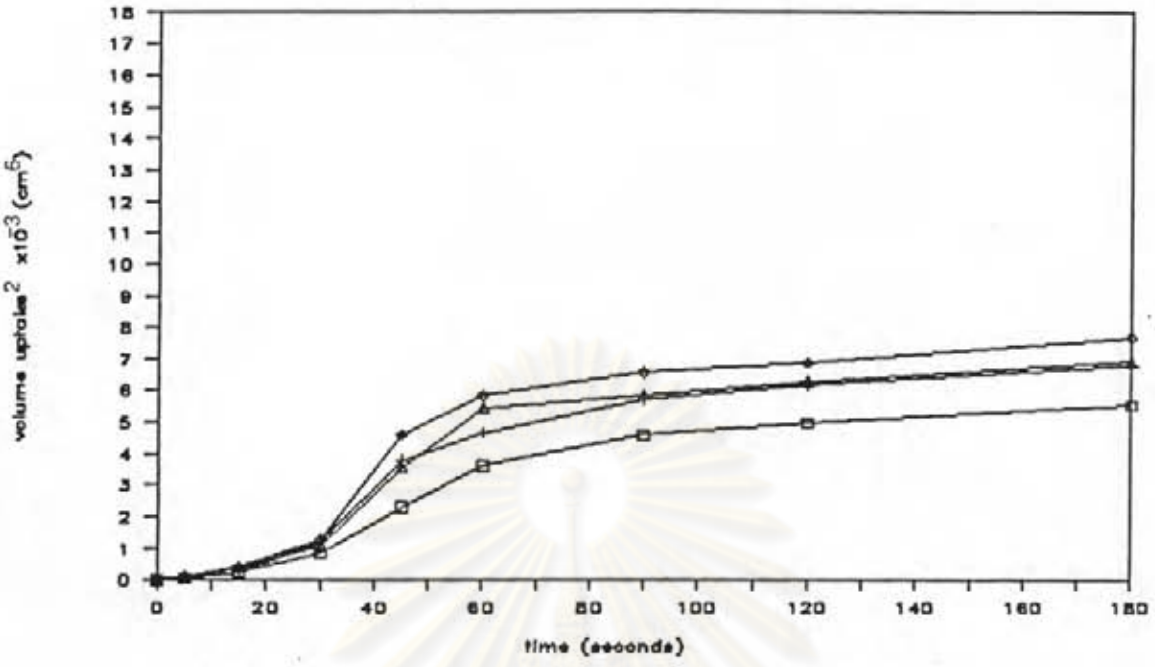

Figure 98. Water penetration into tablets made from dicalcium phosphate dihydrate with 3% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

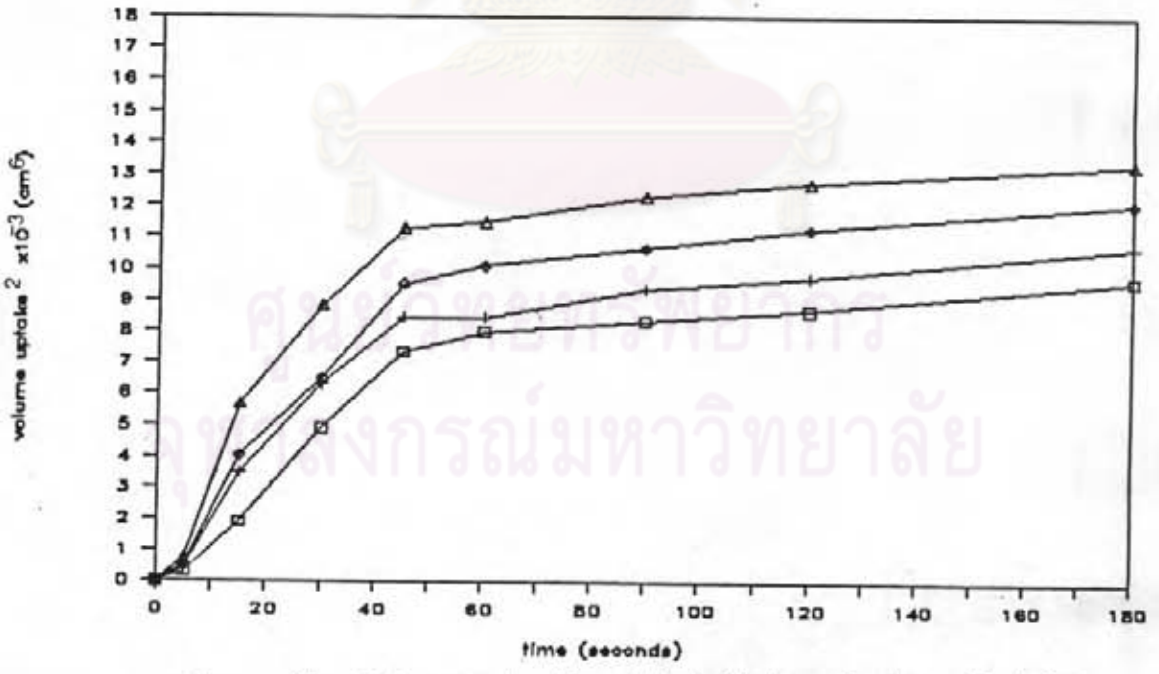

Figure 99. Water penetration into tablets made from dicalcium phosphate dihydrate with 6% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

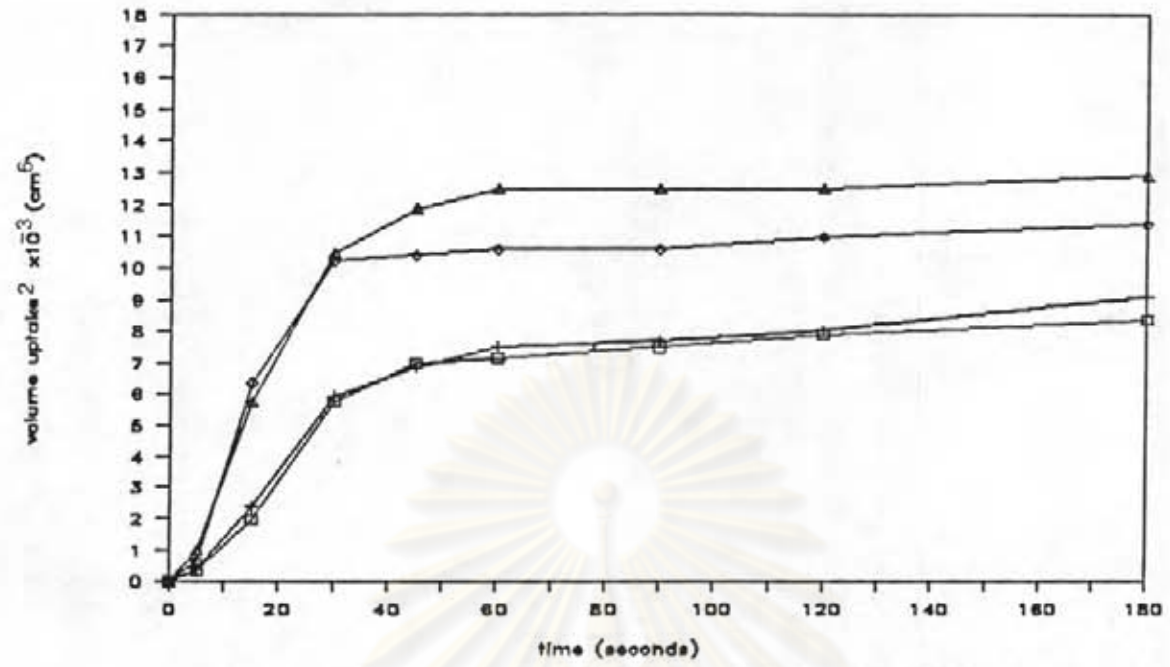

Figure 100. Water penetration into tablets made from dicalcium phosphate dihydrate with 9% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

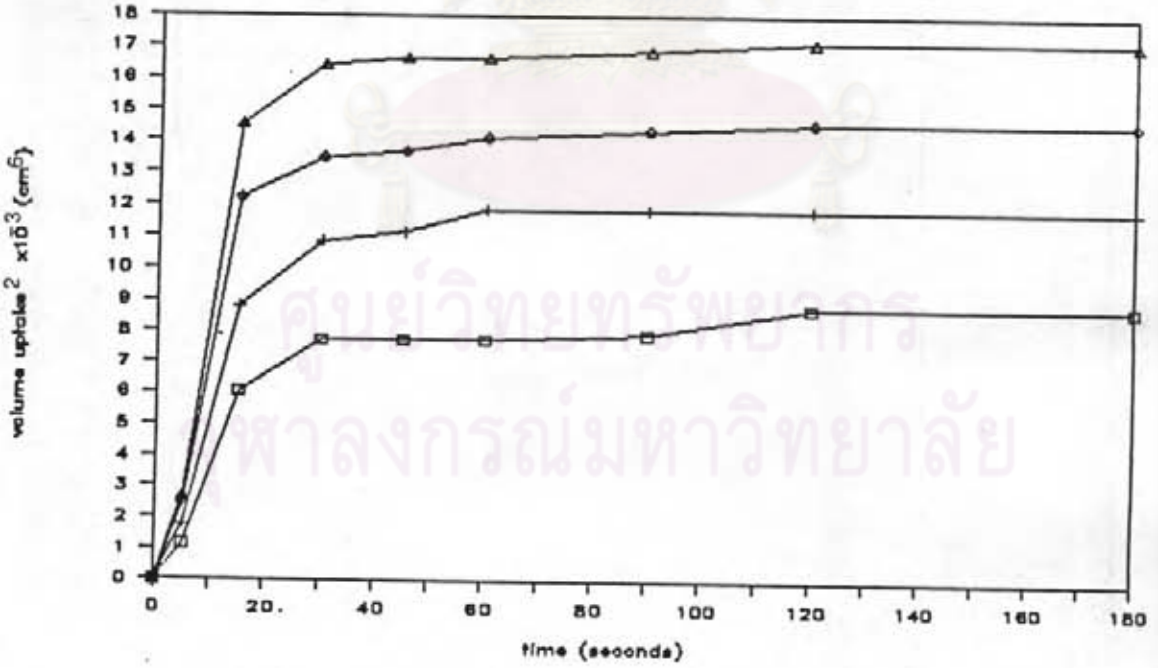

Figure 101. Water penetration into tablets made from dicalcium phosphate dihydrate with 12% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

Increasing concentration of corn starch produced an increasing in penetration rate. Dicalcium phosphate dihydrate tablets containing 3% corn starch showed a lag time of 5 seconds as shown in Figure 98 while the tablets containing higher concentration showed no lag time at all. This result indicated that dicalcium phosphate tablets containing low concentration of corn starch may lead to initial obstacle due to surface condition of the dicalcium tablets.

2. Water soluble diluent

The water penetrations of α-lactose - corn starch tablets were demonstrated in Figures 102 - 105. Similar results to dicalcium phosphate dihydrate tablets, water penetration into α-lactose monohydrate increased when increased compressional force. However, the curves did not show extremely high water uptake during the early stage of penetration but gradually uptook water as time passed while dicalcium phosphate dihydrate system showed the maximum water uptake within 45 seconds. This may due to the dissolution of lactose during penetration process which resulted in increasing viscosity of penetration liquid that retarded the penetration.

The α -lactose monohydrate tablets also showed higher water uptake than the dicalcium phosphate dihydrate tablets when contained the same amount of corn

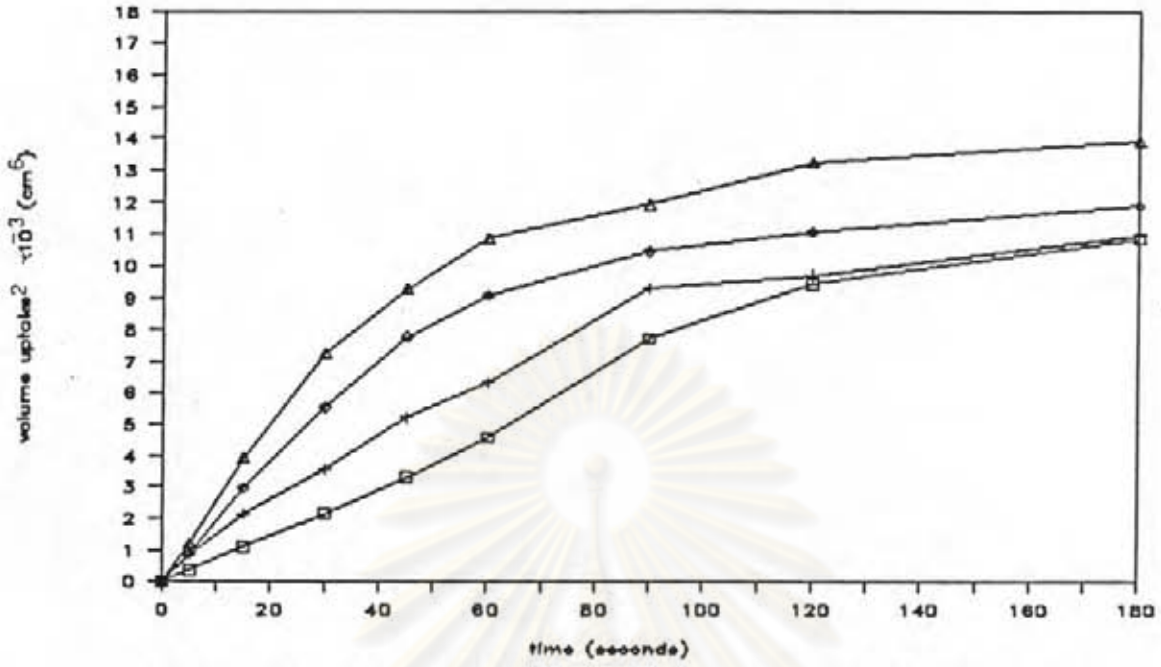

Figure 102. Water penetration into tablets made from α-lactose monohydrate with 3% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

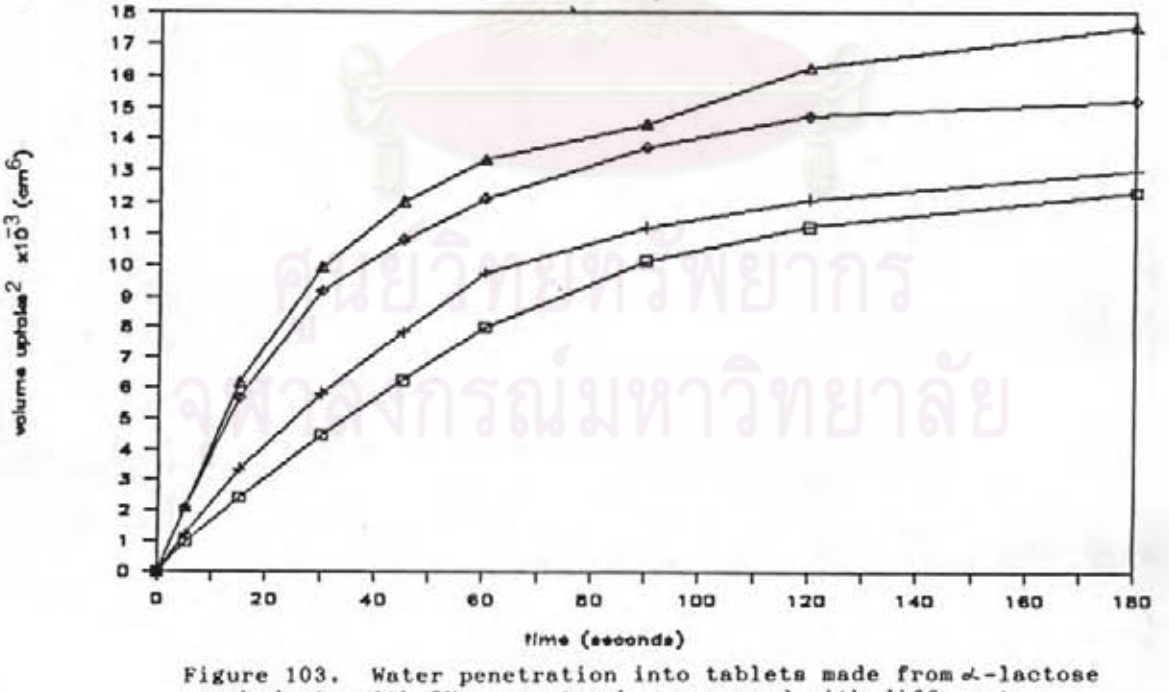

Figure 103. Water penetration into tablets made from α-lactose monohydrate with 6% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

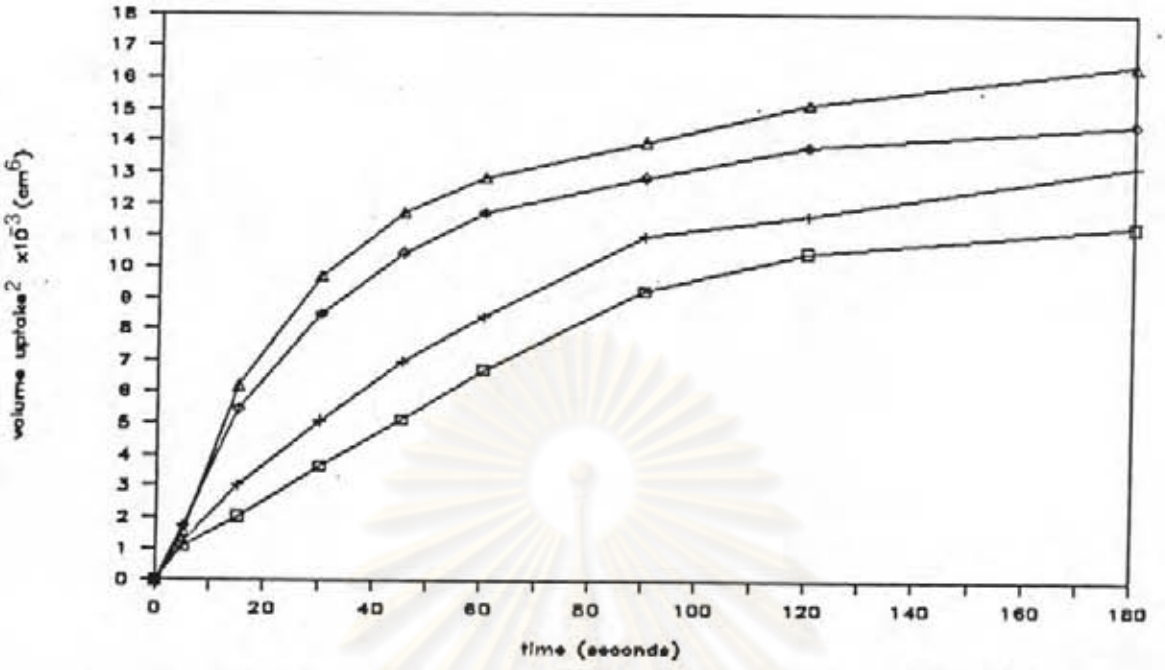

Figure 104. Water penetration into tablets made from α-lactose monohydrate with 9% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

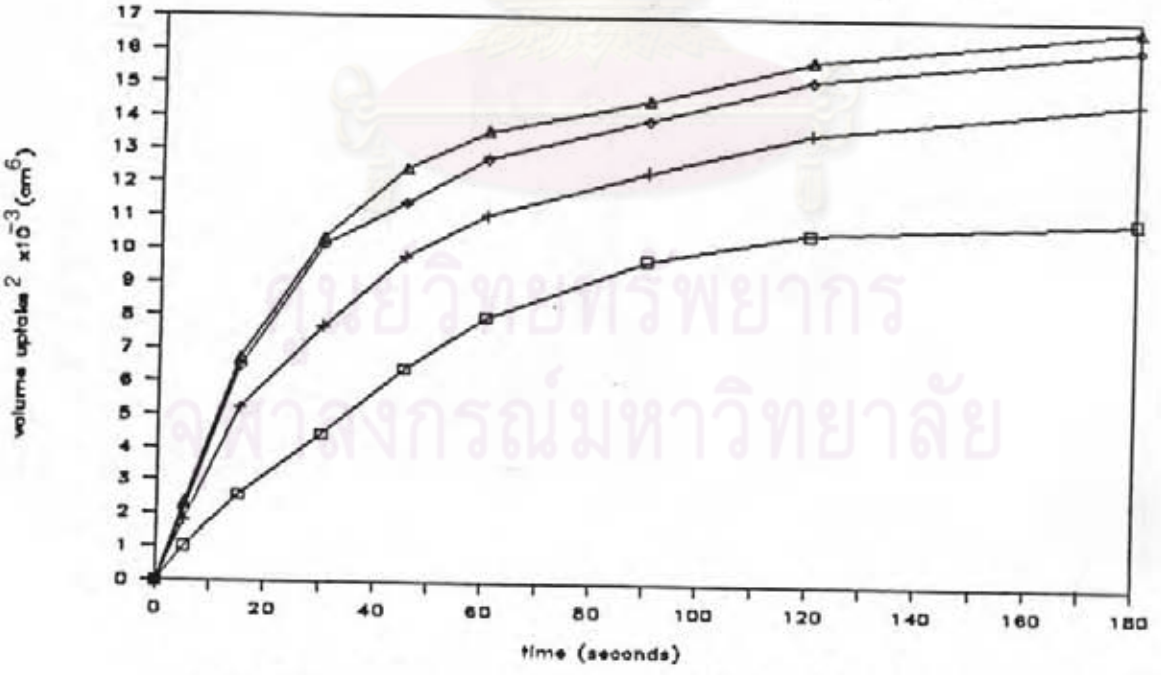

Figure 105. Water penetration into tablets made from α-lactose monohydrate with 12% corn starch compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

starch and compressed with same compressional force. This was due to the dissolution of soluble filler which resulted wider pore and larger pore volume.

This could be concluded that water uptake into tablets containing corn starch as disintegrant with either diulent increased as increased compressional force.

C. Cross linked polyvinylpyrrolidone

1. Water insoluble diluent

The influences of cross linked polyvinylpyrrolidone on the water penetration into dicalcium phosphate dihydrate tablets compressed with various compressional forces was shown in Figures 106 - 109. The water penetration curve of these tablets showed similar pattern to those of dicalcium phosphate dihydrate tablets containing corn starch, except when 7% cross linked polyvinylpyrrolidone was used. Thus, water penetration of dicalcium tablets containing cross linked polyvinylpyrrolidone should be influenced by the similar factors as the dicalcium phosphate dihydrate tablets containing corn starch.

Incorporation of high concentration of cross linked polyvinylpyrrolidone into dicalcium phosphate dihydrate tablets resulted in a slow increase in water penetration rate

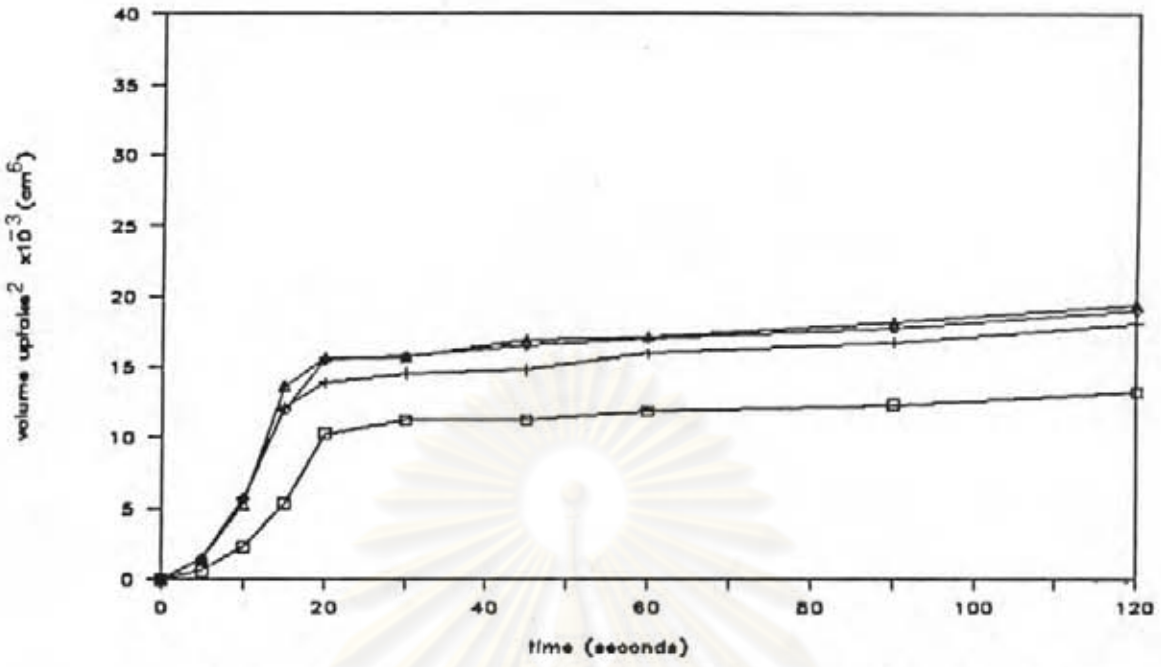

Figure 106. Water penetration into tablets made from dicalcium phosphate dihydrate with 1% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

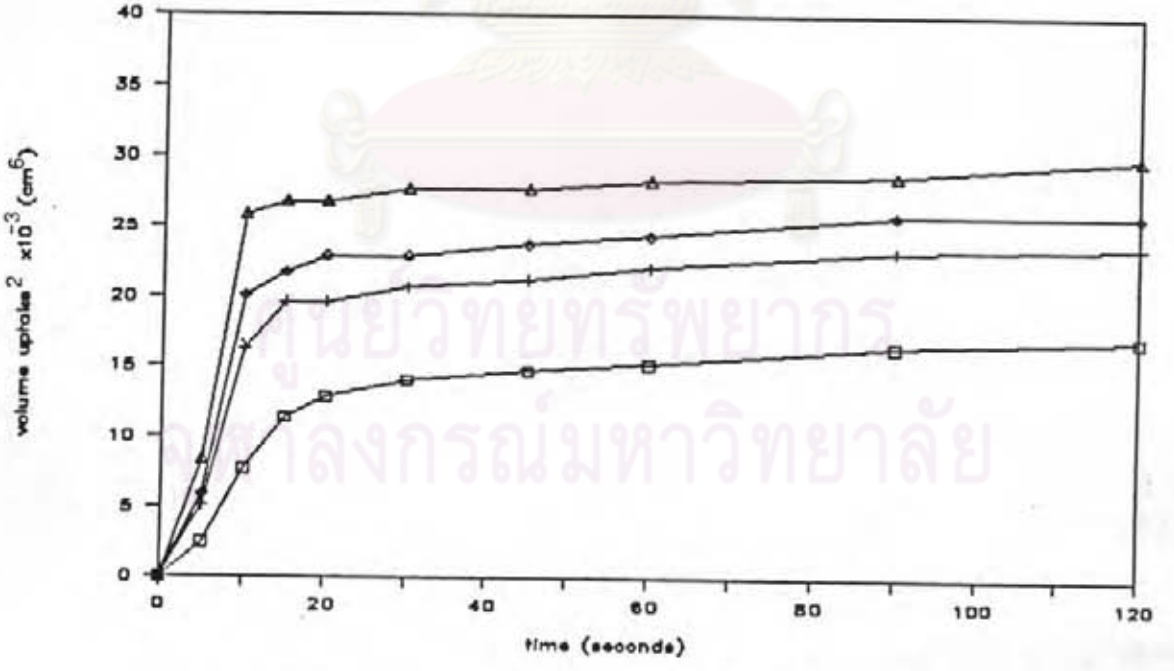

Figure 107. Water penetration into tablets made from dicalcium phosphate dihydrate with 3% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

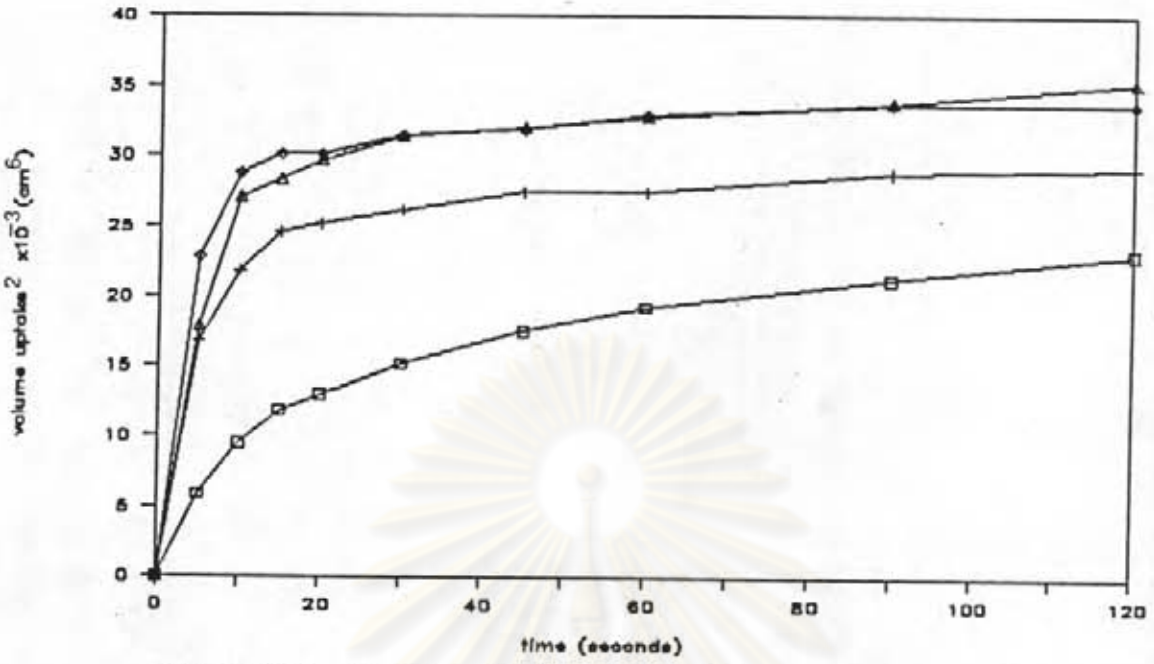

Figure 108. Water penetration into tablets made from dicalcium phosphate dihydrate with 5% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

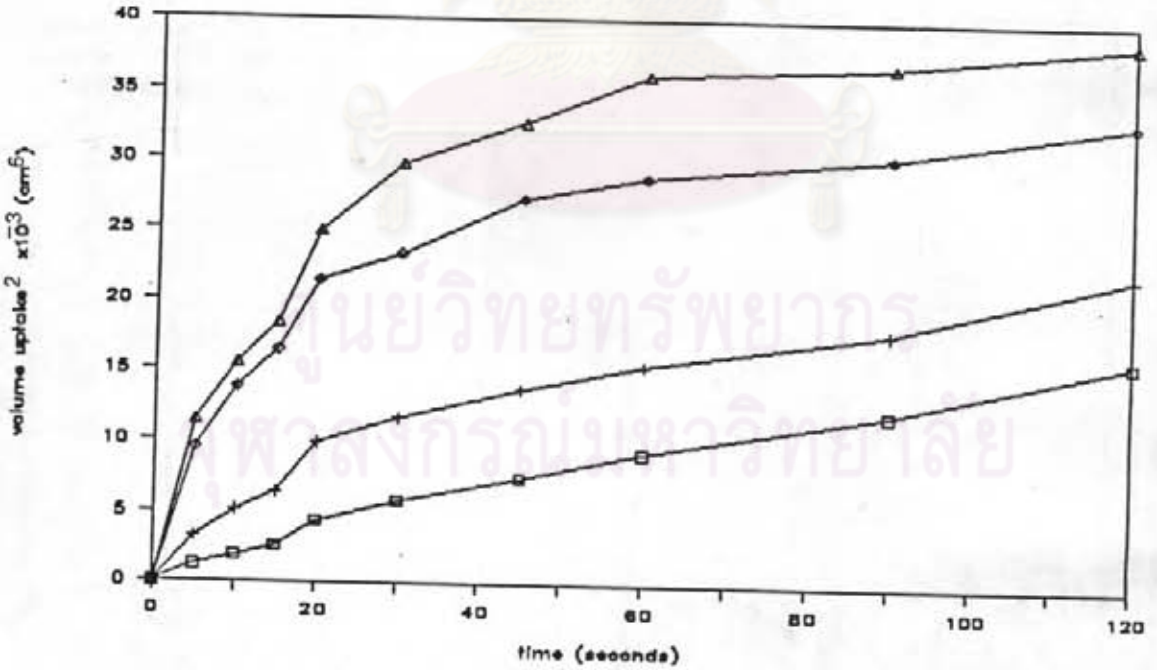

Figure 109. Water penetration into tablets made from dicalcium phosphate dihydrate with 7% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

at the early stage while at lower concentration than 7% of cross linked polyvinylpyrrolidone maximum water uptake was reached within 30 seconds. The main obstacle may due to the swelling of the insoluble cross linked polyvinylpyrrolidone consequently hindered the penetration process.

Dicalcium phosphate dihydrate tablets containing 1% cross linked polyvinylpyrrolidone also showed an initial obstacle of water penetration similar to dicalcium phosphate dihydrate tablets containing 3% corn starch and all concentrations of sodium starch glycolate as disintegrant which may ascribe to the same reason.

2. Water soluble diluent

In case of α-lactose - cross linked polyvinylpyrrolidone tablets, compressional force exerted very slightly influence on water penetration that water uptake slightly increased as increased compressional force as shown in Figures 110 - 113. This indicated that pore size did not play important role in these tablets. The curves showed that water gradually penetrated into those tablets. This indicated that there was a balance between factor aiding penetration and impeding the process.

As well as water penetration into α-lactose monohydrate - cross linked polyvinylpyrrolidone , lactose dissolved causing in wider pore consequently resulting in

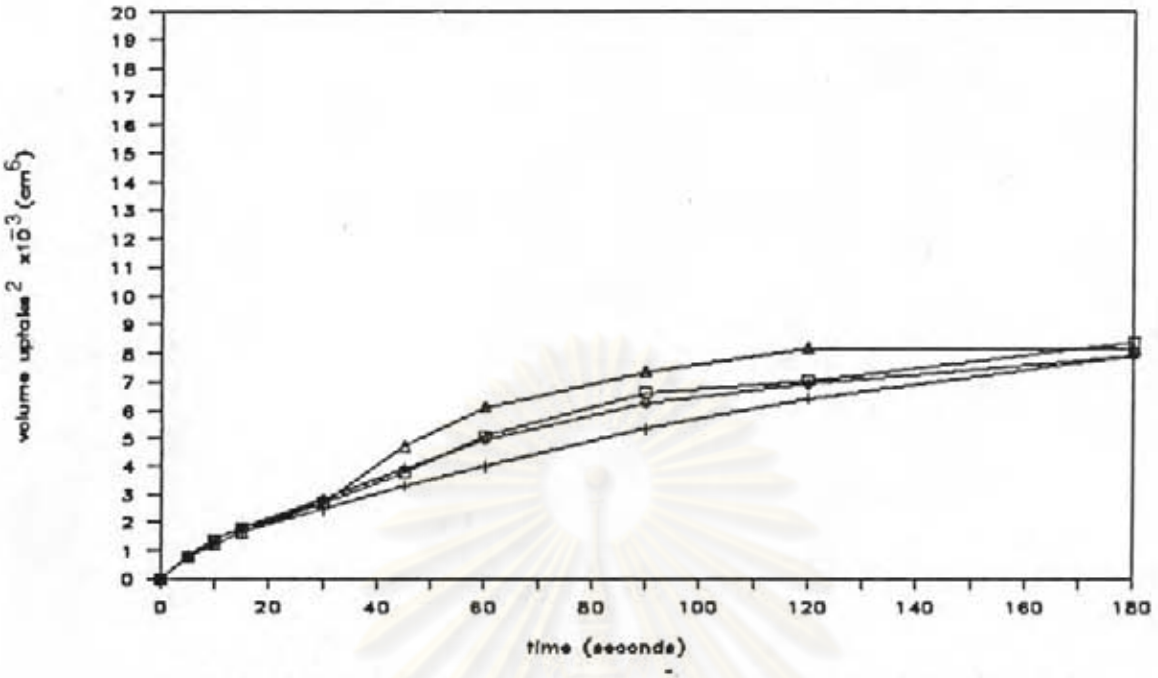

Figure 110. Water penetration into tablets made from α-lactose monohydrate with 1% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

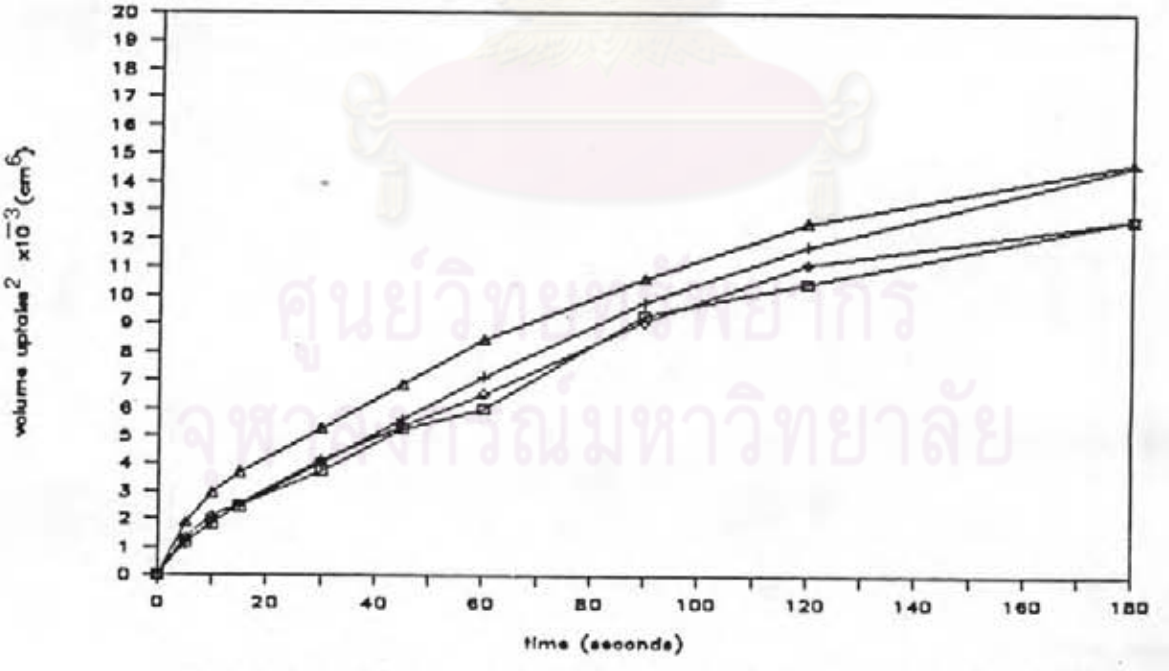

Figure 111. Water penetration into tablets made from α-lactose monohydrate with 3% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

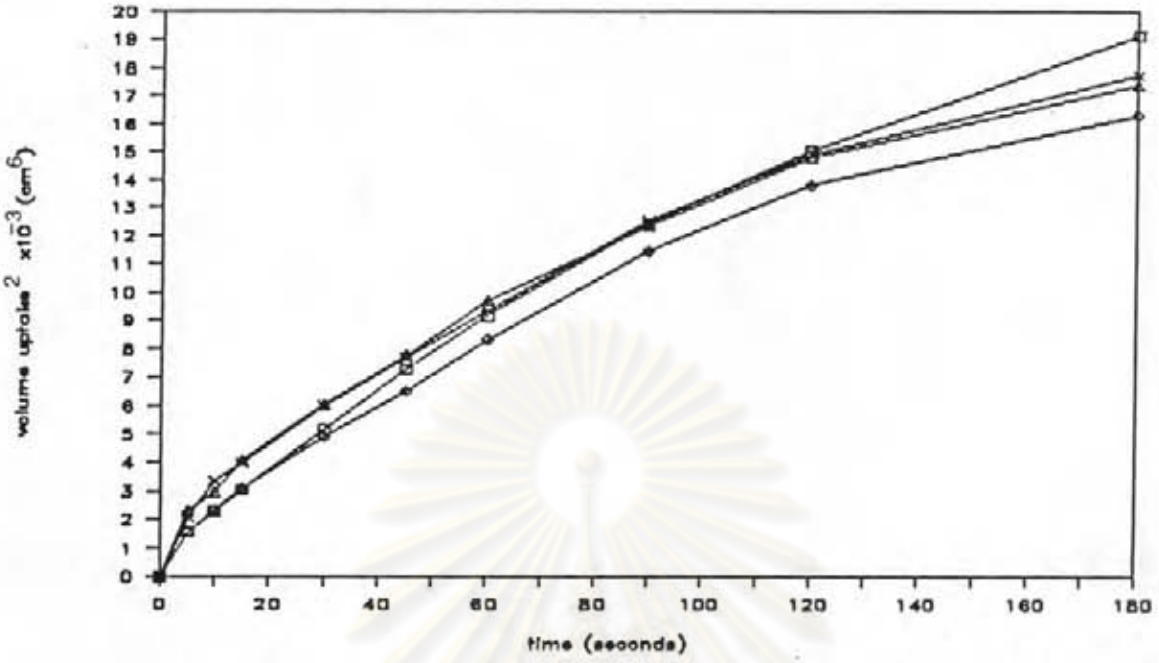

Figure 112. Water penetration into tablets made from α-lactose monohydrate with 5% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

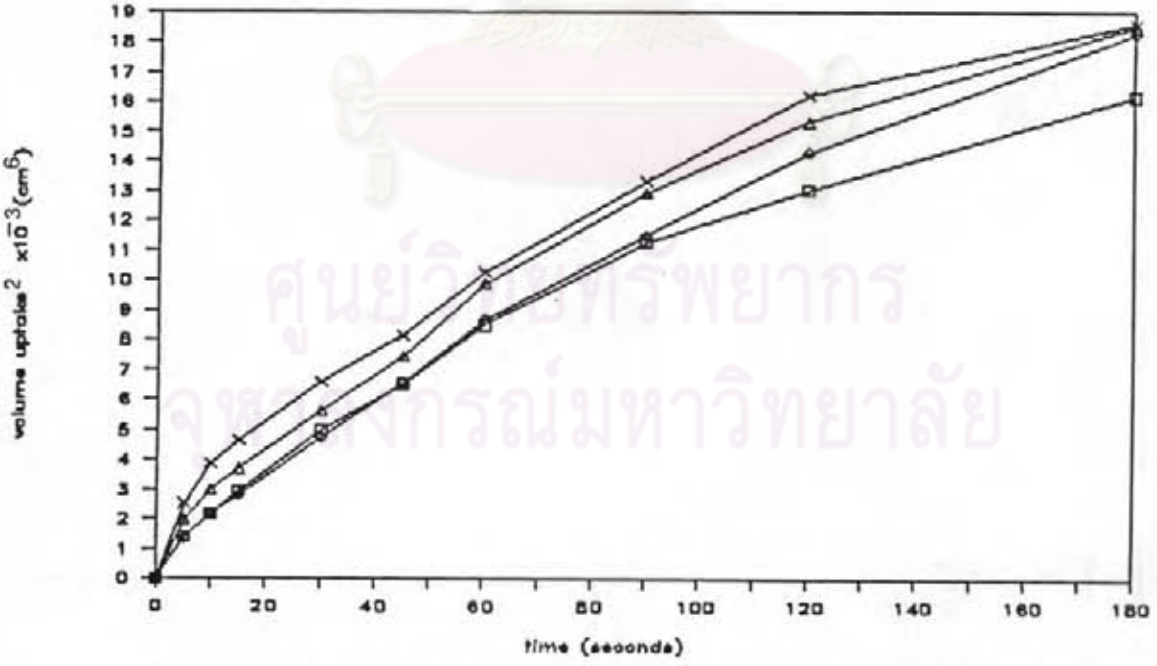

Figure 113. Water penetration into tablets made from α-lactose monohydrate with 7% cross linked polyvinylpyrrolidone compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

increased penetration. Dissolution, however, having increasing the viscosity of the penetration liquid. Thus, the force driving the liquid into the tablets which resulted from creation of disintegrant particles network may be opposed by a viscous resistance of dissolved lactose and swelling of cross linked polyvinylpyrrolidone when hydrated.

These results showed that water penetrated into tablets containing cross linked polyvinylpyrrolidone was influence by similar factors as when corn starch was used as disintegrant.

D. Microcrystalline cellulose

1. Water insoluble diluent

Effect of compressional force on water uptake into dicalcium phosphate dihydrate tablets containing microcrystalline cellulose as disintegrant was illustrated in Figures 114 - 117. The curves showed that the penetration rate was clearly decreased when comprrssed with high compressional force. Therefore, the penetration rate should be corresponded to the calculated pore volume (28) which due to smaller pore volume as increased compressional force.

Addition of higher amount of microcrystalline cellulose to the dicalcium phosphate dihydrate tablets rapidly increased penetration rate and

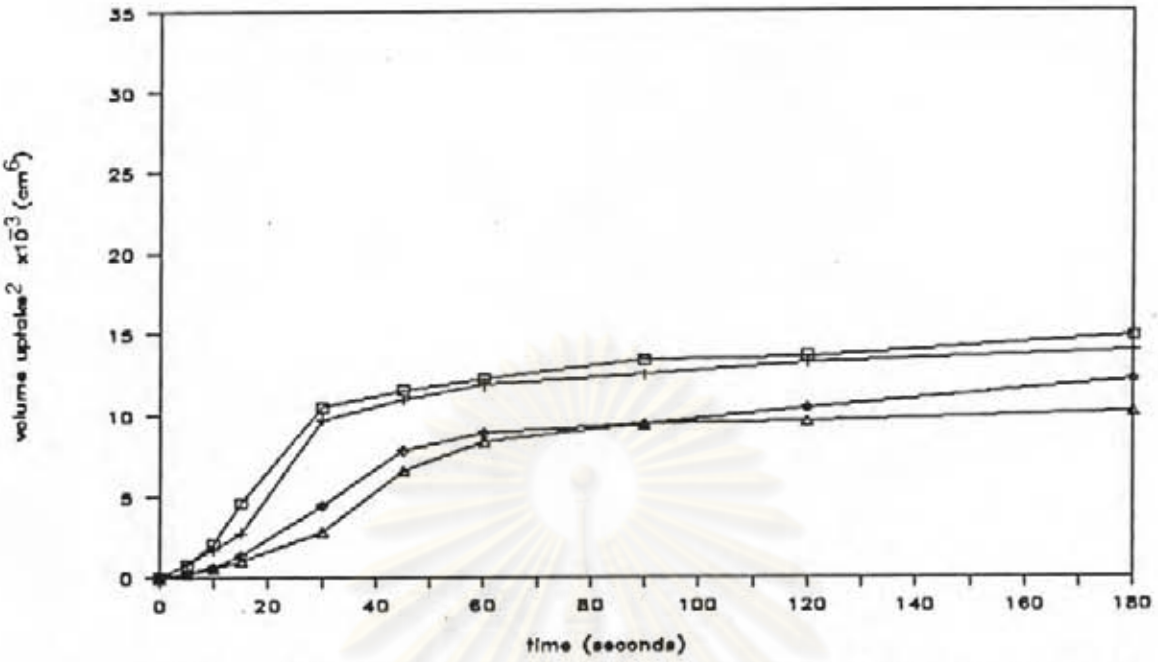

Figure 114. Water penetration into tablets made from dicalcium phosphate dihydrate with 20% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

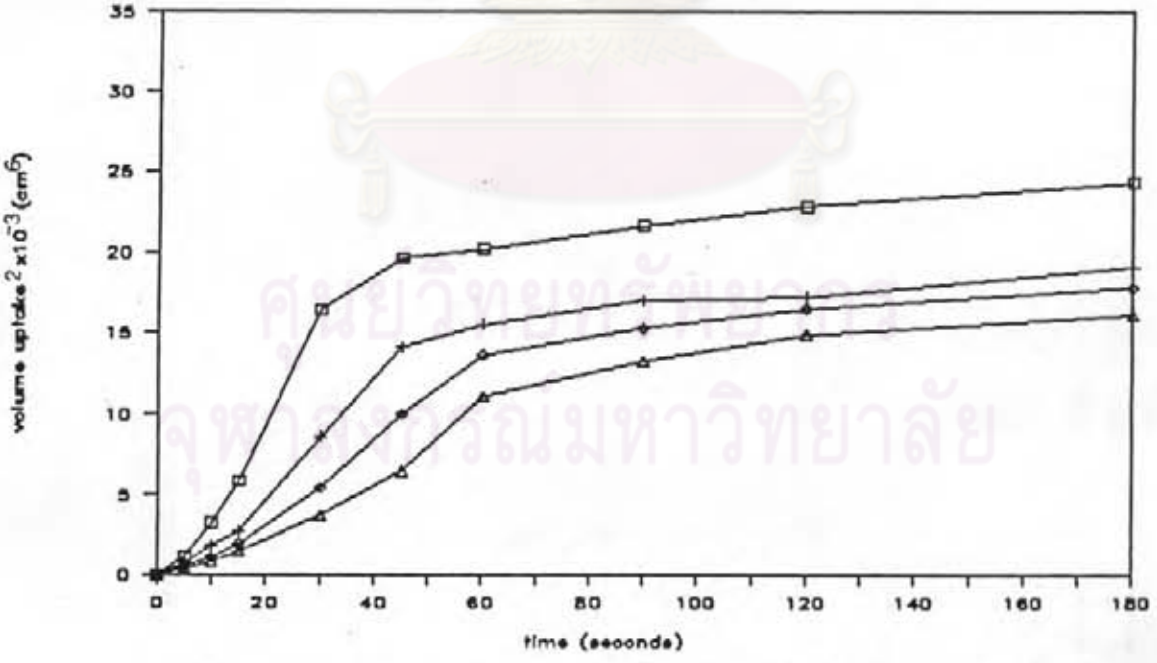

Figure 115. Water penetration into tablets made from dicalcium phosphate dihydrate with 30% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

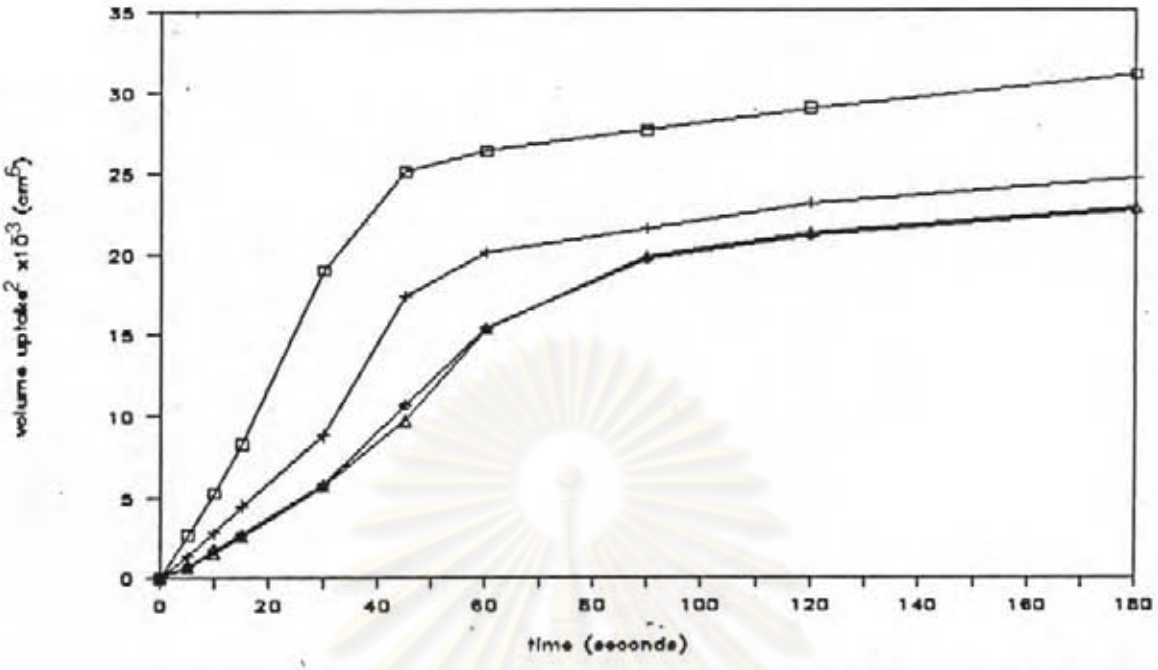

Figure 116. Water penetration into tablets made from dicalcium phosphate dihydrate with 40% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

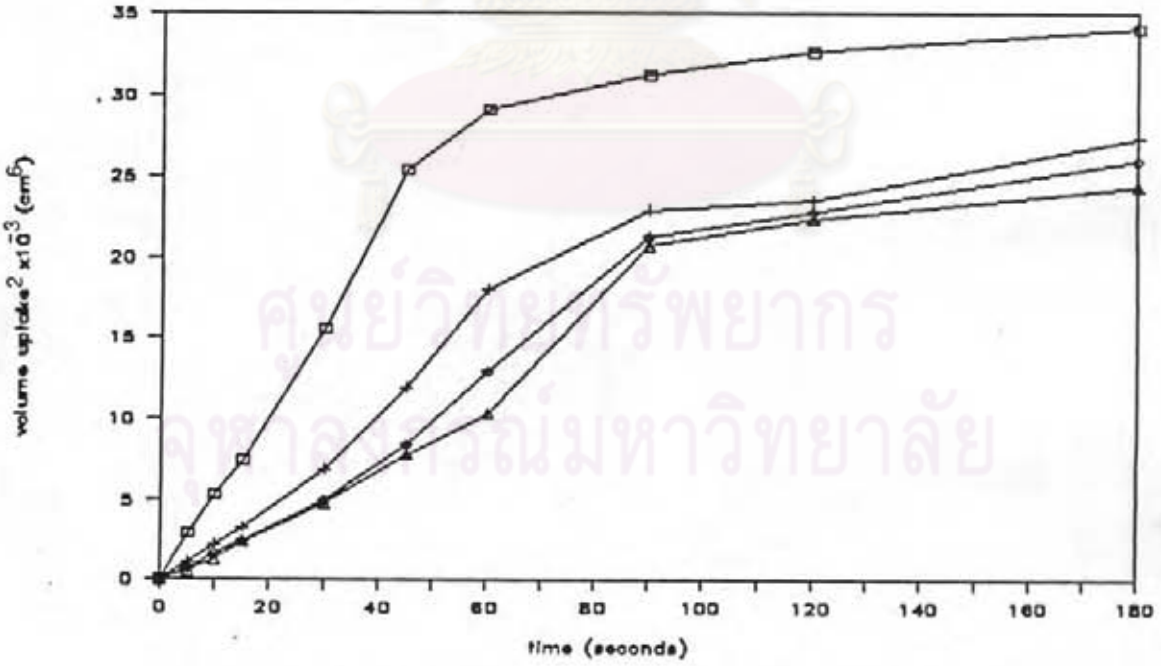

Figure 117. Water penetration into tablets made from dicalcium phosphate dihydrate with 50% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

increased volumetric water uptake. The increased rate was caused by the breaking of the hydrogen bonds between the microcrystalline cellulose particles and the subsequent increaseing in pore volume. Thus, increasing amount of microcrystalline cellulose resulted in increasing volumetric water uptake.

2. Water soluble diluent

Water penetration behaviors of the tablets prepared from α-lactose monohydrate - microcrystalline cellulose were shown in Figures 118 - 121. The addition of 20% and 30% microcrystalline cellulose showed an increase in penetration rate with decreasing compressional force. It was suggested that the decrease in penetration rate dued to decrease pore volume caused by increasing compressional force.

On the other hand, water uptake decreased as increased compressional force when 40% and 50% microcrystalline cellulose was added into α-lactose monohydrate tablets. This may be ascribed to the masking of lactose by the microcrystalline cellulose in tablets with high porosity.

However, increased concentration of microcrystalline cellulose produced an increase in water uptake when compressed at same force.

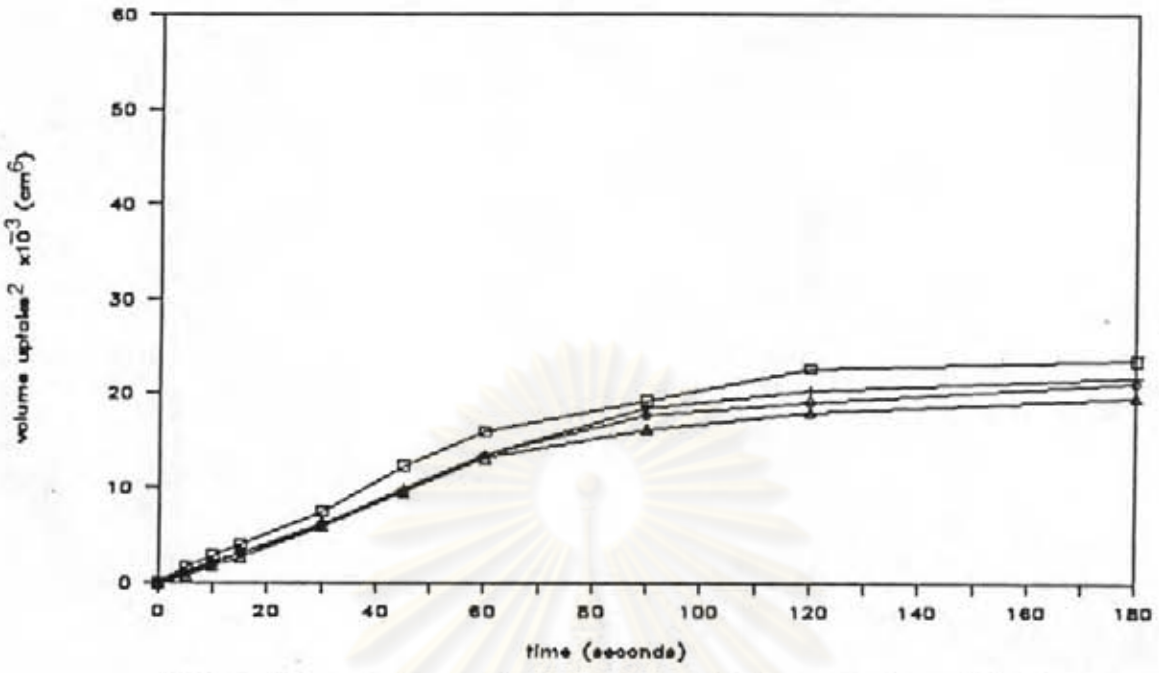

Figure 118. Water penetration into tablets made from α-lactose monohydrate with 20% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

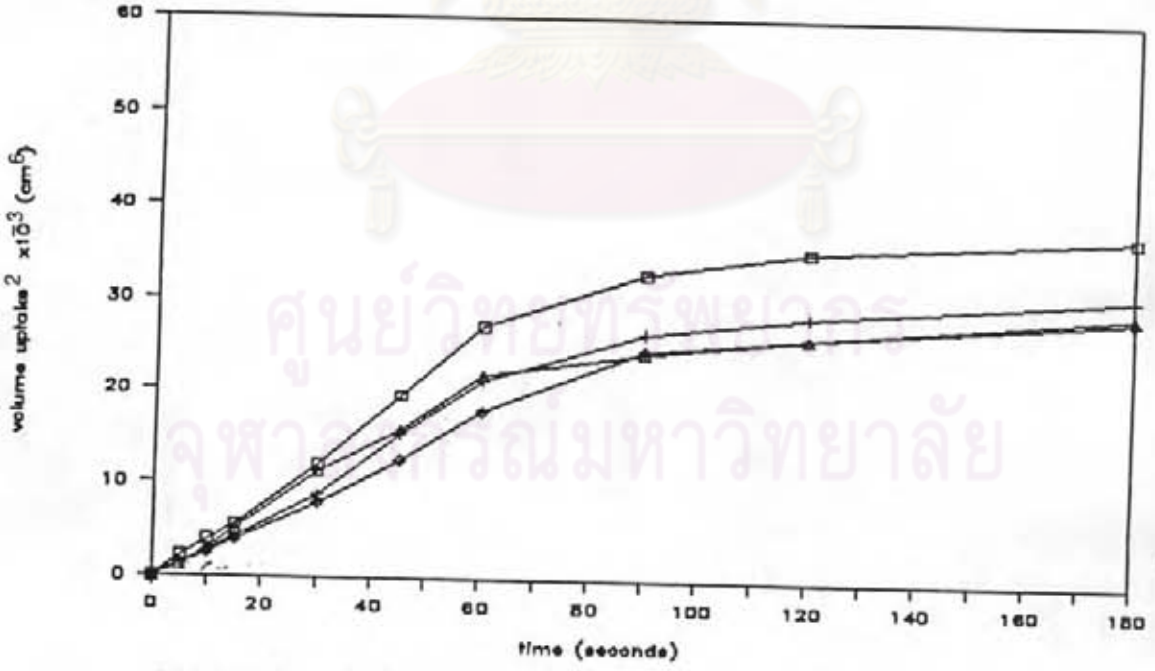

Figure 119. Water penetration into tablets made from α-lactose monohydrate with 30% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

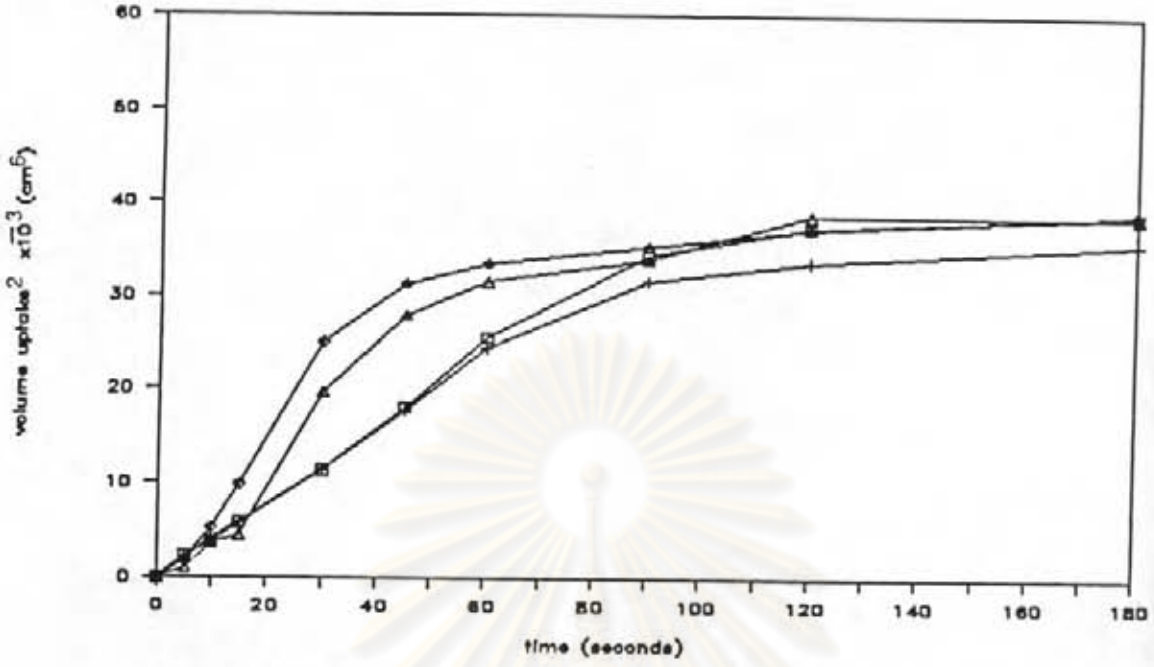

Figure 120 Water penetration into tablets made from α-lactose monohydrate with 40% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

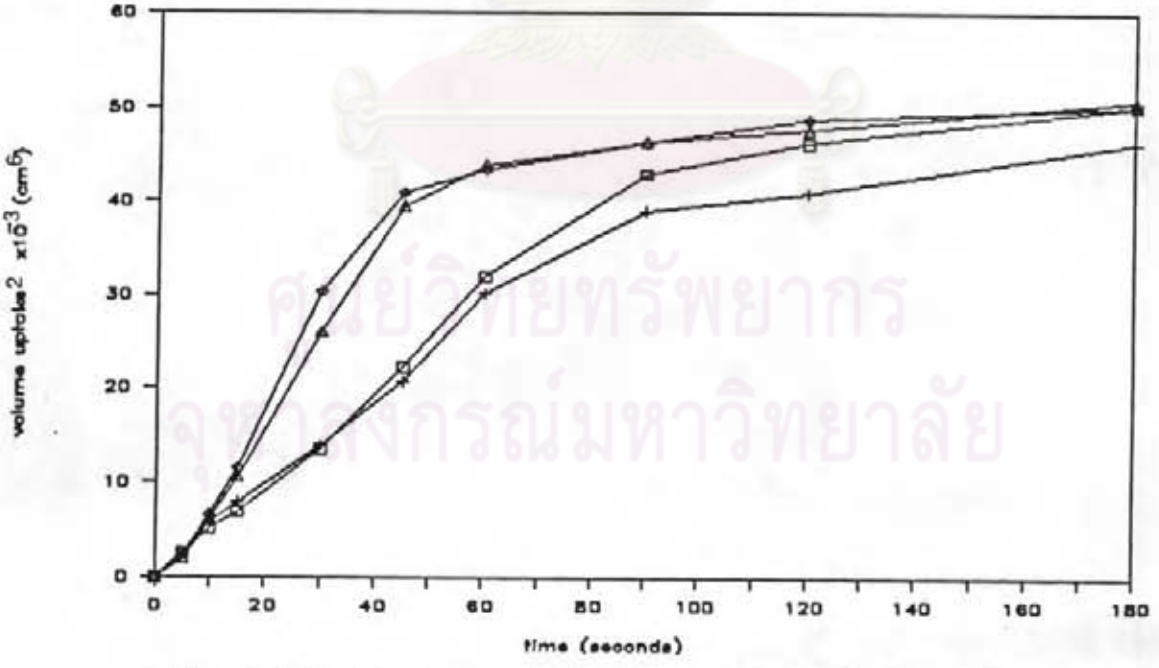

Figure 121. Water penetration into tablets made from α-lactose monohydrate with 50% microcrystalline cellulose compressed with different compressional forces: □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

It could be concluded that water penetration into tablets containing microcryatalline cellulose corresponded with pore volume , that is decrease when increased compressional force.

The water uptake by these four different type of disintegrants showed that sodium starch glycolate exhibited the highest water uptake followed by cross linked polyvinylpyrrolidone, microcrystalline cellulose and corn starch. Dicalcium phosphate dihydrate tablets showed higher water uptake than α-lactose monohydrate tablets when contained same type of disintegrant and compressed at same compressional force.

Disintegration Times

Disintegration times of tablets in different formulations as function of compressional forces were shown in Table 17. Relationship between disintegration times and concentration of sodium starch glycolate in dicalcium phosphate dihydrate and α-lactose monohydrate tablets containing sodium starch glycolate as disintegrant was shown in Figures 122, 123 respectively. In case of dicalcium phosphate dihydrate tablets, disintegration time decreased as increased concentration of disintegrant. Until optimal concentration was reached at concentration of 6% sodium starch glycolate which showed minimum disintegration time.

Table 17 Disintegration Times (seconds) of Tablets in Different Formulations as Function of Compressional Forces (pound)

TABLETTOSE + EXPLOTAB

FORCE	3%	6%	9%	12%
1200	36.4(3.44)	35.0(1.58)	41.8(3.19)	37.6(1.67)
1800	32.8(2.49)	35.2(0.45)	39.8(2.17)	41.8(1.09)
2400	26.8(5.76)	33.4(1.67)	38.6(1.34)	45.2(4.32)
3000	30.2(3.27)	34.4(1.95)	39.8(1.79)	44.0(7.00)

TABLETTOSE + STARCH

FORCE	3%	6%	9%	12%
1200	86.5(4.73)	71.2(5.63)	72.0(2.74)	53.0(6.82)
1800	82.4(5.50)	63.2(4.38)	57.2(2.86)	57.4(7.13)
2400	64.8(3.96)	57.6(4.88)	62.2(9.01)	55.0(2.45)
3000	58.4(3.78)	46.2(11.00)	56.4(11.39)	55.6(2.97)

TABLETTOSE + AVICEL PH101

FORCE	20%	30%	40%	50%
1200	38.0(6.04)	22.2(4.66)	20.0(1.41)	19.4(1.67)
1800	31.8(1.64)	23.0(3.00)	22.2(0.84)	24.2(2.95)
2400	33.6(1.14)	27.0(2.58)	23.8(1.10)	29.0(1.22)
3000	34.0(4.36)	25.8(2.22)	29.2(3.56)	38.2(1.30)

TABLETTOSE + KOLLIDON CL

FORCE	1%	3%	5%	7%
1200	46.0(2.65)	50.4(5.55)	55.2(6.69)	58.8(5.93)
1800	34.6(5.37)	47.2(2.49)	50.4(1.67)	59.8(5.26)
2400	23.6(3.21)	44.6(2.30)	43.0(3.94)	50.4(1.95)
3000	21.2(0.40)	41.0(1.00)	39.8(3.49)	47.4(5.12)

EMCOMPRESS + EXPLOTAB

FORCE	3%	6%	9%	12%
1200	23.8(2.49)	15.8(1.64)	21.2(3.49)	23.4(0.89)
1800	26.0(1.58)	15.2(3.11)	40.2(3.11)	50.8(0.45)
2400	24.8(3.56)	20.0(1.00)	40.2(1.79)	58.6(1.14)
3000	28.0(3.00)	25.0(1.22)	43.6(1.14)	63.6(1.34)

EMCOMPRESS + STARCH

FORCE	3%	6%	9%	12%
1200	79.3(1.50)	14.6(1.57)	13.1(1.07)	13.8(2.17)
1800	62.7(6.43)	14.8(3.19)	19.9(2.34)	11.4(2.79)
2400	101.8(18.59)	15.3(2.63)	13.0(2.24)	10.2(1.64)
3000	112.0(27.60)	15.8(1.48)	10.3(0.50)	8.4(0.89)

EMCOMPRESS + AVICEL PH101

FORCE	20%	30%	40%	50%
1200	43.8(1.50)	44.0(2.58)	44.3(1.50)	56.8(4.65)
1800	59.5(6.66)	58.5(4.43)	61.0(6.00)	74.3(2.99)
2400	83.8(4.79)	74.4(6.27)	79.4(5.64)	90.6(7.54)
3000	56.8(4.65)	74.3(2.99)	91.0(7.54)	138.0(17.68)

EMCOMPRESS + KOLLIDON CL

FORCE	1%	3%	5%	7%
1200	12.5(2.08)	13.6(0.89)	6.8(1.13)	16.3(1.50)
1800	13.6(1.14)	13.0(1.00)	61.0(6.00)	7.2(0.50)
2400	15.2(3.37)	9.2(0.45)	4.8(0.96)	7.3(0.50)
3000	17.5(2.81)	8.3(0.50)	3.3(0.50)	5.8(1.50)

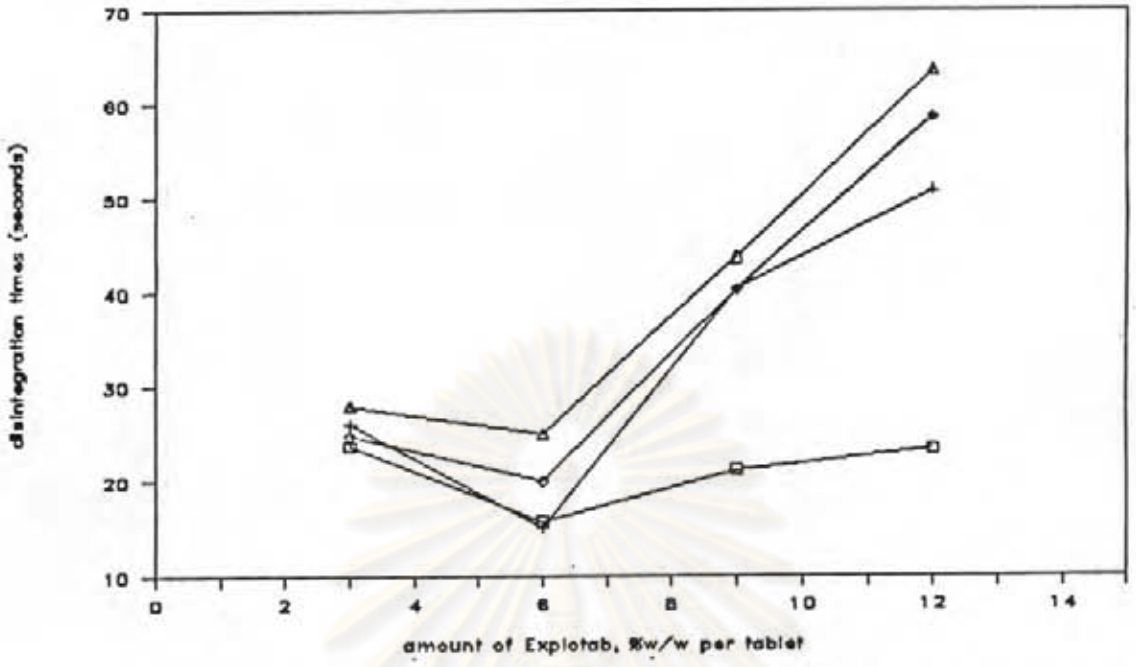

Figure 122. Relationship between disintegration times of dicalcium phosphate dihydrate tablets compressed with various compressional forces and concentration of sodium starch glycolate (Explotab).
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds,
△ 3000 pounds.

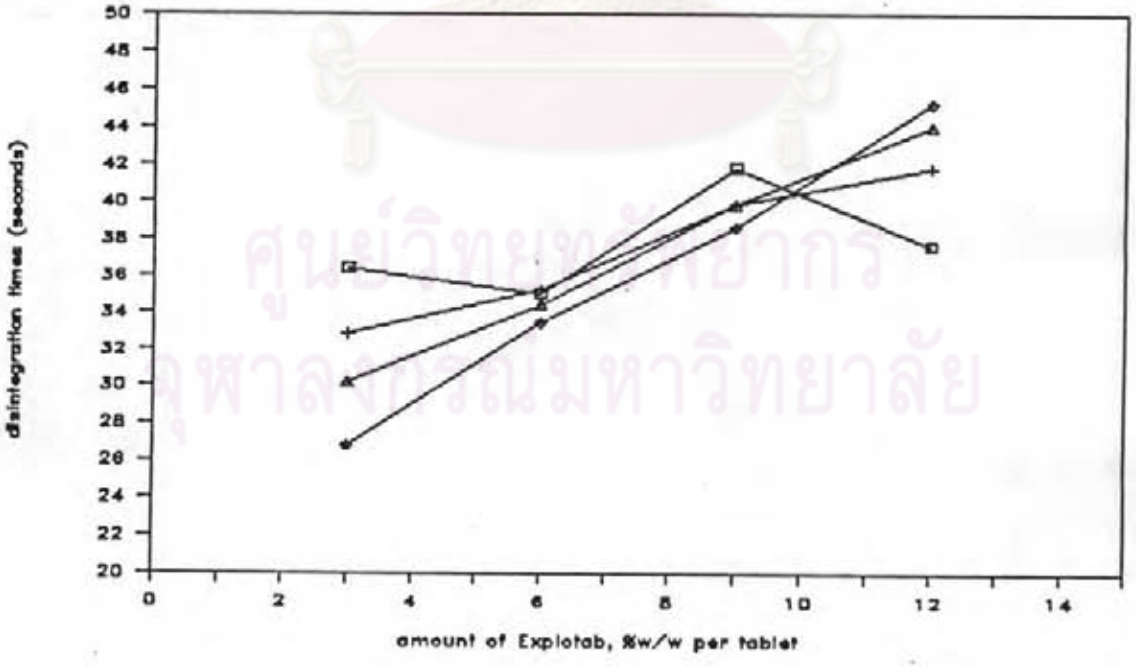

Figure 123. Relationship between disintegration times of α-lactose monohydrate tablets compressed with various compressional forces and concentration of sodium starch glycolate (Explotab).
□ 1200 pounds, + 1800 pounds, ◊ 2400 pounds,
△ 3000 pounds.

Disintegration time was markedly increased when incorporated concentration higher than optimum concentration.

Dicalcium phosphate dihydrate - sodium starch glycolate tablets compressed at 1200 pounds showed the shortest disintegration time followed by 1800, 2400 and 3000 pounds respectively with any concentration of sodium starch glycolate.

Opposition to dicalcium phosphate dihydrate tablets, disintegration times of α-lactose tablets were prolonged when increased concentration of sodium starch glycolate, that is disintegration times increased as increased concentration of disintegrant.

Below concentration of 10% sodium starch glycolate, α-lactose monohydrate compressed with high compressional force showed improve disintegration times. Higher concentration of 10% sodium starch glycolate, disintegration time decreased as decreased compressional force.

The plot between disintegration times and amount of corn starch of dicalcium phosphte dihydrate tablets was illustrated in Figure 124. Dicalcium phosphate dihydrate containing corn starch as disintegrant showed optimum concentration region betweem 6% - 12% to give fastest disintegration times. At this region, compressional force exerted slightly influence on disintegration times, while at 3%, low compressional force gave shorter disintegration times

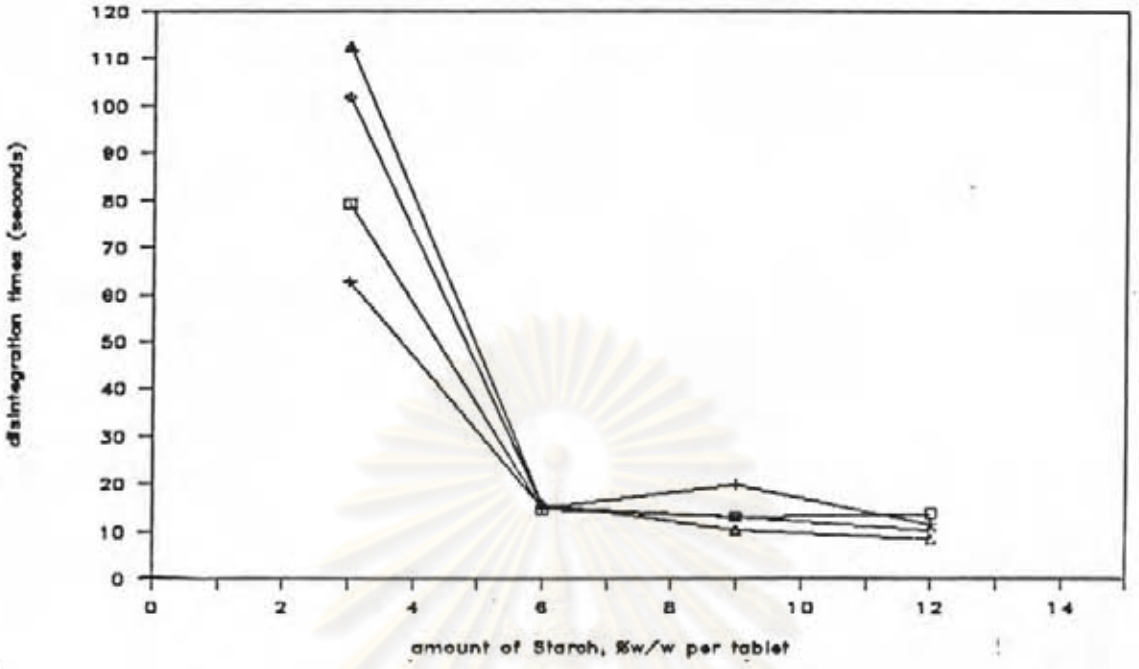

Figure 124. Relationship between disintegration times of dicalcium phosphate dihydrate tablets compressed with various compressional forces and concentration of corn starch. □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

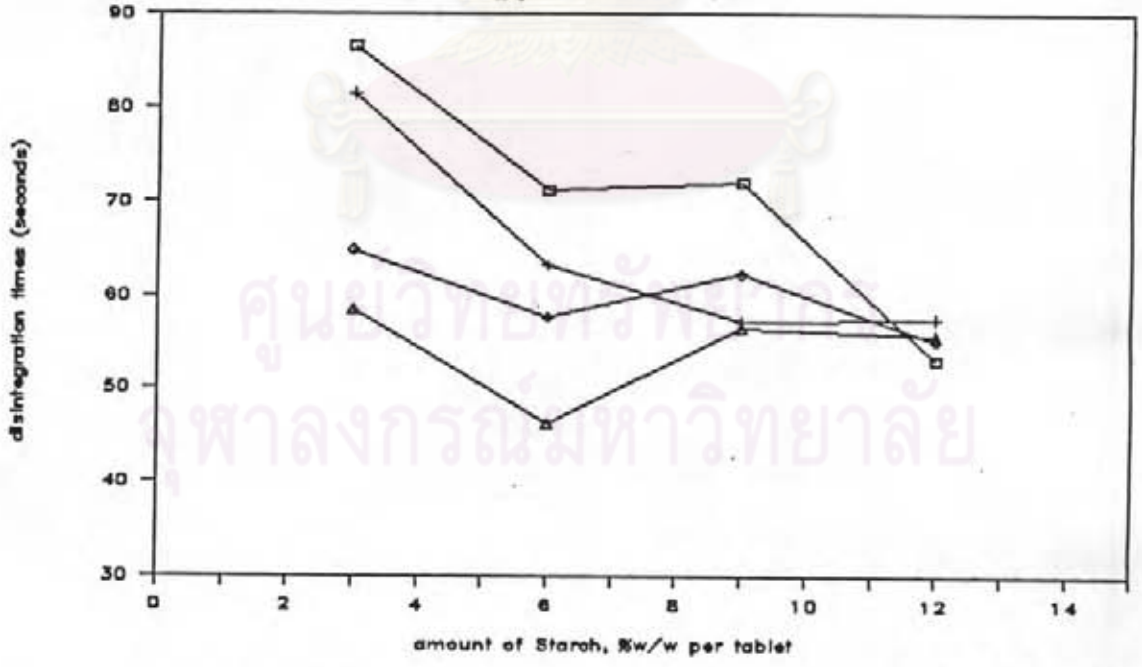

Figure 125. Relationship between disintegration times of α-lactose monohydrate tablets compressed with various compressional forces and concentration of corn starch. △ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, □ 3000 pounds.

Moreover, tablets containing 3% corn starch showed markedly prolonged disintegration times.

In case of α-lactose monohydrate - corn starch tablets, disintegration times showed tendency to decrease as increase concentration of corn starch. It was clearly showed that low compressional force gave longer disintegration times than high force as shown in Figure 125. The tablets compressed at 3000 pounds gave optimal effective concentration at 6% while the others gave at 12% corn starch.

The effect of cross linked polyvinylpyrrolidone on disintegration times of dicalcium phosphate dihydrate and α-lactose monohydrate was shown in Figures 126, 127 respectively. Dicalcium phosphate dihydrate tablets showed initially decrease in disintegration time to a minimum at concentration of 5% and then increased when increased concentration of crosspovidone. All concentrations higher than 1% crosslinked polyvinlypyrolidone, except 1%, tablets gave improved disintegration times when compressed with high compressional force. Conversely, high compressional force gave high disintegration times when 1% cross linked polyvinylpyrrolidone was used.

In case of α-lactose monohydrate tablets containing cross linked polyvinylpyrrolidone, disintegration times increased when increased concentration of disintegrant, that is maximum disintegration times was found when 7% cross

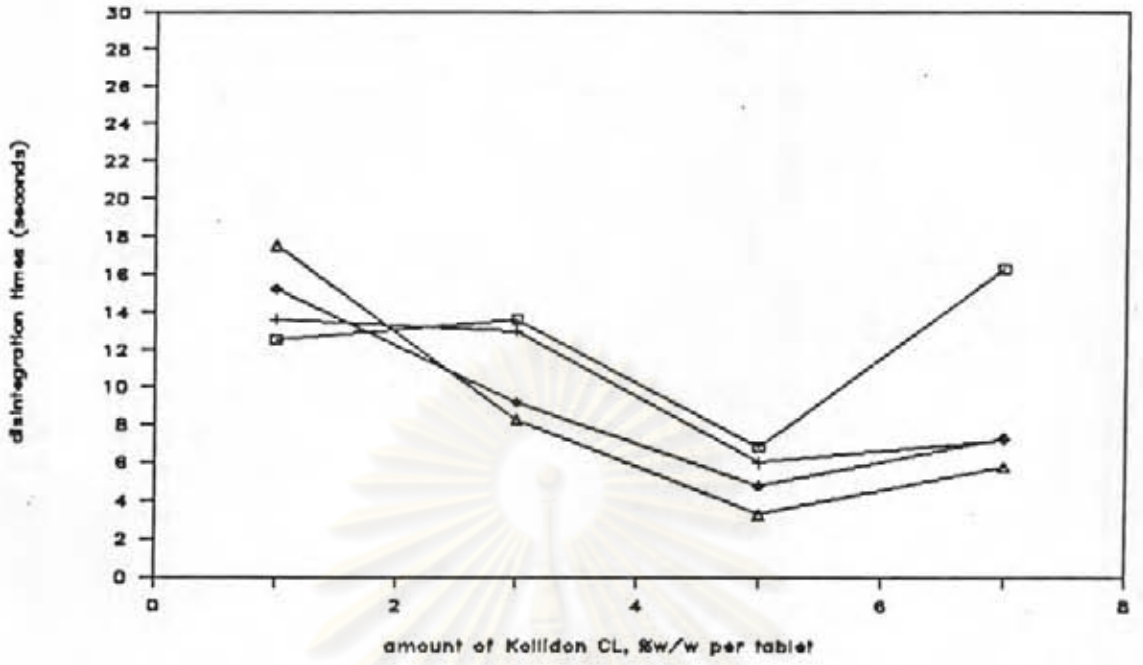

Figure 126. Relationship between disintegration times of dicalcium phosphate dihydrate tablets compressed with various compressional forces and concentration of cross linked polyvinylpyrrolidone (Kollidon CL). □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

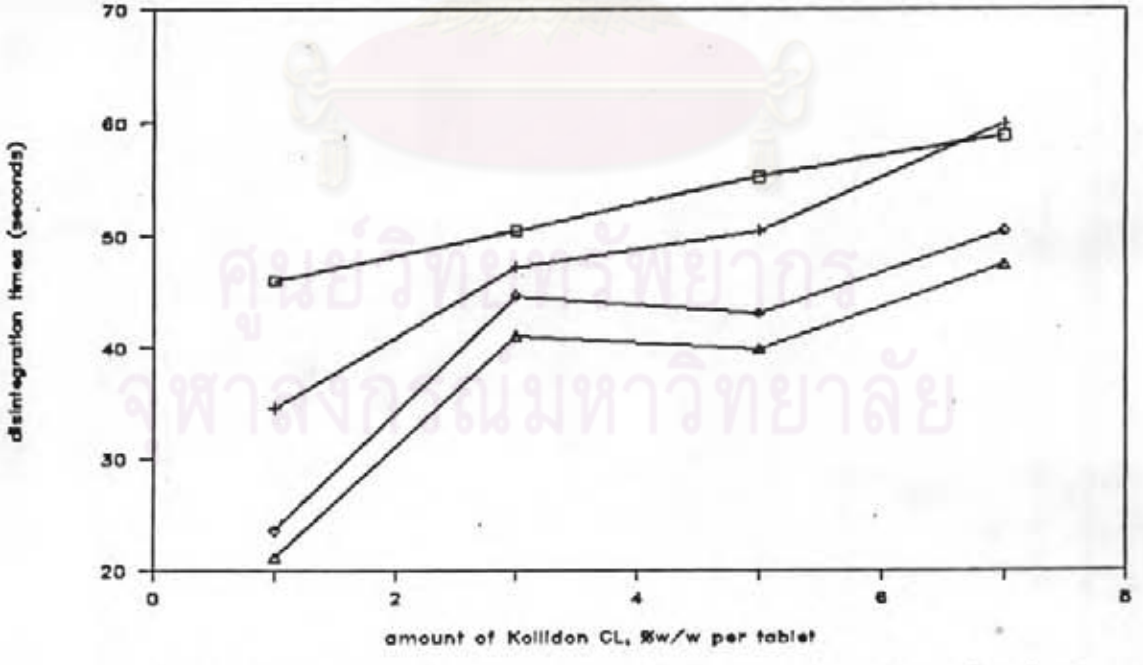

Figure 127. Relationship between disintegration times of α-lactose monohydrate tablets compressed with various compressional forces and concentration of cross linked polyvinylpyrrolidone (Kollidon CL) □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

linked polyvinylpyrrolidone was incorporated. Disintegration times was also increased as increased compressional force. Increasing in disintegration times was observed with any concentration of disintegrant.

Figure 128 showed the relationship between amount of microcrystalline cellulose and disintegration times of dicalcium phosphate dihydrate - microcrystalline cellulose tablets when compressed at different compressional forces. High compressional force delayed the disintegration. In addition, at higher compressional forces, there was an optimum concentration of microcrystalline cellulose at 30% to give a minimum disistegration times. At low compressional forces, the disintegration times were quite the same except for tablets containing 50% of disintegrant. The relative longer disintegration times was observed when the tablets contained 50% microcrystalline cellulose. This may be attributed to the large number of hydrogen bond characterized by the high hardness producing especially when high amount of microcrystalline cellulose was incorporated (28). It was clearly shown that disintegration times was also increased as increased compressional forces.

The plot of disintegration times of α-lactose monohydrate tablets against concentration of microcrystalline cellulose was shown in Figure 129. Tablets compressed with 1800 and 2400 pounds showed an optimum concentration to give

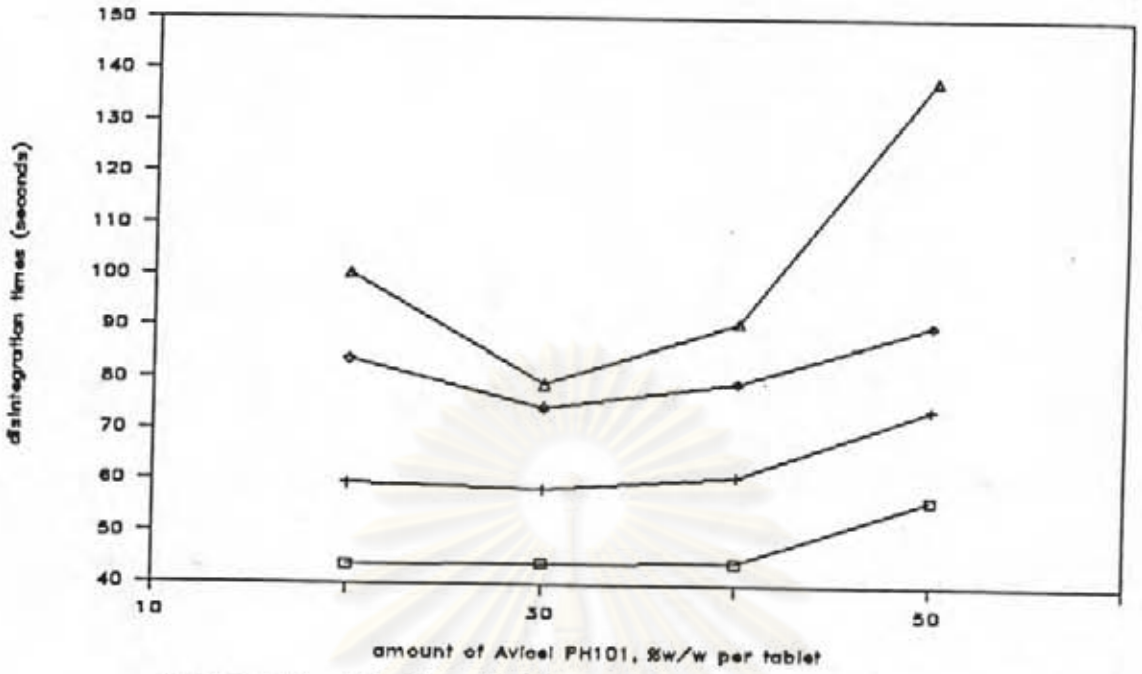

Figure 128. Relationship between disintegration times of dicalcium phosphate dihydrate tablets compressed with various compressional forces and concentration of microcrystalline cellulose (Avicel PH101). □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

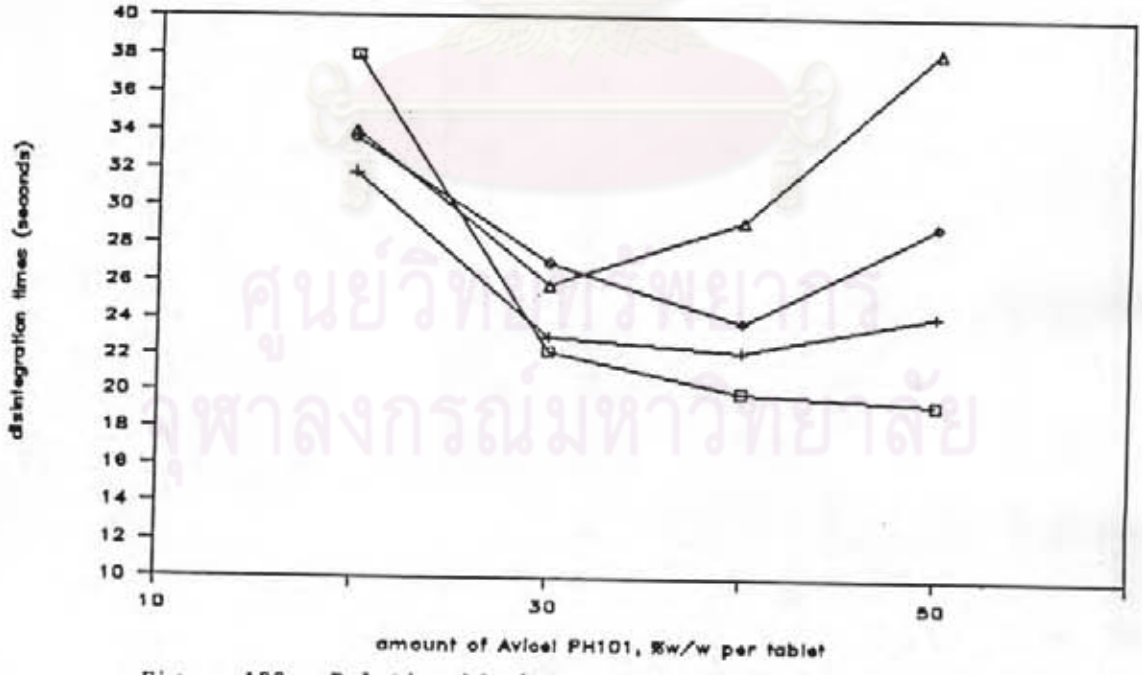

Figure 129. Relationship between disintegration times of α-lactose monohydrate tablets compressed with various compressional forces and concentration of microcrystalline cellulose (Avicel PH101). □ 1200 pounds, + 1800 pounds, ◊ 2400 pounds, △ 3000 pounds.

the best disintegration at 40% of the disintegrant while tablets compressed at 1200 and 3000 pounds showed at 50% and 30% respectively. It was remarkable observed that disintegration times tended to increase when 50% microcrystalline cellulose was used. This could be attributed by the same explanation as dicalcium phosphate dihydrate tablets. It was indicated that the tablets compressed at higher compressional force needed lower concentration of microcrystalline cellulose to produce minimum disintegration time.

The relationships between compressional force and disnitegration times, logarithm of compressional force and disintegration time or compressional force and logarithm of the disintegration time was evidented in Tables 18, 19, 20 respectively. The dependency of tablet disintegration on compressional force amoung these relationships was employed by determining of the correlation coefficient. The X-coefficient indicated the slope of influence whether direct or indirect relationship was existed. Positive value is indicative of direct relationship, whereas negative value is indicative of indirect relationship.

It was appeared that correlation coefficient between disintegration time and logarithm of compressional force of tablets containing sodium starch glycolate were higher than any other relationship. This indicated that there existed a

Table 18 Regression Analysis between Compressional Force and Disintegration Time for Different Formulations.

FORMULATION	R SQUARE	X COEFF.
EMCOMPRESS + 3% EXPLOTAB	0.6638	0.0019
EMCOMPRESS + 6% EXPLOTAB	0.8510	0.0054
EMCOMPRESS + 9% EXPLOTAB	0.7243	0.0112
EMCOMPRESS + 12% EXPLOTAB	0.8552	0.0214
EMCOMPRESS + 3% STARCH	0.6412	0.0232
EMCOMPRESS + 6% STARCH	0.9689	0.0007
EMCOMPRESS + 9% STARCH	0.2328	-0.0026
EMCOMPRESS + 12% STARCH	0.9836	-0.0029
EMCOMPRESS + 1% KOLLIDON CL	0.9744	0.0028
EMCOMPRESS + 3% KOLLIDON CL	0.9115	-0.0033
EMCOMPRESS + 5% KOLLIDON CL	0.9823	-0.0020
EMCOMPRESS + 7% KOLLIDON CL	0.7086	-0.0052
EMCOMPRESS + 20% AVICEL PH101	0.9928	0.0323
EMCOMPRESS + 30% AVICEL PH101	0.9573	0.0202
EMCOMPRESS + 40% AVICEL PH101	0.9920	0.0264
EMCOMPRESS + 50% AVICEL PH101	0.9245	0.0433
TABLETTOSE + 3% EXPLOTAB	0.6116	-0.0041
TABLETTOSE + 6% EXPLOTAB	0.3306	-0.0006
TABLETTOSE + 9% EXPLOTAB	0.4909	-0.0012
TABLETTOSE + 12% EXPLOTAB	0.7612	0.0038
TABLETTOSE + 3% STARCH	0.9550	-0.0168
TABLETTOSE + 6% STARCH	0.9811	-0.0134
TABLETTOSE + 9% STARCH	0.5657	-0.0070
TABLETTOSE + 12% STARCH	0.1477	0.0009
TABLETTOSE + 1% KOLLIDON CL	0.9392	-0.0142
TABLETTOSE + 3% KOLLIDON CL	0.9965	0.0051
TABLETTOSE + 5% KOLLIDON CL	0.9799	-0.0089
TABLETTOSE + 7% KOLLIDON CL	0.8399	0.0073
TABLETTOSE + 20% AVICEL PH101	0.2536	-0.0017
TABLETTOSE + 30% AVICEL PH101	0.7075	0.0025
TABLETTOSE + 40% AVICEL PH101	0.9236	0.0049
TABLETTOSE + 50% AVICEL PH101	0.9699	0.0102

Table 20 Regression Analysis between Compressional Force and Logarithm of Disintegration Time for Different Formulations.

FORMULATION	R SQUARE	X COEFF.
EMCOMPRESS + 3% EXPLOTAB	0.6642	0.00003
EMCOMPRESS + 6% EXPLOTAB	0.8514	0.00012
EMCOMPRESS + 9% EXPLOTAB	0.6922	0.00015
EMCOMPRESS + 12% EXPLOTAB	0.7834	0.00022
EMCOMPRESS + 3% STARCH	0.5700	0.00011
EMCOMPRESS + 6% STARCH	0.9714	0.00002
EMCOMPRESS + 9% STARCH	0.2918	-0.00008
EMCOMPRESS + 12% STARCH	0.9897	-0.00011
EMCOMPRESS + 1% KOLLIDON CL	0.9874	0.00008
EMCOMPRESS + 3% KOLLIDON CL	0.9145	-0.00013
EMCOMPRESS + 5% KOLLIDON CL	0.9479	-0.00017
EMCOMPRESS + 7% KOLLIDON CL	0.7679	-0.00022
EMCOMPRESS + 20% AVICEL PH101	0.9853	0.00020
EMCOMPRESS + 30% AVICEL PH101	0.9363	0.00014
EMCOMPRESS + 40% AVICEL PH101	0.9713	0.00018
EMCOMPRESS + 50% AVICEL PH101	0.9760	0.00021
TABLETTOSE + 3% EXPLOTAB	0.5771	-0.00006
TABLETTOSE + 6% EXPLOTAB	0.3264	-0.00001
TABLETTOSE + 9% EXPLOTAB	0.4849	-0.00001
TABLETTOSE + 12% EXPLOTAB	0.7624	0.00004
TABLETTOSE + 3% STARCH	0.9545	-0.00010
TABLETTOSE + 6% STARCH	0.9626	-0.00010
TABLETTOSE + 9% STARCH	0.5583	-0.00005
TABLETTOSE + 12% STARCH	0.1570	0.00001
TABLETTOSE + 1% KOLLIDON CL	0.9611	-0.00020
TABLETTOSE + 3% KOLLIDON CL	0.9934	-0.00005
TABLETTOSE + 5% KOLLIDON CL	0.9825	0.00008
TABLETTOSE + 7% KOLLIDON CL	0.8487	-0.00006
TABLETTOSE + 20% AVICEL PH101	0.7244	0.00004
TABLETTOSE + 30% AVICEL PH101	0.9485	0.00009
TABLETTOSE + 40% AVICEL PH101	0.9933	0.00016
TABLETTOSE + 50% AVICEL PH101	0.2321	0.00002

Table 19 Regressional Analysis between Logarithm of Compressional Force and Disintegration Time for Different Formulations.

FORMULATION	R SQUARE	X COEFF.
EMCOMPRESS + 3% EXPLOTAB	0.6332	8.3672
EMCOMPRESS + 6% EXPLOTAB	0.7467	22.8065
EMCOMPRESS + 9% EXPLOTAB	0.8228	53.8195
EMCOMPRESS + 12% EXPLOTAB	0.9342	100.8683
EMCOMPRESS + 3% STARCH	0.5449	96.2826
EMCOMPRESS + 6% STARCH	0.9077	2.9802
EMCOMPRESS + 9% STARCH	0.1438	-9.0355
EMCOMPRESS + 12% STARCH	0.9896	-13.1143
EMCOMPRESS + 1% KOLLIDON CL	0.9162	12.0953
EMCOMPRESS + 3% KOLLIDON CL	0.8773	-14.5226
EMCOMPRESS + 5% KOLLIDON CL	0.9300	-8.5545
EMCOMPRESS + 7% KOLLIDON CL	0.8097	-25.2216
EMCOMPRESS + 20% AVICEL PH101	0.9696	143.9178
EMCOMPRESS + 30% AVICEL PH101	0.9833	92.0740
EMCOMPRESS + 40% AVICEL PH101	0.9912	119.0541
EMCOMPRESS + 50% AVICEL PH101	0.8501	187.2689
TABLETTOSE + 3% EXPLOTAB	0.6967	-19.7289
TABLETTOSE + 6% EXPLOTAB	0.3534	-2.7969
TABLETTOSE + 9% EXPLOTAB	0.6150	-6.0559
TABLETTOSE + 12% EXPLOTAB	0.8539	17.9864
TABLETTOSE + 3% STARCH	0.9236	-74.5600
TABLETTOSE + 6% STARCH	0.9426	-59.3648
TABLETTOSE + 9% STARCH	0.6449	-33.5373
TABLETTOSE + 12% STARCH	0.2242	4.9985
TABLETTOSE + 1% KOLLIDON CL	0.9784	-65.4969
TABLETTOSE + 3% KOLLIDON CL	0.9727	-22.8663
TABLETTOSE + 5% KOLLIDON CL	0.9752	-40.1814
TABLETTOSE + 7% KOLLIDON CL	0.7692	-31.3526
TABLETTOSE + 20% AVICEL PH101	0.3649	-9.1935
TABLETTOSE + 30% AVICEL PH101	0.7379	11.3581
TABLETTOSE + 40% AVICEL PH101	0.8529	21.0856
TABLETTOSE + 50% AVICEL PH101	0.9141	44.6457

direct relationship between disintegration time and the logarithm of compressional force of tablet containing sodium starch glycolate. All dicalcium phosphate dihydrate tablets containing this disintegrant showed an increase in disintegration time with the increasing logarithm of compressional force. On the other hand, an increase in logarithm of compressional force led to decrease in disintegration time for α-lactose monohydrate tablet containing sodium starch glycolate except the tablets containing 12% of this disintegrant which disintegration time increased with an increase in logarithm of compressional force. It was also appeared that the X-coefficient or the slope of this relationship increased with increasing concentration of the disintegrant.

For tablets containing corn starch, mild correlation existed between compressional force and disintegration time. An increasing in compressional force tended to increase in disintegration time of dicalcium phosphate dihydrate tablets containing 3% and 6% corn starch. The relationship was reversed for tablets containing 9% and 12% corn starch.

All lactose tablets containing corn starch showed a decreasing in disintegration time when compressional force increased except those of 12% which exhibited conversely.

It was appeared that linear relationship between compressional force and logarithm of disintegration time

existed on tablets containing crossed linked polyvinylpyrrolidone and microcrystalline cellulose The logarithm of disintegration time increased with the increasing compressional force for tablets containing microcrystalline cellulose in both systems, dicalcium phosphate dihydrate and α-lactose monohydrate.

Incorporation of 1% cross linked polyvinylpyrrolidone into dicalcium phosphate dihydrate tablets, also increased logarithm of disintegration time with the increasing compressional force. For dicalcium phosphate dihydrate tablets containing the disintegrant of more than 2% cross linked polyvinylpyrrolidone the logarithm of disintegration time decreased with increasing compressional force. In the case of lactose system, there appeared to be a good relationship between logarithm of disintegration time and compressional force, an increase in compressional force resulting in a lower logarithm of disintegration time except for α-lactose tablets containing 5% cross linked polyvinylpyrrolidone which gave an opposite result.

Dimensionless Disintegration Times

To facilitate comparison among tablets of same compositions but comprssed with different forces, the dimensionless disintegration times, Tn is determined (36). This parameter is defined as:

$$Tn = \frac{Tsample\ n}{Tsample\ 1}$$

Tsample n is the disintegration times of the nth member of the series of tablets containing the same disintegrant and compressed with different forces and Tsample 1 is the disintegration times of the tablets compressed at the lowest compressional force within the series.

The use of a dimensionless value, Tn, allows a direct comparison of trends in tablets behavior whether compressional force affected disintegration times. In such comparison the disintegration times of the tablet compressed with the lowest compressional force becomes unity. Value of $Tn < 1$ is indicative of a beneficial effect of the compressional force on disintegration, whereas value of $Tn > 1$ indicates a detrimental effect.

The effects of compressional forces on the dimensionless value of dicalcium phosphate dihydrate and α - lactose monohydrate tablets containing sodium starch glycolate, corn starch, cross linked polyvinylpyrrolidone and microcrystalline cellulose were illustrated in Figures 130 - 137. Compressional force considerably affected disintegration times of dicalcium phosphate dihydrate tablets containing sodium starch glycolate. The greater the compressional force the higher was the disintegration time.

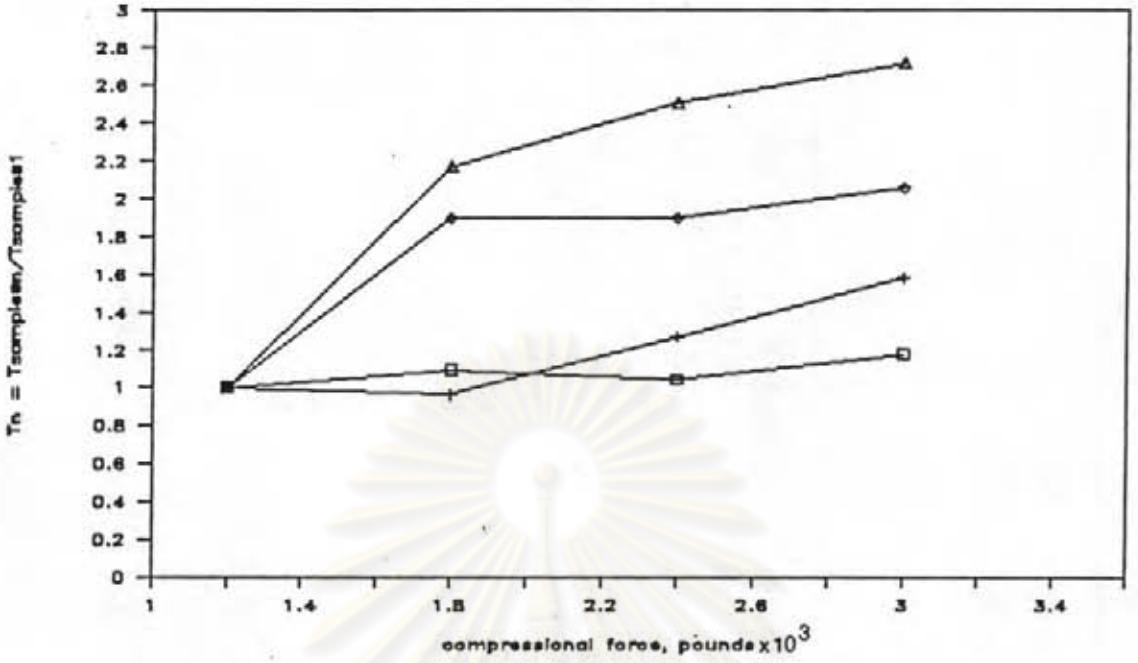

Figure 130. Plot of the dimensionless disintegration value, Tn as a function of compressional force for dicalcium phosphate dihydrate tablets containing □ 3%, + 6%, ◊ 9% and △ 12% sodium starch glycolate.

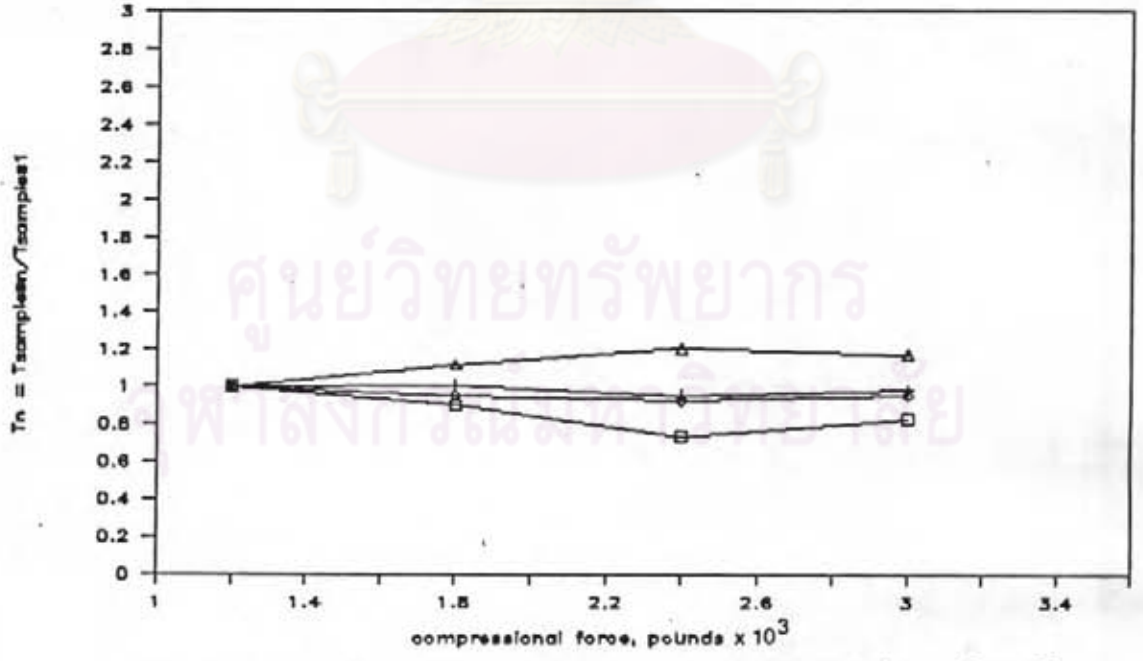

Figure 131. Plot of the dimensionless disintegration value, Tn as a function of compressional force for α-lactose monohydrate tablets containing □ 3%, + 6%, ◊ 9% and △ 12% sodium starch glycolate.

For tablets of 3% sodium starch glycolate, disintegration seemed to be insensitive to compressional force.

Variation of compressional force exhibited very slightly effect on disintegration times of α-lactose monohydrate - sodium starch glycolate tablets as shown in Figure 131. Addition of 3% sodium starch glycolate showed a slightly decrease in disintegration time as the compressional force increased while addition of 12% of this disintegrant exhibited conversely. The value of unity was found when 6% and 9% was added.

The disintegration time of dicalcium phosphate dihydrate tablets containing 3% starch initially decreased to a minimum then increased as the compressional force increased while those of tablets containing 9% and 12% of this disintegrant markedly decreased after the compression beyond 1800 pounds. For tablets of 6% disintegrant, force exerted no influence on disintegration time. In the case of α-lactose monohydrate tablets, increase in compressional force tended to decrease the disintegration. Nevertheless this effect did not occur in tablets containing 12% disintegrant.

Incorporation of 1 % crosspovidone into dicalcium phosphate dihydrate tablets, disintegration time increased with increasing compressional forces while tablets containing other concentrations exhibited conversely. In the lactose system, an increase in compressional force led to a decrease

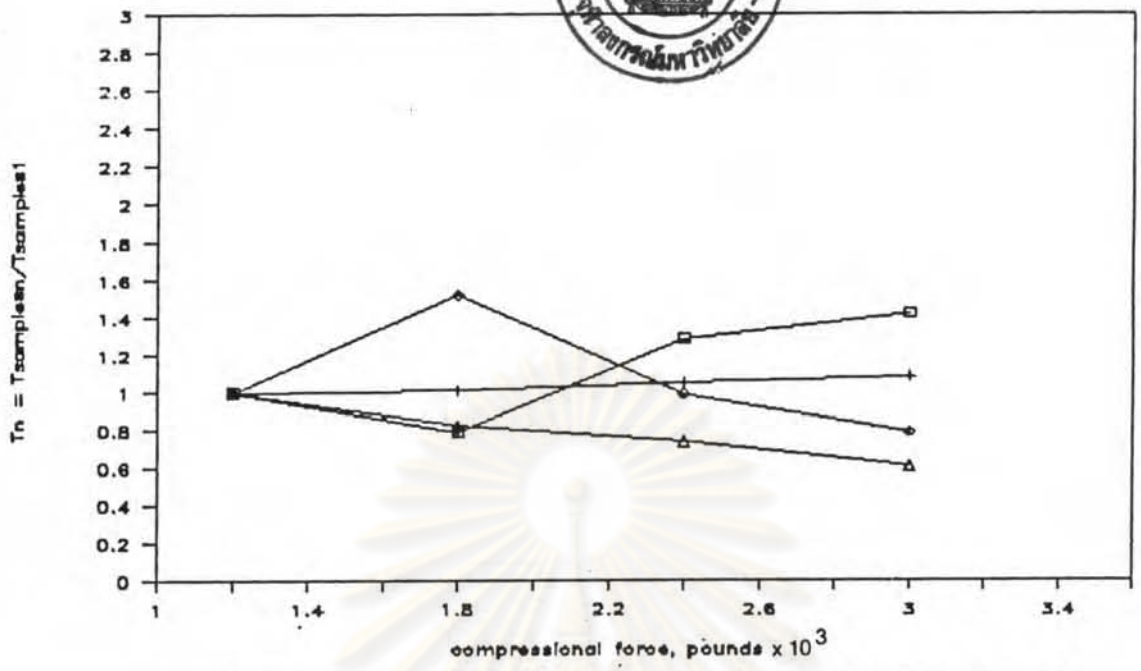

Figure 132. Plot of the dimensionless disintegration value, Tn as a function of compressional force for dicalcium phosphate dihydrate tablets containing □ 3%, + 6%, ◊ 9% and △ 12% corn starch.

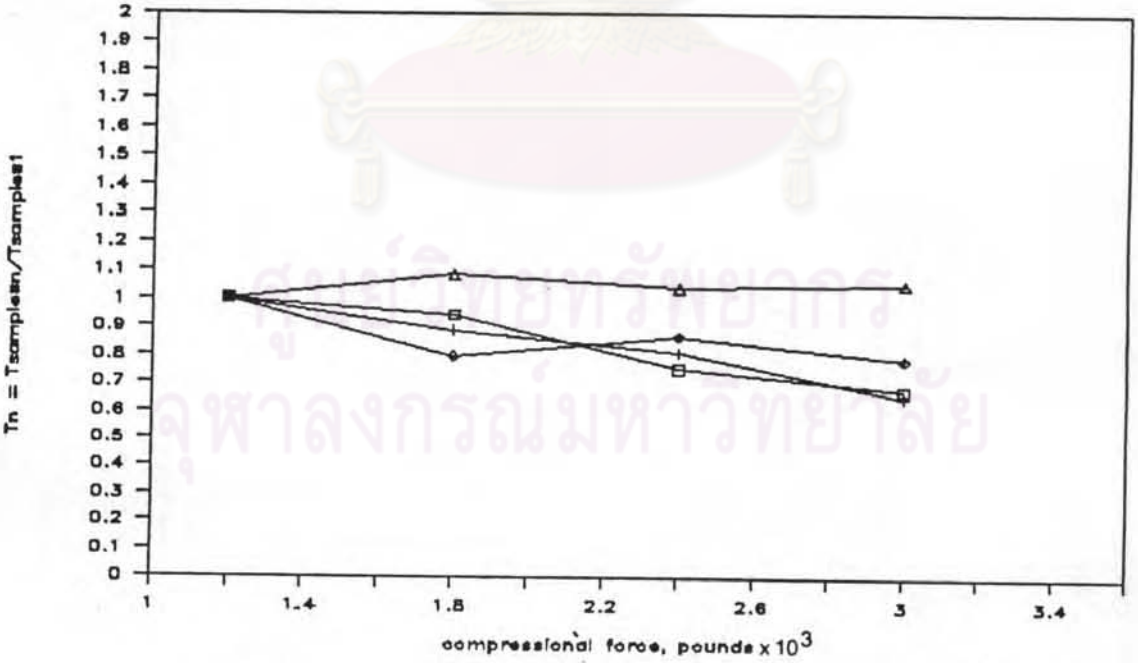

Figure 133. Plot of the dimensionless disintegration value, Tn as a function of compressional force for α-lactose monohydrate tablets containing □ 3%, + 6%, ◊ 9% and △ 12% corn starch.

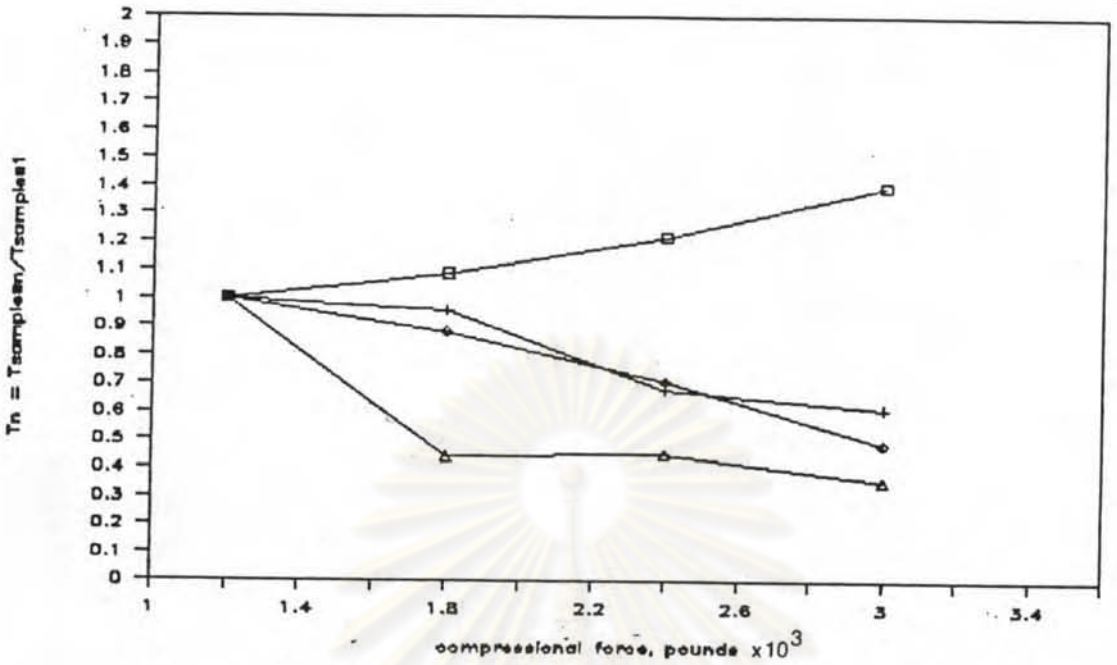

Figure 134. Plot of the dimensionless disintegration value, Tn as a function of compressional force for dicalcium phosphate dihydrate tablets containing □ 1%, + 3%, ◊ 5% and △ 7% cross linked polyvinylpyrrolidone.

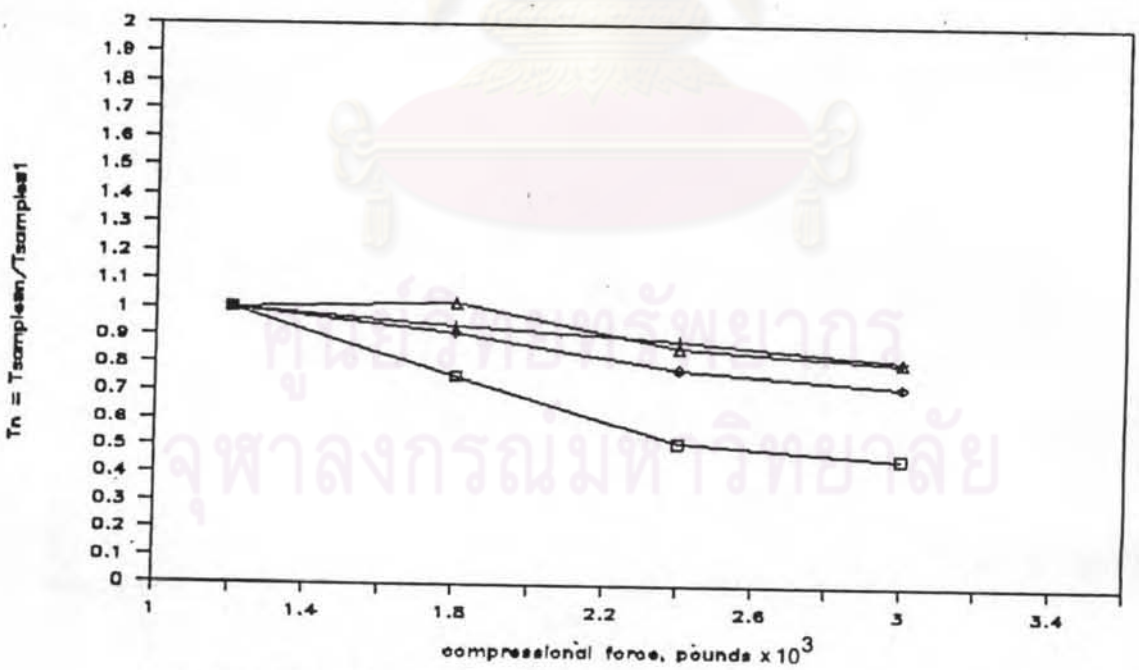

Figure 135. Plot of the dimensionless disintegration value, Tn as a function of compressional force for ∝-lactose monohydrate tablets containing □ 1%, + 3%, ◊ 5% and △ 7% cross linked polyvinylpyrrolidone.

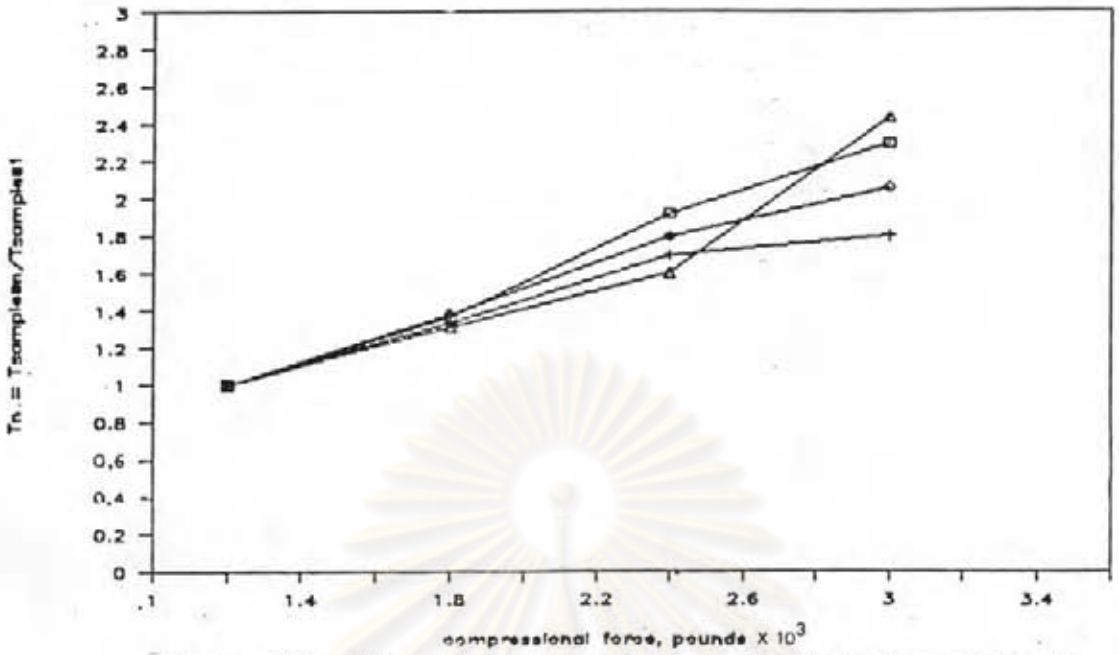

Figure 136. Plot of the dimensionless disintegration value, Tn as a function of compressional force for dicalcium phosphate dihydrate tablets containing □ 20%, + 30%, ◊ 40% and △ 50% microcrystalline cellulose.

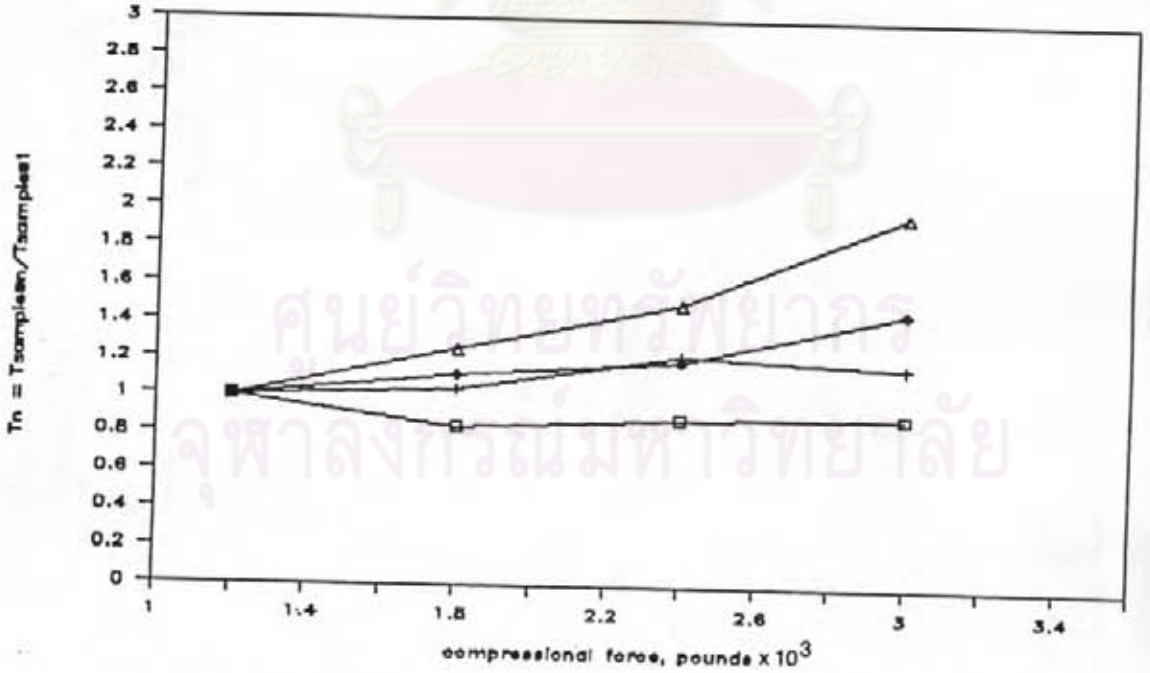

Figure 137. Plot of the dimensionless disintegration value, Tn as a function of compressional force for α-lactose monohydrate tablets containing □ 20%, + 30%, ◊ 40% and △ 50% microcrystalline cellulose.

in disintegration time of tablets containing all concentration of cross linked polyvinylpyrrolidone.

The disintegration times of dicalcium phosphate dihydrate tablets containing microcrystalline cellulose dramatically increased with compressional force.

For α-lactose monohydrate tablets containing high percentage of microcrystalline cellulose, higher compressional force prolonged the disintegration time. The dependency of disintegration time on compressional force was not shown in tablets containing the lowest concentration of 20% disintegrant.