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GLIDANTS AND LUBRICANT PROPERTIES OF SEVERAL TYPES OF TALCS

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ABSTRACT

Glidant and lubricant efficiencies of a number of different types of talcs were evaluated. The _in vitro_ properties of tablets lubricated with talcs were compared to those lubricated with magnesium stearate. Talc lubricated tablets showed superior _in vitro_ properties compared to magnesium stearate lubricated tablets. Different sources of talcs showed significant differences in glidant and lubricant efficiencies.

INTRODUCTION

A number of different types of talcs were obtained from Cyprus Industrial Mineral Company. The objective of this study was to determine the potential glidant and lubricant efficiencies of these talcs. Also to determine the effects of these talcs on tablets _in vitro_ properties and to test the physical stability of some of these tablets.

METHODS

Glidant Properties of Talcs

The physical properties of the talcs available from the Cyprus Industrial Mineral Company are shown in Table 1. A recording powder flowmeter was used for evaluating the glidant efficiencies of these talcs. The recording powder flowmeter equipment consisted of a Mettler PR-1200 top loading electronic balance connected to a strip chart recorder with a linear potentiometer. The linear potentiometer reduced the analog signal output from the balance to a level suitable for input into the strip chart recorder. The glass funnel used as the hopper had 12 cm top diameter, 11 cm length and 1.2 cm orifice diameter. 100 g of powder was poured into the funnel with the orifice closed. When the orifice was opened the powder flowed into the beaker and a trace was obtained on the strip chart recorder. The chart speed was set at 30 cm/min.

Lubricant Properties of Talcs

The formulation used for the powder flow study consisted of 55% Emcompress and 45% acetaminophen which had been mixed for 5 minutes on a turbula mixer. The talc was then added in concentration of 0.0% to 0.5% and mixed for further 3 minutes. The flow of each of the 100g of formulation was done in triplicate. The mass flow rate and the linearity were determined.

TABLE 1
Properties and Sources of Talcs Used in This Study

Talcs[a]	Geographic Source	Density (lbs/ft) Loose	Tapped	Median(um)	Percent Undersize <10um	<20um
Altalc 300*	Montana	20	48	6	75	95
Altalc 400*	Montana	16	41	4	90	98
Altalc 500*	Montana	14	37	3	95	99
Alabama 300*	Alabama	19	51	7	68	86
Alabama 400*	Alabama	16	45	7	80	97
Beaverwhite 325*	Montana	21	40	6	66	88
Supra	Italian	26	58	15	39	64
Suprafino	Italian	16	44	5	85	99
Alpha Glide 200*	Italian	26	59	13	41	--
Alpha Glide 325*	Italian	16	40	5	88	--

[a]All Products Supplied By Cyprus Industrial Minerals Co. and commercially available
*USP Grade

An instrumented stokes B-2 rotary press was used for evaluating the lubricant efficiencies of talcs. The compression and ejection forces were measured by the piezo electric transducers located in the eyebolt and the ejection cam respectively. The analog data from the piezo electric transducers were converted to the digital form by the analog to the digital converter. The digital output was then collected and analyzed on Apple II computer.

250g of the formulation as shown in Table 2 was prepared and mixed for 6 minutes on the turbula mixer.

TABLE 2
Formulations Used For Evaluating Lubricant Efficiencies of Talcs

Lubricant	Drug	Matrix
Talc(s) 1%[a]	Acetaminophen 5%	Avicel PH102 93.75%
Magnesium stearate 0.5%	Acetaminophen 5%	Avicel PH102 94.50%
Talc(s) 1%[b]	Hydrochlorothiazide 10%	Avicel PH102 88.8%
Magnesium stearate 2.0%	Hydrochlorothiazide 10%	Avicel PH102 88.0%

[a]Plus magnesium stearate 0.25% [b]Plus magnesium stearate 0.2%

The tablets were compressed at fixed press settings and the press speed was set at 24 revolutions per minute. The output of force against time data was collected for 10 tablets per minute in triplicate.

The tests done to determine the in vitro properties of the tablets prepared included USP weight variation test, crushing strength, friability, USP disintegration test and USP dissolution test. In addition the physical stability test was done on tablets made with model acetaminophen formulations as shown in which Table 1 which additionally also contained 0.5% of primogel. The physical stability test involved storing the tablets in an oven at 40°C in closed and open containers, in dry environmental conditions, for 10 weeks. The properties of these tablets were compared to their initial properties prior to start of the physical stability study. The data were evaluated using one way fixed effects ANOVA and least significant difference test, at significance level of 0.05.

RESULTS AND DISCUSSION

Powder Flow Studies

The literature suggests that the 3 major factors that influence the flowability of powders are the particle properties, the environmental conditions and the testing methods. The particle properties includes the particle shape (1). The spherical and the oblong shaped particles flow easily while the sharp edged particles flow less readily. The flow becomes poorer with irregularly shaped particles and the flow is even more adversely affected by the formation of bridges which tends to occur particularly with plate shaped and the fibrous type particles. Glidants are postulated to improve the flowability of powders by decreasing the surface rugosity of the irregularly shaped particles (1,2) and also by reducing van der Waals attractions (2,3) among particles, thereby preventing formation of bridges.

The particle size is another easily evident factor that differs between the free flowing and the poor flowing or cohesive powders. The cohesive powders poor flow is due to their large surface area available for interparticulate friction resulting in development of electrostatic charges and the adsorption of moisture and gases. It is postulated that glidants tend to minimize these tendencies and collect very fine host particles on glidant surfaces (1,2).

Another particle property that influences the powder flow is the particle size distribution. Several studies have shown that the powder flow is greatly influenced by the proportion of the fines present in the powder. The flow rate of a ternary mixture of magnesium oxide was shown to increase as proportion of fines in the mixture was increased (4). However, an excess of fines usually adversely affects the powder flow (3). Other particle properties that tend to affect the flow are the particle density, the particles elastic and plastic deformation properties (5).

The second major factor that influences the flow of the particles is the environment. The humidity affects the particle moisture content. In addition to adsorbing moisture, the particles adsorb gases and impurities present in the environment (5).

The third major factor that affects the flowability of the powders is the testing methods. Some of the factors that can control the rate at which the powder emerges from the circular orifice are the shape of the hopper (6,7). The flow contours of powder in a flat bottom hopper have been studied. The particles in the center of the hopper flow faster, and the particles next to the wall flow the slowest. The stationary region of powder next to the wall of the hopper slows the flow rate of the powder adjacent to the wall. This wall effect is minimal when the difference between diameter of container and the diameter of hopper orifice is greater than 30 times the diameter of the particle and also when the ratio of the diameter of the container to that of the orifice is greater than the value 2.5 (8).

The height of the powder column in the hopper does not affect the flow rate, unless the head of the powder column falls below the height of 2.5 times the diameter of the container at which point the flow rate will increase (8).

Another factor that affects the flow of powder from the hopper is the bulk density. One of the reasons why addition of fines to regular size particles increases the flow rate is that, the fines tend to fill the voids between the larger particles and thereby increase the bulk density. Consequently a greater mass per unit volume is discharged and therefore the flow rate is increased. However, the use of very high percentage of fines will fully fill the voids between the larger particles and therefore increase the interparticulate friction (8).

The single most important factor that influences the flow rate is hopper orifice diameter (4,8). The flow rate in grams per second is proportional to the orifice diameter raised to the power n, for many materials the value of n is between 2.5 and 3.2 (6).

Jones and Pipel (4), and Danish and Parrot (8) have developed more precise relationships between the diameter of hopper orifice and the flow rate. These equations take into consideration the factors that are functions of particle size, particle shape, particle surface roughness, the density of the powder material and the hopper geometry.

Most of the studies in the literature have expressed results in terms of flow rate. Another function that is important in addition to flow rate is the uniformity or the linearity of flow. This was evaluated qualitatively by Gold et al. (9) and quantitated by Hegde et al (7) using the linearity powder flow index. The linearity powder flow index is the difference between the square of the least square correlation coefficient and the minimal value of 0.8 multiplied by 100. The linearity combined with flow rate can be of great help in formulation development, quality control and scale up trouble shooting.

Glidant Properties of Talcs

The basic avenues available for improving the flow rate of powders are precompression, wet granulation, and addition of glidants. The selection of glidants and their concentration is empirical since there is no generally acceptable method for evaluating the glidant effectiveness. Gold et al. (3) highlighted some of the ways in which the glidants affect the powder flow. They obtained f-values which is the ratio of the powder flow rate in the presence of the glidant compared to the flow rate in the absence of the glidant. F-values greater than one indicated increased flow rate, while f-values less than one indicated decreased flow rate upon addition of glidant. Using lactose powder they showed that addition of up to 20% of fines increased f-values. However, addition of talc or magnesium stearate produced even higher f-values compared to addition of fines. Therefore glidants increased the flow rate by an additional mechanism other than just an increase of the percent of fines. They also found that talc was less able to increase the flow compared to magnesium stearate. They suggested that magnesium stearate was able to decrease van der Waal's forces to a greater extent compared to talc. Perhpas talc would have been a more efficient glidant if the surface rugosity of the lactose powder particles used was high. Further increases in the concentrations of magnesium stearate and talc decreased the flow rates probably by altering the particle size distribution of the lactose powder.

The talcs used in this powder flow study are commercially available and their physical properties are shown in Table 1. The powder loose density ranged from 14 to 26 lbs/ft^3 while the tapped density ranged from 37 to 58 lbs/ft^3. The median particle size ranged from 3 to 15um. The percent undersize, for <10 um particle size ranged from 39 to 95% and for <20 um particle size ranged from 64 to 99%. There is no correlation apparent between the talcs physical properties and their glidant efficiencies.

As shown in Table 3 and 4 the relative standard deviation values for flow rate and linearity data are extremely low indicating very highly reproducible results. The mass flow rate data of the powder flow study are shown in Figure 1,2,and 3. Using quite low talc concentrations, it was found that Ultraglide 325, Altalc 400, Beaverwhite talcs gave maximal flow rate at 0.1% talc concentration. In addition Supra, Alabama 300 and Alabama 400 also gave maximal flow rate at 0.1% concentration. The remaining 4 talcs, Altalc 500, Ultraglide 200, Suprafino, Altalc 300 gave increasing flow rate up to 0.25% talc concentration.

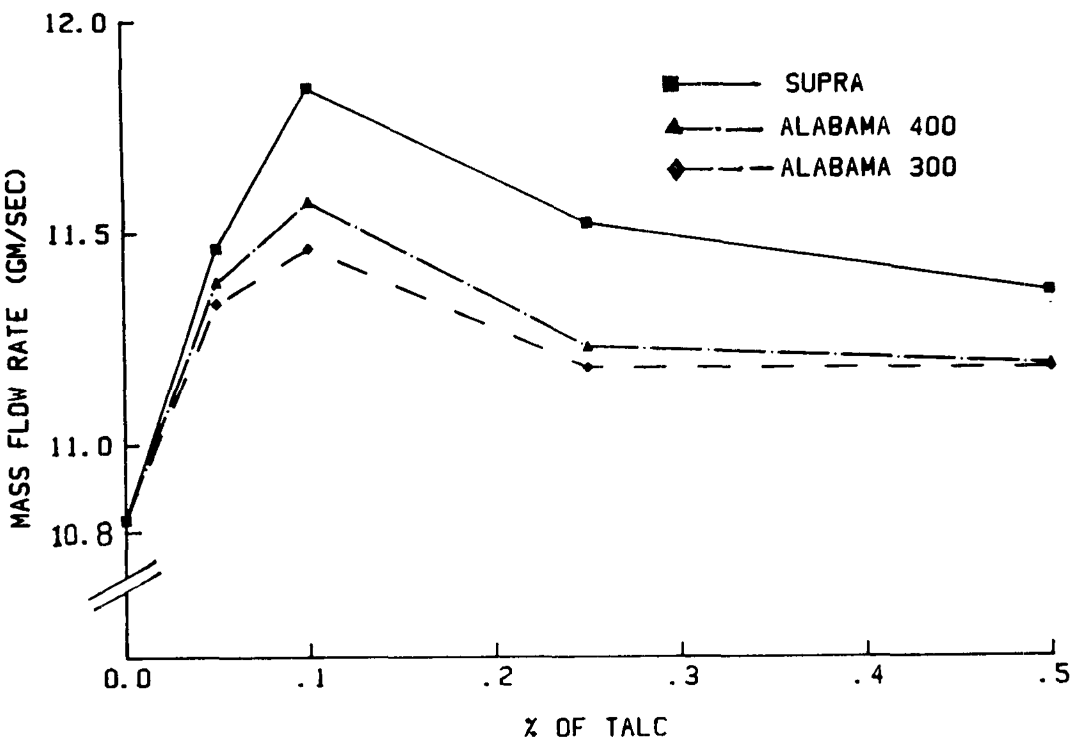

FIGURE 1
Effects of Talcs on Flow Rate of Powder Mixture

TABLE 3
Reproducibility of Flow Rates

Percent Altalc 300	Flow Rate (gm/sec) 1	2	3	Relative standard Deviation (%)
0	10.79	10.83	10.84	0.28
0.1	11.46	11.55	11.69	0.95

TABLE 4
Reproducibility of Linearity of Powder Flow

Percent Altalc 300	Linearity 1	2	3	Relative Standard Deviation %
0	19.78	19.80	19.76	0.1
0.1	19.80	19.90	19.87	0.26

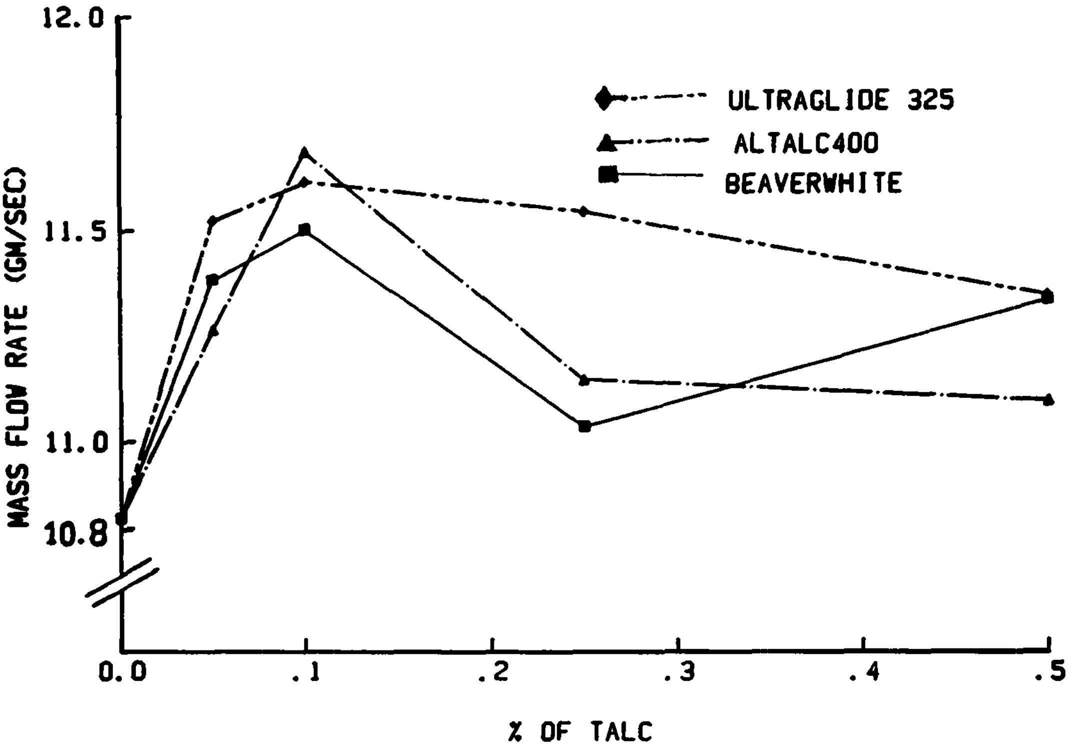

FIGURE 2
Effects of Talcs on Flow Rate of Powder Mixture

Table 5. compares the flow rate and linearity data for 0.1% and 0.25% of talcs concentrations. In summary, supra has best glidant action at 0.1%, while Altalc 500 has best glidant action at 0.1% and 0.25% of talc concentrations. The glidant efficiency of 0.1% Supra or Altalc 500 is same as that of 0.25% Ultraglide 200. As the flow rate increased with addition of talc, linearity also tended to increase, although no statistically

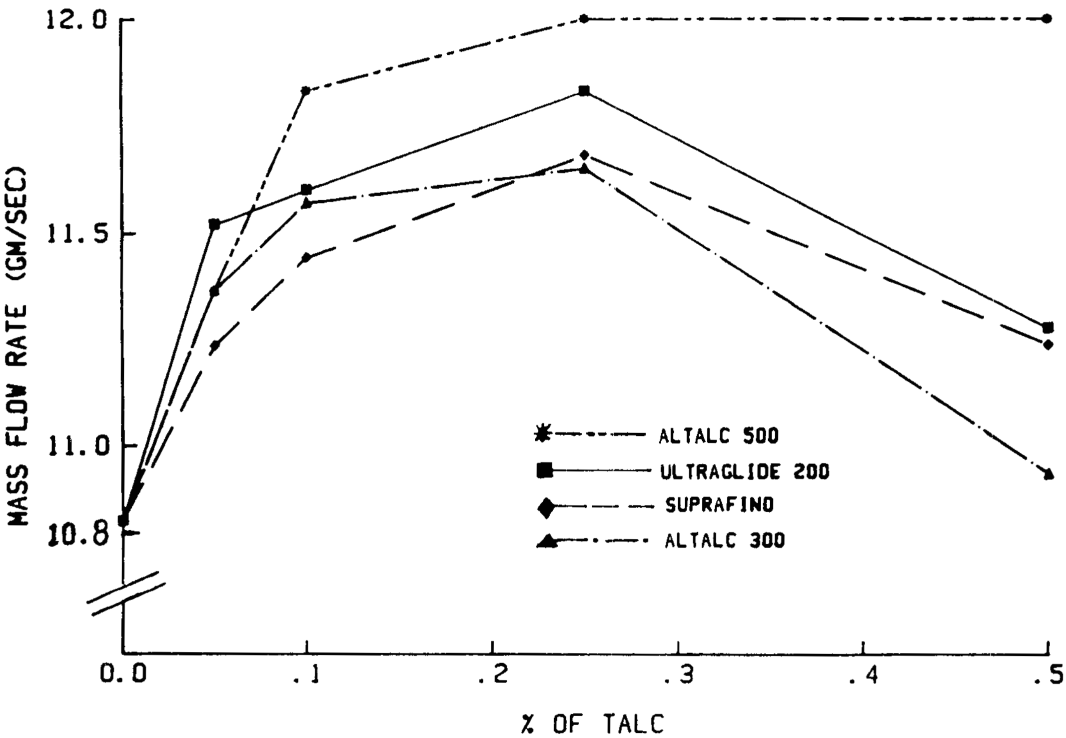

FIGURE 3
Effects of Talcs on Flow Rate of Powder Mixture

significant differences in linearity values could be shown.

Tablet Lubricants Studies

There are studies in the literature that have investigated the use of talc as tablet lubricant. Efficient lubrication in tablet manufacturing is of considerable importance in order to promote the production of elegant tablets at an optimum rate with minimum stress

TABLE 5
Comparisons of Mass Flow Rates and Linearity Values of Acetaminophen and Emcompress Powder Mixture

Talc	Concentrations of Talcs 0.10% Flow rate (G/sec)	0.10% Linearity	0.25% Flow rate (G/sec)	0.25% Linearity
Altalc 500	11.83	19.86	12.04	19.86
Supra	11.84	19.85	11.52	19.85
Ultraglide 200	11.60	19.86	11.83	19.82
Altalc 300	11.57	19.86	11.65	19.85
Suprafino	11.44	19.78	11.68	19.86
Altalc 400	11.68	19.80	11.14	19.80
Ultraglide 325	11.61	19.82	11.54	19.82
Alabama 400	11.57	19.81	11.23	19.80
Beaverwhite 325	11.50	19.84	11.03	19.84
Alabama 300	11.46	19.80	11.18	19.81

on the tablet press, by facilitating the ejection of tablets. Talc is particularly helpful in preventing the sticking and picking of tableting mass to the punch faces (10). While magnesium stearate is more useful for preventing the binding of the tableting mass to the die wall (10).

The efficiency of lubricants may be evaluated by determination of their physical properties such as water solubility (11), shear strength (12) and melting point (13). These studies report that efficient lubricants tend to have low water solubility, low shear strength and low melting point. However, critical review of the literature suggests that lubricant efficiency is better predicted by evaluation on instrumented tablet press compared to evaluation based on the physical and chemical properties of the lubricants. The lubricant efficiency on an instrumented tablet press can be evaluated in a variety of ways. Addition of lubricant to a formulation increases the force transmitted to the lower punch and decreases the frictional force at die wall (14). The R-values range from 0.6 for poor lubricant to 1.0 for perfect lubricant. The R values have been criticized for not being sufficiently sensitive. Other studies have also measured frictional force at die wall and/or radial die wall force. Probably a better indicator of lubricant efficiency is the ejection force, since it takes into consideration the adhesion force as well as the frictional force at the die wall. The ejection energy (15) may be a more accurate indicator of lubricant efficiency. Decrease in ejection force or ejection energy values indicate improvement in lubricant efficiency.

Lubricant Properties of Talcs

The lubricant efficiencies of talcs were evaluated by measuring the force required for the ejection of 300 mg acetaminophen tablets. Using one way fixed effects ANOVA and the least significant difference test, the lubricant efficiency of 1% Altalc 300 and 1% Supra was found not to be significantly different from that of 0.25% magnesium stearate. One percent of Alabama 300 and the Altalc 400 was 15.3% less efficient while 1% Alabama 400 was 29.8% less efficient compared to 0.25% magnesium stearate.

The lubricant efficiencies of talcs were also determined using model hydrochlorothiazide formulation as shown in Table 2. The lubricant efficiencies were evaluated using ejection force values. Compared to 1% Supra, the lubricant efficiency of 1% Alabama 300, 1% Altalc 400 and 1% Alabama 400 was 3.9% less efficient, while Altalc 300 was 10% less efficient.

Several studies have evaluated the efficiency of lubricants using ejection force values (13,14,15,16,17). The evaluation of lubricant efficiency of talc based on ejection force values as in this study and in the literature (11,14,15,17) indicates that on equal weight basis talc is less efficient than magnesium stearate.

Numerous studies have shown that lubricant efficiency can be improved by increasing concentration of lubricant. Magnesium stearate lubricant action is due to formation of a film which coats the surfaces of the tableting mass (16,18), and the tooling. Talc is a laminar solid whose layers slip and roll over one another in the direction of motion (19). Lubricant efficiency of talc is unlikely to increase with increase in compaction force because this rolling over action of talc becomes restricted.

In addition higher concentration of talc is required compared to magnesium stearate because talc forms a barrier of monoparticulate layer while magnesium stearate forms a molecular film barrier (16,18). Furthermore, the lubricant efficiency of magnesium stearate increases with increasing mixing time, because it shears during mixing and becomes attached onto the unlubricated surfaces (18,20). Matsuda et al (15) showed that better lubricant efficiency was obtained when magnesium stearate and talc was mixed with granules just prior to compaction compared to incorporation of lubricant at the granulation stage.

Both talc and magnesium stearate are hydrophobic lubricants (10,11). However, magnesium stearate is more efficient at covering the surfaces of the particles compared to talc (15) and therefore able to interfere with bonding between particles during consolidation. Therefore magnesium stearate has much greater deleterious effect than talc on tablet hardness (16,17,20,21) and percent friability. Furthermore, magnesium stearate prolongs disintegration time (16,20,22) and unlike talc, the magnesium stearate decreases the dissolution rate of drug (23,24).

Therefore there is merit in examining the possible use of magnesium and talc combinations (17) in order to optimize the lubricant efficiency and tablet performance properties.

Tablet Properties

The *in vitro* properties of the tablets made in this study from model acetaminophen formulations and model hydrochlorothiazide formulation are shown in Table 6 and 7.

The appearance of these tablets were evaluated in a controlled, double blind cross over study. The model acetaminophen formulations tablets appearance were similar in all respects for various talcs and magnesium stearate lubricated tablets. However, the magnesium stearate only and the Altalc 400 lubricated tablets had slightly more cracked edges. In case of the hydrochlorothiazide formulation the magnesium stearate lubricated tablets had pitted top and bottom surfaces and slightly cracked edges. These defects were absent in all talc lubricated tablets.

The talc lubricated tablets of model acetaminophen or hydrochlorothiazide formulations were considerably harder in varying degrees compared to magnesium stearate and Alabama 300 lubricated tablets. Also the tablets lubricated with the talcs had better friability properties. In particular the Altalc 300, and Altalc 400

TABLE 6
Properties of Acetaminophen Tablets

Lubricant	Tablet[a] Weight(mg)	RSD[b]	Percent[c] Heavier	Hardness[d] (Kg)	Percent[e] Harder	Percent Friability	Disintegration Time(sec)
Alabama 400	306.8	0.30	104.7	12.0	131.9	0.18	25
Altalc 400	303.6[f]	0.41[g]	103.6[f]	11.3[i]	124.2[i]	0.07	25
Alabama 300	300.3[f]	0.68[h]	102.5[f]	10.5[i]	115.4[i]	0.14	25
Altalc 300	299.4[f]	0.47[g]	102.2[f]	10.2[i]	112.1[i]	0.07	25
Supra	293.1	0.72[h]	100.0	10.3[i]	113.2[i]	0.21	25
Magnesium Stearate	309.2	0.43[g]	---	9.1	100.0	0.30	25

[a] Mean of 20 tablets.
[b] Relative standard deviation of tablet weights.
[c] Relative tablet weights were compared to those lubricated with Supra, because of difference in molecular weight between magnesium stearate and talcs.
[d] Mean of 10 tablets.
[e] Relative tablet hardness were compared to those lubricated with 0.5% magnesium stearate lubricated tablets.
[f,g,h,i] No statistically significant differences.

TABLE 7
Properties of Hydrochlorothiazide Tablets

Lubricant	Tablet[a] Weight(mg)	RSD[b]	Percent[c] Heavier	Hardness[d] (Kg)	Percent[e] Harder	Percent Friability	Disintegration Time (Sec)
Altalc 300	246.6	0.28[f]	102.3	5.3	120.5	0.04	20
Alabama 300	245.0	0.16[g]	101.6	4.4	100.0	0.12	18
Supra	243.3	0.33[f]	100.9	5.1[h]	115.9[h]	0.08	20
Altalc 400	242.2	0.15[g]	100.5	4.7[h]	106.8[h]	0.08	20
Alabama 400	241.1	0.31[f]	100.0	4.8[h]	109.1[h]	0.12	22
Magnesium Stearate	257.1	0.91	---	2.8	---	0.50	25

[a]Mean of 20 tablets.
[b]Relative standard deviation of tablet weights.
[c]Relative tablet weights were compared to those lubricated with Alabama 400 because of difference in molecular weight between magnesium stearate and talcs.
[d]Mean of 10 tablets.
[e]Relative tablet hardness were compared to those lubricated with Alabama 300 because of greater percent of magnesium stearate used (Table 2).
[f,g,h]No statistically significant differences.

TABLE 8
Dissolution Rate of Acetaminophen From Tablets

	Percent of drug dissolved*			
	15 min	30 min	40 min	60 min
Altalc 300	59.3(4.1)	81.4(1.2)	89.9(0.1)	97.6(2.5)
Altalc 400	51.2(1.5)	72.0(2.4)	81.2(1.6)	93.4(1.2)
Alabama 300	55.5(5.0)	74.7(6.4)	83.2(5.3)	93.6(0.2)
Alabama 400	59.3(2.7)	79.4(1.7)	84.4(1.6)	93.5(1.5)
Supra	60.2(6.4)	81.4(3.2)	90.3(4.2)	96.8(3.2)
Magnesium Stearate	54.3(2.9)	81.5(1.4)	93.1(0.2)	99.4(0.5)

*The value in parenthesis is standard deviation.

lubricated tablets gave considerably less friable tablets compared to magnesium stearate lubricated tablets.

The disintegration time of talc lubricated tablets disintegration time ranged from 22 to 25 seconds. There was no statistically significant difference in the dissolution rate of acetaminophen from 1% talc + 0.25% magnesium stearate lubricated tablets compared to 0.5% magnesium stearate lubricated tablets as shown in Table 8. The dissolution rate of hydrochlorothiazide from 1% talc + 0.2% magnesium stearate lubricated tablets compared to 2.0% magnesium stearate lubricated tablets was statistically significantly different for example, at 10 minutes the percent of hydrochlorothiazide dissolved from magnesium stearate only lubricated tablet is 56% compared to 92% from talc lubricated tablets, see Table 9.

TABLE 9
Dissolution Rate of Hydrochlorothiazide From Tablets

	Percent of Drug Dissolved*					
	5 min.	10 min.	15 min.	25 min.	35 min.	60 min.
Magnesium Stearate	34.5(4.5)	56.6(1.4)	75.8(4.9)	89.0(2.3)	95.3(2.3)	99.2(0.8)
Altalc 300	78.0(1.2)	89.8(1.0)	96.4(1.2)	98.2(0.6)	98.6(0.5)	98.8(0.7)
Altalc 400	78.6(2.0)	91.7(1.5)	94.6(0.6)	98.4(0.9)	99.5(0.7)	100(0.0)
Alabama 300	83.1(2.6)	92.0(1.5)	95.6(1.6)	99.0(0.9)	99.7(0.4)	100(0.0)
Alabama 400	78.9(0.8)	93.0(1.3)	96.2(1.5)	99.8(0.4)	100 (0.0)	100(0.0)
Supra	77.5(2.5)	92.0(2.0)	95.4(1.0)	99.2(0.7)	99.7(0.3)	100(0.0)

*The value in parenthesis is standard deviation.

TABLE 10
Properties of Acetaminophen Tablets After Physical Stability Test

	Decrease in Percent Mean Weight			
Container	Altalc 300	Altalc 400	Supra	Magnesium Stearate
Open	2.5	2.4	2.5	2.5
Close	1.4	2.0	2.4	2.5

The properties of tablets made from the model acetaminophen formulations to which 0.5% primogel had been added was evaluated after undergoing physical stability test as shown in Table 10. The tablets lubricated with 1% talc and 0.25% magnesium stearate had less cracked edges compared to tablets lubricated with 0.5% magnesium stearate. The open and closed container tablets showed a decrease in mean weight of about 2.5% while Altalc 400 and Altalc 300 lubricated tablets showed a decrease in weight of 2.0% and 1.4% respectively. The hardness values remained unchanged compared to their initial values at the start of the physical stability test. The disintegration time values for talc and magnesium stearate only lubricated tablets was 25 seconds.

The relationship between lubricant efficiency and effects of lubricants on tablet hardness has yet to be fully delineated. In case of magnesium stearate as the tablet lubricant, the decrease in tablet hardness correlates with the increase in disintegration time (16,20) because the hydrophobicity decreases the contact angle of water with capillary pore in the tablet (22).

Levy and Gumtow found that magnesium stearate retarded the dissolution rate of salicylic acid, and that the presence of starch as disintegrant did not improve the dissolution from tablets lubricated with magnesium stearate (23). Similarly, a prolonged mixing of magnesium stearate in a formulation, decreased the dissolution rate of salicylic acid (20). The dissolution rate of salicylic acid and aspirin decreased somewhat exponentially with increase in magnesium stearate concentration but the presence of talc had no effect on dissolution rate (24).

CONCLUSIONS

The data from the literature and the present study clearly indicate that talc has excellent glidant properties and is likely to be of great value in remedying any powder flow problem. Quite low concentrations of talc have a very substantial effect on powder flow. Although the lubricant efficiency of talc (as quantified by ejection forces) is less than equal weights of magnesium stearate, talc by itself or in combination with magnesium stearate has considerable potential as a lubricant.

Tablets made with talc as a lubricant have a significantly better appearance and hardness than comparable tablets containing magnesium stearate. For some drugs at least the dissolution rate of talc lubricated tablets is superior to those lubricated by magnesium stearate alone. Different sources of talc show significant differences in glidant and lubricant efficiency.

In summary, the talcs studied in this investigation clearly merit careful consideration as pharmaceutical adjuvants. For hydrochlorothiazide, often regarded as the classic example of a drug liable to biological availability problems, tablets lubricated by talc have improved dissolution compared to similar tablets lubricated by magnesium stearate above. Additionally, for some systems talc can improve hardness, friability and appearance. It is noteworthy that different sources of talc show significant variation in their effect on tablet properties. Thus, companies using talc for pharmaceutical purposes should give attention to uniformity of the quality of the material which they use.

Work on the pharmaceutical uses of talc is continuing in this laboratory and will be published in due course.

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