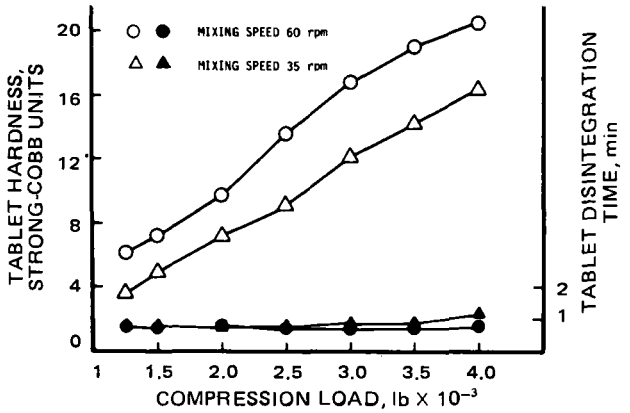

Figure 2—*Tablet hardness–compression load profiles and corresponding disintegration times. Mixing time was 5 min. Key: ○ and △, tablet hardness; and ● and ▲, tablet disintegration time.*

and after attrition is given in Table II. These results indicate no significant differences in the granulation size before and after attrition. Figure 1 gives the results of the tablet hardness–compression load profiles. The compressibility of the three granulations was essentially the same. These data indicate that when the three formulations were mixed for 10 min instead of for 5 min (1), the dilution factor effects on granule hardness and compressibility disappeared. A similar degree of wetting in the powders was reached by adequate mixing, which resulted in no differences in hardness, friability, and compressibility of the dried granules prepared from thick and thin starch pastes. Thus, we have shown clearly that the dilution factor effects on hardness, friability, and compressibility of granules are a consequence of improper mixing during the wet granulation procedure.

Figure 2 also gives the average disintegration times as a function of the compression load for the three formulations given in Table I. At lower compression forces, the differences in the disintegration times of the three formulations are slight and do not appear to follow any definite trend relating to the viscosity of the starch paste. However, at higher compression loads, the differences in the disintegration time might be significant and thus relate to a slightly longer disintegration time for tablets made with thin starch paste compared to thick starch paste.

In the conventional wet granulation procedure, the speed of mixing generally determines the mixing time. The results in Fig. 2 show the effect of mixing speed at a constant mixing time on the tablet hardness–compression load profiles from tablets prepared using Formulation C. The harder tablets at the 60-rpm mixing speed are in agreement with the smaller percentage of fines formed after attrition. The tablet disintegration time was not affected by the change in mixing speed at a constant mixing time.

(1) P. M. Hill, *J. Pharm. Sci.*, **65**, 313(1976).

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Starch Paste Granulations: Factors Causing Binder Dilution Effects on Granulations and Tablets — A Response

Keyphrases□ Starch paste granulations—effect of starch paste viscosity on granule hardness and physical properties of tablets □ Granulations, starch paste—effect of starch paste viscosity on granule hardness and physical properties of tablets □ Dosage forms—tablets, effect of starch paste viscosity on granule hardness and physical properties of tablets

To the Editor:

Granulation mixing time is an important variable, of course. That fact is recognized by often specifying maximum mixing times for the manufacture of granulations. However, the purpose of my communication was to show the unexpected effect of starch paste viscosity on the hardness of the resulting granules. This effect is of interest because the same total amount of water was used in each experiment and it would not be immediately apparent that the paste viscosity would affect the rate of wetting under this circumstance.

A 5-min mixing time was used because the mass appeared to be maximally wet in that time. This is usually the case in the production setting for products made today. The granulating operator has the flexibility to mix until the mass appears granular. It would not be feasible to place a finite limit on mixing time because the actual time required often varies with some physical aspect of the powders such as moisture content, particle size, or shape. The paste dilution study lends support, in fact, to Chowhan and Palagyi's statement that: "Careful evaluations should be carried out for any changes in the process, such as dilution of the binder solution, ..."

The authors also stated that the dilution factor effects disappeared when the three formulations were mixed for 10 min instead of 5 min. This is not entirely true. Even though they showed that the effect on compressibility disappears as shown by similar hardness–pressure profiles, some effect is still reflected in increasing tablet disintegration times. Admittedly, the changes are small and would not be expected to affect tablet acceptability unless a product had a very short disintegration time limit.

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