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COMMUNICATIONS

Effect of dehydration on the binding capacity of particulate hydrates

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The binding capacities of α-D-glucose dehydrated at temperatures from 60–135 °C increased with increasing temperature of dehydration.

In an earlier publication (Lerk et al 1983) it has been reported that the binding properties of α-lactose monohydrate increase with increasing thermal or chemical dehydration of the solid. Continued research proved the phenomenon to be shown by other hydrates, like dextrose monohydrate, citric acid monohydrate, calcium sulphate dihydrate, calcium monohydrogen dihydrate and calcium biphosphate hydrate. This is shown for dextrose monohydrate herein.

Sieve fractions of 75–105 μm of α-D glucose (Merck art. 8342) were fully dehydrated at different temperatures, ranging from 60–135 °C. The treated powder samples were compressed, after cooling to room temperature (22 °C), into 500 mg tablets, having a diameter of 13 mm by means of an hydraulic press, and increasing the force over 10 s to 25 kN, keeping the pressure constant for 0·1 s, and decreasing the force again within 10 s. The compacts (n = 30) were tested for crushing strength with a Schleuniger Hardness Tester, 2E.

Compared to a crushing strength of almost zero, for the tablets compressed from non-treated α-D glucose monohydrate, the fully dehydrated samples all showed a strongly increased binding capacity (Fig. 1). Moreover, the crushing strength of the tablets was found to increase with increasing temperature of dehydration of the powder. This last observation points to a change in texture of the particles during treatment. This was visualized by scanning electron microscopy. The micrographs, reproduced in Fig. 2, show the conversion of whole crystals of α-D glucose monohydrate (a) into fully dehydrated porous particles with still the original geometry (b) (5 h, 85 °C) and particles with a complete different texture (c) (0·5 h, 135 °C), respectively.

In conclusion, the results endorse the phenomenon of changing binding properties of hydrates by thermal or chemical dehydration, as earlier reported for α-lactose monohydrate. It may be expected that this phenomenon will also occur at the desolvation of solvates.

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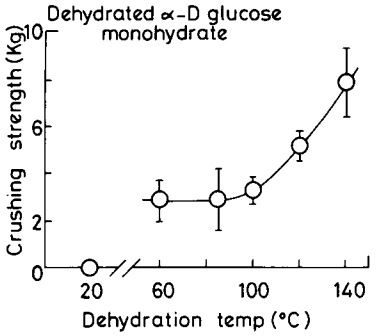

FIG. 1. Crushing strength of tablets, compressed from fully dehydrated α-D glucose monohydrate, treated at different temperatures.

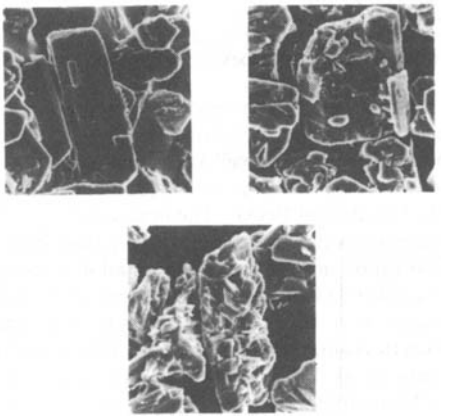

FIG. 2. Scanning electron micrographs of α-D glucose monohydrate (a), and of fully dehydrated α-D glucose monohydrate, treated for 5 h at 85 °C (b), and for 30 min at 135 °C (c), respectively.

REFERENCE

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