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Preparation and Surface Properties of Encapsulated Powder Pharmaceuticals

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ABSTRACT

During the blending of two powders in a mixer, the preferential adhesion and sticking of fine powders onto other large powder surfaces were usually observed. These frictional charging and physical adhesiveness properties can be used to modify and encapsulate the surfaces of solids. In the present study, a centrifugal rotating-type mixer was used to study the possible wax encapsulation process in binary (drug–potato starch) ordered powder mixes. The results indicate the expected trend of wax encapsulating efficiency as the continuous and homogeneous adhesions of the fine drug particles on potato starch surfaces increases. The wax encapsulated products offer a better controlled release property for drugs compared to that of the ordered drug–potato starch mixture.

Index Entries: Encapsulated powder pharmaceuticals; powders, encapsulated pharmaceutical; pharmaceuticals, encapsulated powder; surface properties, of encapsulated powder pharmaceuticals.

INTRODUCTION

In the preparation of granules and tablets, the blending of pharmaceutical solids and excipients or disintegrators is simply operated with

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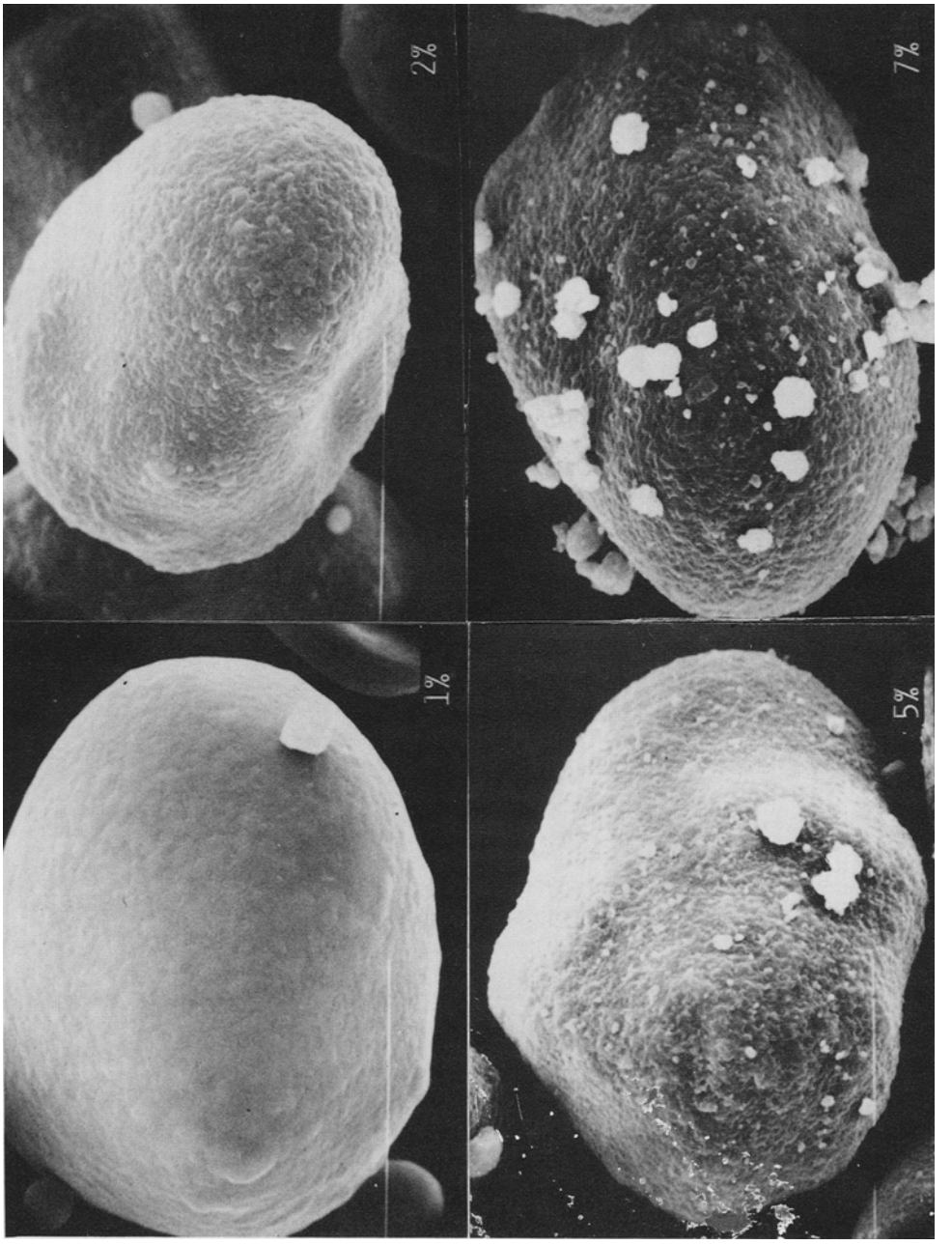

Fig. 1. SEM photographs of isoproterenol HCl coated potato starch.

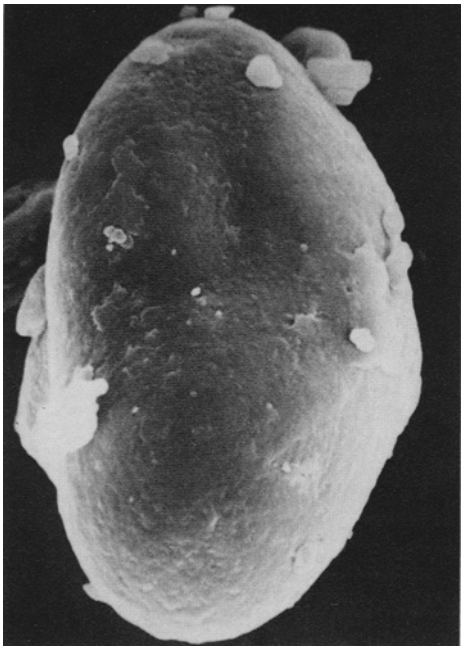

Fig. 2. Carnauba wax microcapsule.

such equipment as a planetary mixer or an automatic mortar. However, the conditions of ordered powder mixing, such as the degree of blending and the blendability of powders, plays an important role in determining the physical and mechanical properties of granules and tablets after their preparation.

More generally speaking, in the manufacture of solid dosage forms, the preferential adhesion and sticking of the powders onto the surfaces of other powders were observed in some cases to result from electrostatic charging, sticking, or friction of fine cohesive powders during blending. These frictional charging and physical adhesiveness properties can be used to prepare the mechanically ordered mixtures or to modify and encapsulate the surface of drug solids. The present study deals with the possible microencapsulation of drug powders or drug coated-core powders when blending powder/powder systems, for example, the combinations of (a) such wall substances as magnesium stearate, glyceryl monostearate, carnauba wax, and (b) such core substances as isoproterenol HCl for an asthma, acetylsalicylic acid as an anodyne, and drug coated-potato starch (150–250 mesh).

EXPERIMENTAL

A centrifugal rotating-type mixer was used for the comparisons of encapsulating efficiency. The speed and mixing time were 100–950 rpm

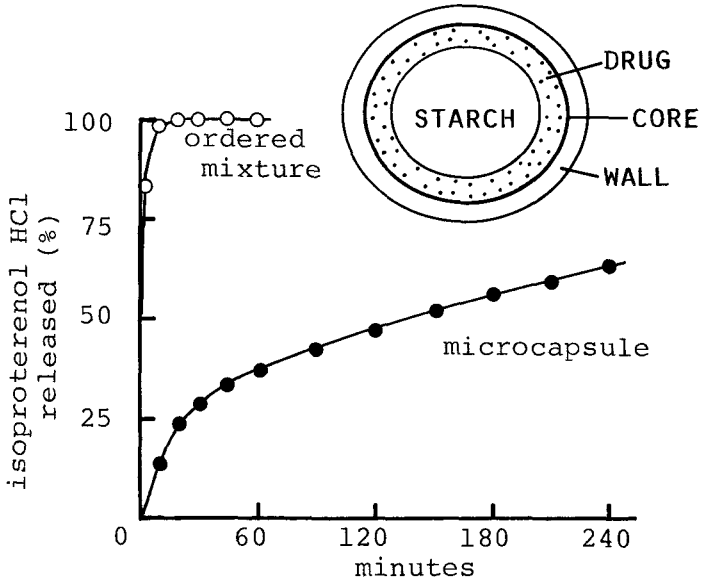

Fig. 3. Release of isoproterenol HCl.

and 20–100 min. In the present study, 40 g of potato starch was mixed with given drug powders. Figure 1 shows the typical SEM photographs of batch mixing 1, 2, 5, or 7% (w/w) isoproterenol HCl and potato starch. Thus, the mixer was suitable for producing an acceptable state (modification or coating in other words) of the continuous and homogeneous adhesions of the drug particles on the surface of starch. The drug particles appeared to form the most stable ordered coating within 5% (w/w) and most of the ordered particles were tightly bound by strong adhesion forces. Large aggregate parts of weakly held drug particles may be detachable by very low separation forces such as those applied by vibration. Figure 2 shows the typical SEM photograph of 10% (w/w) carnauba wax-encapsulated microcapsule containing 5% (w/w) isoproterenol HCl coated-potato starch particle. In this photograph, the wall material is surrounding a 70 μm diameter core particle. The coating on particle appears to be thick and uniform, confirming the belief that encapsulation of particles takes place by mutual aggregation and their melting of many wax particles around the core particle.

The in vitro release from hard capsules containing isoproterenol microcapsules was studied using 720 mg of microcapsules containing 32 mg of drugs. Figure 3 shows the effect of mixing techniques on the comparative release of isoproterenol HCl in 0.1 HCl (JP X, paddle method, 100 rpm, 37°C).