MICROCAPSULE DRUG DELIVERY SYSTEMS

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INTRODUCTION

Microencapsulation, a new and rapidly expanding technology pioneered by the NCR Corporation, is receiving considerable attention both industrially and academically. Microencapsulation is a process designed to reproducibly apply thin polymeric coatings to small particles of solids, droplets of liquid (pure or solutions), or dispersions. For the purposes of this discussion, microencapsulation will be arbitrarily differentiated from macro-coating techniques in that the former involves the coating of particles ranging dimensionally from several tenths of a micron to 5,000 microns in size. A unique feature of this micropackaging technique is in the minuteness of the coated particles and their subsequent potential usefulness in handling physiologically active materials in a variety of dose forms.

A number of microencapsulation processes are described in the literature, and these have been referred to as mechanical, electrostatic or vacuum deposition and polymerization. The processes which will be reviewed in this paper are primarily those utilizing phase separation or coacervation techniques.

DESCRIPTION OF PROCESSES

A general outline of the batch type processes consists of a series of three steps carried out under continuous agitation. The
1. ESTABLISHMENT OF THREE-PHASE SYSTEM

2. DEPOSITION OF LIQUID-POLYMER COATING MATERIAL

3. SOLIDIFICATION OF COATING MATERIAL

FIGURE 1. Schematic of process.

three process steps are schematically illustrated in Figure 1.

Step One of the process is the formation of three immiscible chemical phases: a liquid manufacturing vehicle phase, a core material phase, and a coating material phase. Step Two of the process consists of depositing the liquid polymer coating around the core material. This is accomplished by controlled, physical mixing of the coating material (while liquid) and the core material in the manufacturing vehicle. Deposition of the liquid polymer coating around the core material occurs if the polymer is sorbed at the interface formed between the core material and the liquid vehicle phase. This sorption phenomenon is a prerequisite to effective coating. The continued deposition of the coating is promoted by a reduction in the total free interfacial energy of the system brought about by a decrease of the coating material surface area during coalescence of the liquid polymer droplets. Step Three of the process involves rigidizing the coating, usually by thermal, cross-linking, or desolvation techniques, to form a self-sustaining entity, i.e., a microcapsule.