Surface characteristics of gelatin microcapsules by scanning electron microscopy

Scanning electron photomicrographs of microcapsules prepared by an interfacial condensation procedure have recently been published by Jenkins & Florence (1973). Microcapsules of mean diameter 3–4 μm apparently possessing pores of approximately 100 nm diameter are shown. Occasional splits in the capsule wall are visible which the authors suggest could be caused during the preparative technique for microscopy although the possibility that the splits may be present initially has not been ruled out.

We have used a scanning electron microscope (Jeol Model JSM-50A) to prepare photomicrographs of gelatin microcapsules made by the simple alcohol-gelatin coacervation procedure of Nixon & Walker (1971). The method has been modified to include the hardening stage after the first cold isopropanol wash and by the adoption

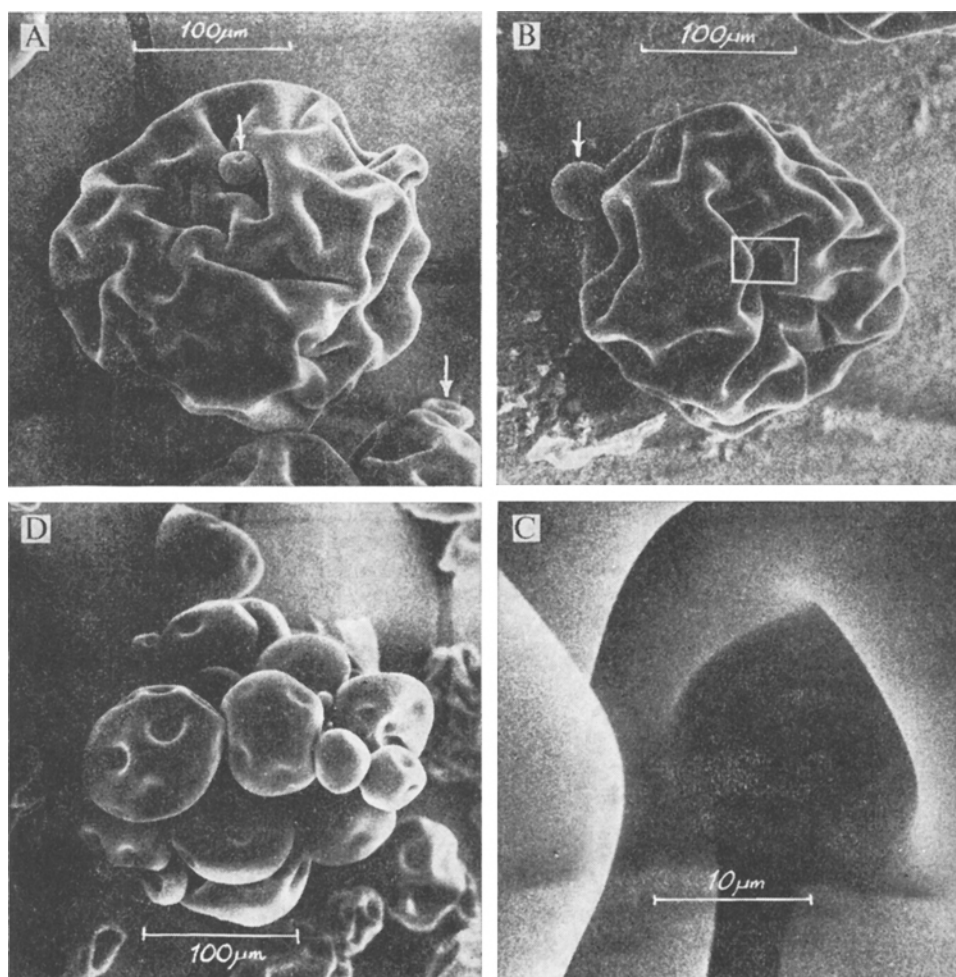

FIG. 1. A & B. Scanning electron photomicrograph of gelatine-coacervate microcapsule prepared by the method of Nixon and Walker (modified as in the text). C. Enlargement of marked section of B. D. Pro-microcapsule spheroid cluster in a late state of fusion (supporting the theory of coacervate microcapsule formation put forward by Walker, 1972). See text.

of a 30 min hardening time as a standard procedure. The inclusion was a solid sulphonamide-type diuretic.

The gelatin microcapsules were much larger (100–500 μm) than the nylon microcapsules prepared by Jenkins & Florence (about 3 μm) and photomicrographs of them have been published previously (Walker, 1972; Nixon, 1973). We now give more details of their surface characteristics.

Capsules produced by simple alcohol coacervation possessed characteristically folded and invaginated surfaces. This surface structure has been seen in both water-mounted specimens (by light microscopy, unpublished) and in those prepared for the scanning electron microscope indicating that it is due to the initial production procedure and not artifactual. Fig. 1A and B show typical specimens. The folding and invagination is marked. However, there is no evidence of cracking of the coating. Fig. 1C, which is a magnification from the marked portion of Fig. 1B, also shows no evidence of cracking. The folds can be seen as smooth transitions rather than sharp discontinuities such as would result from cracks. At this magnification it would be expected that any pores present would be visible, but none were seen.

If the surface characteristics of the microcapsules represented cracks, rapid release of the inclusion would be expected and crystals in the interior of the microcapsule would be visible. We found release of the inclusion to take place over about 30 min and to be adequately described by a percentage release versus log time plot which further supports the absence of fissures.

That we found no pores as seen by Jenkins and Florence may well be due to the differences in materials used but there is a possibility that their method of drying (vacuum/phosphorus pentoxide), being much more extreme than the cold isopropanol and ethanol we used, may have caused the appearance of pores.

The large microcapsules in Fig. 1A and B are accompanied by small spheroids (marked by arrows). Their presence together with 1D could be adduced as evidence for the theory that coacervate microcapsules form initially by conglomeration of smaller coacervate droplets (Walker, 1972).

One of us (B.R.M.) is in receipt of a Pharmaceutical Society of Great Britain Scholarship. This work forms part of a thesis to be submitted to the University of London in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy.

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