

# Encapsulation of hydrophobic ingredients in gelatin-based microcapsules by complex coacervation

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Microencapsulation is the enclosure of active ingredients in microparticles in order to obtain controlled release characteristics, improve stability during processing and storage, separate incompatible ingredients, improve handling, or reduce exposure of toxic active ingredients. A wide range of materials and technologies are available for microencapsulation purposes. This paper deals with the encapsulation of hydrophobic ingredients in gelatin-based microcapsules by complex coacervation.

Coacervation is the separation of an aqueous polymeric solution into two miscible liquid phases: a dense coacervate phase and a dilute equilibrium phase. Complex coacervation can result spontaneously on mixing oppositely charged polyelectrolytes in aqueous media, such as gelatin and polyphosphate. The charges must be sufficiently large to induce interaction, but not large enough to cause precipitation. With this technique, microcapsules are prepared with zero-order release characteristics. Triggered release can be obtained by increased pressure, and slow release via diffusion and/or degradation of the gelatin wall.

In this study, a solid hydrophobic active ingredient with a very low water-solubility was encapsulated in gelatin-based microcapsules. Various processing conditions were varied, such as ratio gelatin:oil, crosslinker concentration, volume of the water phase, energy input, and type of oil used to dissolve or disperse the active ingredient. It was shown that particle size and morphology of the capsules could be manipulated in relation to the processing conditions. Particle sizes ranged from small (10-40  $\mu\text{m}$ ) to large (500-750  $\mu\text{m}$ ) microcapsules. In addition, release of the active ingredient was adjusted by changing microcapsule properties like particle size, thickness- and crosslink density of the gelatin wall, and location and distribution of the active ingredient in the microcapsules.

From this study it was concluded that complex coacervation is a versatile technology for microencapsulation of lipophilic ingredients (solid or liquid) in protein-based microcapsules.