**Microencapsulation of ginger oil by complex coacervation in batch stirring and atomization: effects of the concentration of wall material.**

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Complex coacervation (CC) is one of the main microencapsulation techniques, where polymers with opposite charge attract themselves, repel the solvent and consequently precipitate. There are few studies seeking to perform the CC technique on a continuous basis, which would allow a more sustainable process. This work presents the comparison of the traditional CC method in batch stirring with a new method. In this new method the CC process occurs by atomizing the ginger oil/gelatin on a solution of gum Arabic. The objective was to evaluate the effects of the wall material/oil ratio on the efficiency of the two CC methods and on the morphology of the microcapsules produced.

For CC through atomization, emulsions of ginger oil (1:1 of ginger oil to gelatin in dry mass) produced by ultrasonic homogenization (3 min, 210 W, 20 Hz) in aqueous solution of gelatin (1 to 10 g / 100 g, pH 3.5, 50 oC) were atomized using a double-fluid atomizer nozzle (air flow of 3.60×10-5 m³/s and emulsion flow rate of 2.45×10-7 m3/s) onto a vessel containing aqueous solution of gum Arabic (1 g / 100 g, pH 3.5, 50 °C). After atomization, the dispersion was cooled to 10 °C for curing and sedimentation.

In the traditional batch stirring method, the same emulsion was added to the gum Arabic solution under magnetic stirring, followed by adjusting the pH to 3.5 and cooling to 10 °C. Then, the samples were frozen and lyophilized for the following analyses: encapsulation efficiency (EE) [EE=100×(OT-OS)/OT] and oil retention (RO) [RO = 100×OT/OI], being OT=capsule total oil, OS=oil on capsule surface, OI=oil in the initial emulsion; Fourier transform infrared spectrometry (FTIR); scanning electron microscopy (SEM).

The EE values ​​ranged from 89.74 to 98.7%, and there were no significant differences between samples produced by the traditional method and by atomization. On the other hand, RO increased significantly when CC was performed by atomization compared to the batch stirring process, ranging from 21.5 to 88.7%. FTIR analyses accounted for the presence of characteristic peaks of amide groups in both processes, which indicates that the CC process occurred in an effective way1 in both methods. The micrographs obtained by SEM show capsules with smooth surfaces and with a porous matrix. Therefore, it is concluded that the technique proposed of CC through atomization is able to produce microcapsules equal or better than those formed by the traditional batch stirring method.

*References:*

1 Shaddel, R., Hesari, J., Azadmard-Damirchi, S., Hamishehkar, H., Fathi-Achachlouei, B., & Huang, Q. (2018). Use of gelatin and gum Arabic for encapsulation of black raspberry anthocyanins by complex coacervation. *International journal of biological macromolecules*, *107*, 1800-1810.