**Optimization of membrane emulsification parameters and polymer ratio/pH for microencapsulation through Complex Coacervation**

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The choice of the homogenization method in emulsification process may affect parameters such as stability, volume fraction, droplet’s size distribution and average diameter. This becomes even more important if a shear sensitive compound should be emulsified. Having an appropriate emulsion and proper polymer ratio (gelatin - GE and Arabic gum - GA) are vital steps to obtain complex coacervated capsules able to properly protect its core material during microencapsulation processes. In this sense this work combines: membrane emulsification (a low energy process with predictable droplet size as a function of shear applied1 – alternative to classic homogenisation) and complex coacervation (CC) between gelatin and Arabic to create microcapsules with controllable average diameter (*Dav*) and liquid oil core. Dispersion Cell (DC) was used to create the emulsions. The DC uses a metal disk membrane with straight through pores (pore diameter: 25 µm; distance between the pores: 250 µm). Shear above the membrane in DC is generate using an impeller (540 – 2300 RPM) and applying different shear using the same injection rate it is possible to generate droplets of different size. As a continuous phase 100 ml of 2% Tween 20 was used. The sunflower oil (dispersed phase) was injected (1–10 mL min-1) into the DC using a syringe pump forcing it to pass through the membrane pores. The final oil concentration on the emulsion was 5 % in volume concentration. Once the emulsification was completed the emulsion was transferred to a beaker and analysed. The diameter of the emulsion droplets was determined using the software Image Pro-Plus 6.0 on microphotographs of the emulsions, and at least 300 drops per sample were measured in triplicate. The droplet size was reported as mean average diameter (*Dav*) and the size distribution as Coefficient of Variation [*CV=(SD/AV)×100, where SD stands for the standard deviation and AV for the average of the diameter measurements*]. A model determined by Kosvintsev et. al. (2005)1 was used to determine the theoretical droplet diameter (*D*). To optimize the CC conditions, polymer ratio (1:1, 1:4, 2:1, as GA:GE) and pH (2,5 to 5,5) were varied having the turbidity at 600 nm2 as reference for process efficiency. For the polymer ratio of 2:1 the optimum pH was 3.5 and for the rations 1:1 and 1:4 the optimum pH was 4.5. Considering that the core material is emulsified in protein solution, the authors adopted the optimum condition as ratio of 1:4 and pH of 4.5, to maximize the load of core material during microencapsulation process.

Droplet size (*Dav*) varied between 50 and 200 µm. *Dav* decreased with the increase of the rotation speed of the stirrer while *Dav* when the rotation speed was kept constant increased with the increase of the Sunflower oil flow. 3 replicates for each test were performed and no sample presented a coefficient of variation higher than 30 %, indicating that the process is robust in replicating the droplet sizes.

*References:*

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2 Lv, Y., Yang, F., Li, X., Zhang, X., & Abbas, S. (2014). Formation of heat-resistant nanocapsules of jasmine essential oil via gelatin/gum arabic based complex coacervation. *Food Hydrocolloids*, *35*, 305-314.