Microcapsule fabrication by membrane emulsification

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Batch emulsification is a classic method to fabricate suspensions of microcapsules. However, size distribution and elasticity of microcapsules vary on several orders of magnitudes [1]. On the other side, microfluidic droplet generators allow a precise control of the size and mechanical properties on microcapsules [2], but the rate of production is very low. Membrane emulsification is a mean to fabricate an emulsion, or a dispersion of an aqueous (or oil) phase in an oil (or aqueous) phase [3]. This method overcomes the difficulties like inhomogeneous size distribution and mass production that the other methods face with them [4]. The objective of this study is to develop a method of membrane emulsification for the production of uniform microcapsules.

A membrane emulsification was performed to produce self-assembled microcapsules by emulsification of 0.25% (w/w) solution of chitosan in rapeseed oil with surfactant. The aqueous phase was introduced inside the oil phase through a flat disc membrane, which is positioned under a paddle stirrer, which provides detachment mechanism of droplets. The membranes have ring regular arrays of pores of 5, 10 and 20 microns diameter and 200 micros spacing between the pores. They are made by stainless steel and treated by a hydrophobic coating process in order to generate water to oil emulsion.

We show that membrane emulsification is a versatile and efficient method to produce suspensions of microcapsules whose the average diameter can be varied according to the process parameters (membrane, flow rates, agitation). This method can be optimized to get suspensions with size variation of less than 15%.

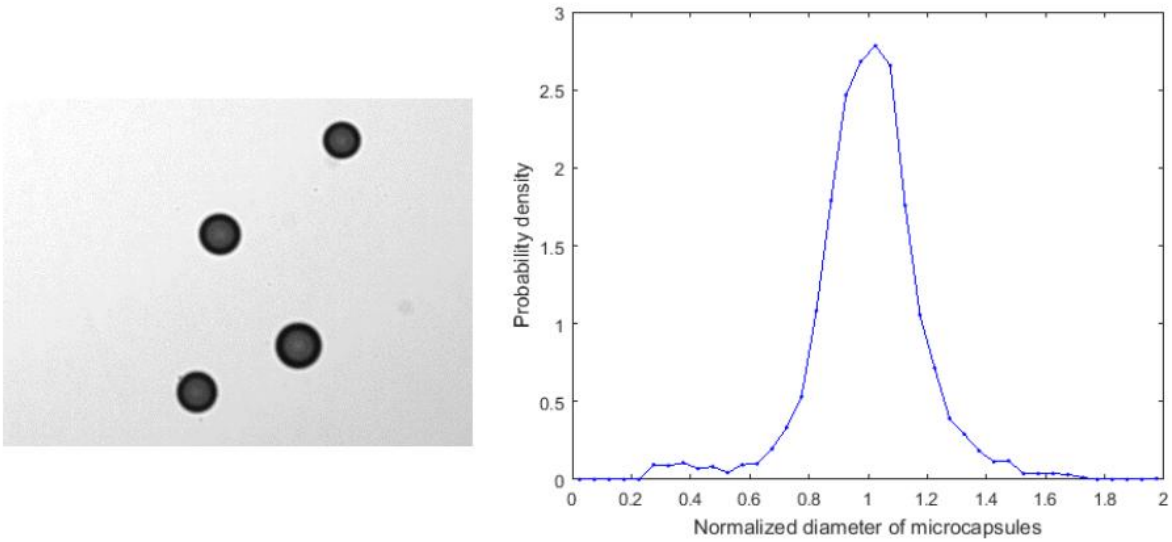

Figure 1: Microcapsules and the optimal probability density of size.

References

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