Encapsulation of probiotics by water-in-oil membrane emulsification and gelification

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The market for functional foods containing probiotics and bioactive compounds has experienced significant growth in recent years. Health promotion is the main factor contributing to this market. However, viable microorganisms should reach the intestine for effective probiotic activity. Microencapsulation is an alternative to increase microorganism resistance to the product processing and formulation conditions, as well as the migration through the digestive system. Membrane emulsification seems to be an attractive alternative to conventional encapsulation techniques since the pore size of the membrane or filter can control the final size of the microcapsules in addition to the milder process conditions that contribute to the maintenance of bacterial viability. In this study we evaluate the membrane emulsification technique's potential in producing probiotic microcapsules, using different proteins as wall material. Sodium alginate (ALG) and whey protein (WPI), rice protein (RPC), or pea protein (PPC) were tested as encapsulating materials. Encapsulation strategies were based on internal and external gelification. Operating pressure, volume, stirring rate, and polymer concentration were investigated. Emulsions and dried microcapsules were characterized using dynamic laser scattering, optical, and scanning electron microscopy. The best conditions to produce the microcapsules were tested for encapsulation of *Lacticaseibacillus rhamnosus* GG®. The microcapsule diameter varied from 18 to 29 ?m and encapsulation yields of around93 % could be obtained. The combination of alginate and whey protein, rice protein, or pea protein improved encapsulation efficiency, resulting in high probiotic viability after simulated gastrointestinal conditions (> 7.18 log CFU g^{-1}).