Polymeric microparticle synthesis as advanced materials in biomedical applications

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Chronic Obstructive Pulmonary Disease (COPD) is a disease that affects human lungs due to narrowing of the airways and destruction of lung tissue. Methods of treating the disease vary, depending on its stage, including oxygen therapy and drug administration. Drugs with a particle size >10 μm cannot reach the lungs due to collisions with the walls in the nasopharyngeal area, with the associated mechanisms still remaining elusive.[1,2] Poised to provide solutions to the problem, research was launched in our lab to design and synthesize biodegradable and bioavailable microparticles with a size range of 2-5 μm.

In recent years, numerous studies have been conducted with biodegradable polymers, such as PCL, PLA, PLGA and natural polysaccharides, like chitosan.[3,4] Polymeric microcapsules are used extensively for raising the bioavailability of an administered drug. Specifically, PCL is a biodegradable polyester that decomposes gradually in water, providing a sustainable and controlled release. The structure and solubility resistance of PCL offer protection of the pharmaceutical agent until its release. In order to form the desired microparticles, oil in water (O/W) emulsions are produced using a series of stabilizers (Tween 80, Span 60 and whey protein isolate WPI). Dichloromethane is used for the preparation of the oil phase and ultrapure water as the aqueous phase. After continuous stirring, homogenization of the mixture, centrifugation, and drying of the supernatant, the desired microparticles are obtained.

The morphology and size distribution are studied using FT-IR, confocal microscopy and Mastersizer 3000. The FT-IR spectrum confirms the formation of PCL-emulsifier microparticles. Both particle size distribution measurements and particle observations under microscope show a size range of <5μm.

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