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Droplet microfluidics: A tool to prepare polymeric microcarriers with complex morphologies for new drug delivery strategies

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Microencapsulation is used for the protection of drug, controlled release, reduced administration frequency, patient comfort and compliance. In comparison with conventional techniques for encapsulation, microfluidics offers a new route to precisely control over microcarriers' size, shape, morphology, composition and thus release properties. Continuous flow off-the-shelves capillaries-based microfluidic droplet generators, assembled within minutes, were used to produce size-controlled and drug-loaded plain, core-shell, Janus and Trojan polymeric microcarriers. A single capillary-based device was employed to obtain either poly (ethyl acrylate) plain microparticles or poly (acrylamide) Trojan microparticles embedded with drug-loaded poly (ethyl acrylate) nanoparticles previously obtained from the nano emulsification of the monomer phase within an elongation flow micromixer. On the opposite, a two capillaries-based device was employed to prepare poly (acrylamide)/poly (methyl acrylate) core-shell and Janus microparticles from the emulsification into droplets of 2 immiscible monomer phases that were downstream polymerized by UV irradiation at 365 nm far away from maximum absorption wave length of drugs thus insuring their integrity. This lecture proposes to study the production and the release properties of these microcarriers as well as the subsequent new release strategies (e.g. sequential, synergetic, nanoparticle delivery to GIT etc.) arising from these uncommon morphologies. It will be demonstrated how operating parameters (fluids' flow rate, nature of the monomer, concentration of the surfactant etc.) can affect the size and the morphology of the polymeric microcarriers and how to tune the sustained release of a single API or 2 incompatible APIs encapsulated into a single microparticle.

Biography

Christophe A Serra is a Professor at the University of Strasbourg teaching at the European School of Chemistry, Polymers and Materials Science (ECPM). He has received his MS and PhD degrees in Chemical Engineering from the National Engineering School of the Chemical Industries (Nancy) and Paul Sabatier University (Toulouse), respectively. His researches concern the development of intensified and integrated microfluidic-assisted polymer processes for the synthesis of architecture-controlled polymers and functional micro structured polymer particles.

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