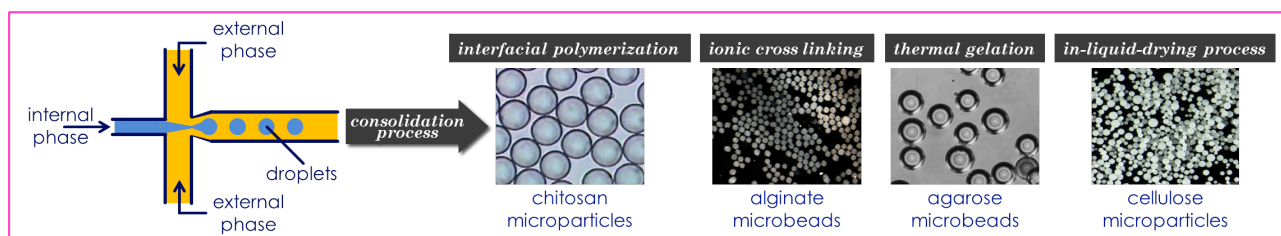


Highly Controlled Production of Micro and Nanoparticles by Microfluidics

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Microfluidics is a new emerging technological field dealing with the handling of fluids in micro/nano environments that has found applications for the miniaturization of many processes including chemical synthesis, biochemical assays, drug screening. Factors affecting the efficacy of micro and nanoparticles, which include size, size distribution, morphology, and porosity are all highly dependent on the method of preparation. In this respect, microfluidic based methods offer an unique strategy to fabricate highly uniform and morphologically controlled systems with tunable chemical and mechanical properties.



1. Description of the product

In the case of the production of microparticles, microfluidic strategies typically involve the initial formation of emulsions of droplets in an immiscible phase (i.e. a multiphase flow), followed by the consolidation of the droplets. Depending on the chemical structure of the internal phase, the liquid droplets can be hardened by different procedures including in liquid drying process, interfacial polymerization, ionic cross linking or thermal gelation. In addition, the multiphase flow, achieved into microfluidic systems, allows to accomplish the mixing of organic solvent and water in a defined robust manner, by a rapid and adjustable process owing to the specific characteristics of the microfluidic environment.

Since the droplets into the microchannels are monodisperse and the size of droplets can be controlled by flow rate ratio, microparticles of any size can be virtually obtained. Microcapsules, microparticles or scaffold with different shapes, such as disk-shape particles, can be generated by the droplet consolidation in a confined geometry inside the channel.

2. Innovative aspect of the product

With respect to the strategies for the production of micro and nano particles, conventional techniques such as spray drying, spray cooling, extrusion, fluidized bed, coacervation or emulsification present some limitations. These processes usually involve some harsh operation conditions such as the use of high pressure or temperature, or organic solvent, which could in turn damage the encapsulated drugs or cause contamination. Moreover, all the aforementioned fabrication methods can lack of reproducibility in macro-scale environments and they are prone to the production of large and polydispersed microparticles, often characterized by an irregular surface. Microfluidics indeed overcome these drawbacks and provides a new route to produce micro and nano particles encapsulating drugs in a highly reproducible way.

3. Main advantages of the offer

Conversely to conventional methods, microfluidic chips continuously generate micro and nanoparticles with control over the morphology and shape. Moreover, manipulating the relative flow rates of the two fluids, the precise control of droplet size can be achieved.



4. Technology key words

Microfluidics, liposomes, polymeric micelles, antiviral drugs, antitumor drugs, quantum dots

5. Current Stage of Development

Work in advanced state – Formulations were tested at different levels including, in vitro and ex vivo.

6. Intellectual Property Rights

Some examples of microparticles are covered by patent and available for licensing.

Technical and scientific publications

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