BIO-APPLICATION OF POLYMERIC SPHERES USING MICROFLUIDIC

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In the last decade polymeric microspheres have played a progressively widely role in the bio-medicine field. The countless advantages linked to the use of these micromaterials, like the small diameter, large surface area, easily administration have determined their successful application in drug delivery, tissue-engineering and bio-imaging[1]. Microspheres are spherical particles of micron size with a diameter in the range of 1-1000 µm, which can be obtained from various type of natural and synthetic materials like polymeric matrices. Inside this context, particular interest could be directed towards a novel microfluidic approach for the preparation of polymeric microspheres. The microspheres were produced through a fast and easy technique involving an infusion pump, commonly used in the intravenously administration of drugs. For the preparation, a chloroform solution of an epoxy-dodecylamine polymer[2] was drop-casted through a syringe from the infusion pump onto a stirred PVA water solution (Figure 1, left). The fall of water-insoluble drops of chloroform determined the formation of microspheres once the surface of the aqueous solution was touched. By changing the pump's flux and the distance between the needle and the water surface it was possible to control the size distribution of the spheres, which was usually between 10-80 µm (Figure 1, right). One of the main advantages of this protocol is the possibility to readily modify the surface and the inner content of the spheres by dispersing additives, small molecules or carbon nanostructures in the polymer or in the water solution, respectively. For instance, by covering the spheres with carbon nanotubes or graphene oxide sheets it could be possible to exploit some of their properties, like photothermal effect and electrical conductivity in cancer therapy and tissue regeneration[3]. Finally, the combination of polymeric microspheres and various nanostructures via microfluidic technique could open novel and interesting possibilities for bio-medicine applications.

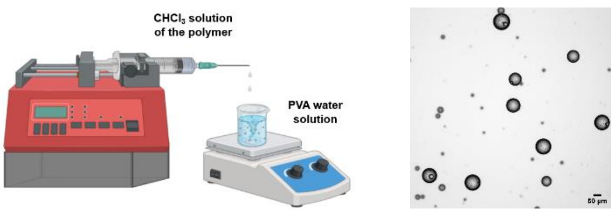

Figure 1. Scheme of the microfluidic procedure (left), TOM images of polymeric microspheres (right).

Key words: *microspheres, epoxy, microfluidic, carbon nanostructures, drug delivery.*

REFERENCES

[1] H. Kazi M. Zakir et al., "Development of microspheres for biomedical applications: a review", Prog. Biomater., vol. 4, pp. 1-19, 2015.
[2] J. Puig et al., "Epoxy Networks with Physical Cross-Links Produced by Tail-to-Tail Associations of Alkyl Chains", Macromolecules, vol. 42, pp. 9344–9350, 2009.
[3] M. Maleki et al., "Graphene oxide: A promising material for regenerative medicine and tissue engineering", BioMol Concepts, vol. 11, pp. 182-200, 2020.