HIGHLY POROUS BEADS VIA THIOL-ENE PHOTOPOLYMERISATION FROM MULTIPLE EMULSION PRECURSORS

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Emulsion templating is a versatile method that enables the preparation of highly porous polymers with tunable properties. The basis of emulsion templating is the formation of high internal phase emulsions (HIPEs) which have an internal phase volume of at least 74.05%[1]. These HIPEs were used as a template for the formation of highly porous beads through the formation of a multiple emulsion[2]. The HIPE was comprised of an organic phase (acrylate, multifunctional thiol, surfactant and photoinitiator) and an aqueous phase ($CaCl_2$) with a volume fraction of 80%. Subsequently another aqueous phase consisting of dissolved polyvinylpyrrolidone (PVP) was added to the HIPE to form a water-in-oil-in-water (w/o/w) multiple emulsion. To initiate the photopolymerisation the mixture was illuminated with blue LED light (455-460 nm) and left to polymerise for approximately 2 hours. The produced beads had an average diameter between 400 and 500 µm (depending on the acrylate to thiol ratio). Additionally, the beads had a highly porous and interconnected structure on both the surface and the inner parts.

This is the first time LED light was used for the production of polyHIPE beads using suspension polymerisation. Unlike thermally initiated suspension polymerisation, it produces spherical structures without any observable irregularities which are common in thermally initiated reactions, as heating destabilises emulsions[3].

[1] Pulko, I.; Krajnc, P. High Internal Phase Emulsion Templating - A Path To Hierarchically Porous Functional Polymers. *Macromol. Rapid Commun.* **2012**, *33*, 1731–1746, doi:10.1002/marc.201200393.

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[3] Freire, M.G.; Dias, A.M.A.; Coelho, M.A.Z.; Coutinho, J.A.P.; Marrucho, I.M. Aging mechanisms of perfluorocarbon emulsions using image analysis. *J. Colloid Interface Sci.* **2005**, *286*, 224–232, doi:10.1016/j.jcis.2004.12.036.