FUNCTIONAL NANOPARTICLES SYNTHESIZED VIA SURFACTANT-FREE DISPERSION POLYMERIZATIONS AS NOVEL POLYMERIZATION TECHNIQUE

Elrika Harmzen, Rueben Pfukwa and Bert Klumperman*

Stellenbosch University, Department of Chemistry and Polymer Science, Private Bag X1, Matieland 7602, South Africa
E-mail: bklump@sun.ac.za.

ABSTRACT

Polymeric nanoparticles (PNP) have drawn great interest in the last few years due to their potential applications, including in biomedical and optical technologies. It is still a challenge, however, to prepare PNPs with low size dispersities, reproducibly.[1] Most reported methods require expensive apparatuses, multi-step reactions and complex post-processing washing steps.[2,3] PNPs with reactive groups on the surface can be surface modified, forming functional PNPs (FPNP) with new physical, chemical or biological characteristics. FPNP, however, are much more difficult to prepare, it is very difficult to introduce functional groups and control the functionalization, and there are very few reports on this topic.[1] In these reports, inorganic materials are often utilized, however the resulting FPNPs often have a large size dispersity, require additional chemical treatment, and the colloidal and wetting properties are poorly characterized, therefore these FPNPs have a limited applicability in various field.[4]

This work presents a facile technique for preparing well-defined FPNPs, based on highly-crosslinked poly (styrene-maleic anhydride) (SMA) spherical nanoparticles, via a novel surfactant-free dispersion polymerization technique. Crosslinking is introduced by copolymerizing with divinylbenzene. These FPNPs have tunable surface functional groups which can be modified for various specific applications, including the stabilization of Pickering emulsions, the formation of Janus particles using Pickering emulsions as templates, and the encapsulation of live bacteria.[5]

References:

(1) He, J.; Chen, D.; Fan, X.; Wang, L.; Deng, J.; Yang, W. *Chin. Chem. Lett* **2013**, *24*, 970–974.
(2) Nagavarma, B. V. N.; Yadav, H. K. S.; Ayaz, A.; Vasudha, L. S.; Shivakumar, H. G. *Asian J Pharm Clin Res* **2012**, *5*, 16–23.
(3) Rao, J. P.; Geckeler, K. E. *Prog. Polym. Sci.* **2011**, *36*, 887–913.
(4) De Folter, J. W. J.; van Ruijven, M. W. M.; Velikov, K. P. *Soft Matter* **2012**, *8*, 6807–6815.
(5) Dai, L. L. In *The Delivery of Nanoparticles*; Dr. Abbass A. Hashim (Ed.), Ed.; INTECH Open Access Publisher, 2012; pp. 263–276.