Substance release kinetics of spherical and non-spherical hybrid nanoparticles generated by aerosol-photopolymerization

E. Akgün[1], M. Vranceanu[2], B. Sachweh[2], J. Hubbuch[1], M. Wörner[1]

[1]Process Engineering in Life Sciences, Karlsruhe Institute of Technology, Karlsruhe, 76131, Germany
[2]BASF SE, Ludwigshafen, 67056, Germany
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Presenting author email: ertan.akguen@kit.edu

Release of the absorbed or encapsulated material from polymeric environments in a controlled manner has extensive and emerging applications as, for example, self-healing coatings (Suryanarayana *et al*, 2010) and controlled release platforms in the pharmaceutical and medical fields (Pinto Reis *et al*, 2006). The main advantages of such nano – and microscale particles are storing and protecting the inner material from the environment and performing controlled and sustained release (Suryanarayana *et al*, 2010).

Romero-Cano and Vincent (2002) compared the controlled release kinetics from poly(lactic acid) nanoparticles with different morphologies. All of the morphologies were spherical, but the active ingredient to be released was at different locations within the spheres. In this contribution, we compare the release kinetics of spherical and non-spherical (nanocaps) nanoparticles.

In our previous contributions, aerosol-photopolymerization has already been shown to be suitable for the generation of differently structured polymeric and hybrid nanoparticles. Figure 1 illustrates such polymer particles not hybridized yet. This contribution deals with loading of the produced spherical nanoparticles and nanocaps with specific substances such as caffeine and comparing their release kinetics from nanopolymers with different structures. A power of this method is the possibility of loading the nanoparticles *in situ*. Apart from this, photoinitiation serves for fast initiation rates, contributing to increased overall polymerization rates. Fast kinetics is favoured due to the sub-minute average aerosol residence time in the process. Photoinitiation permits an operation at ambient temperature, minimizing monomer droplet evaporation before polymerization. The aerosol-based process results in a continuous hybrid particle generation process. In addition, the incorporation of surfactants, required for many liquid phase processes, may be avoided, leading to highly pure particulate products.

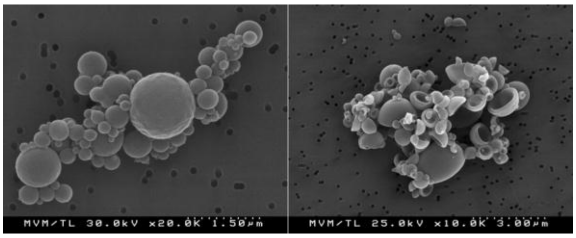

Figure 1. Spherical and non-spherical polymer nanoparticles generated by aerosol-photopolymerization.

The structure of the produced hybrid nanoparticles loaded with a specific substance was characterized by scanning electron microscopy. Transmission electron microscopy was also performed for further investigations on the hybrid character of particles before and after substance release.

The released amounts of caffeine from spherical nanopolymers and nanocaps were measured by HPLC. Figure 2 illustrates an exemplary comparison of the two particle types for low caffeine loadings of polymer particles.

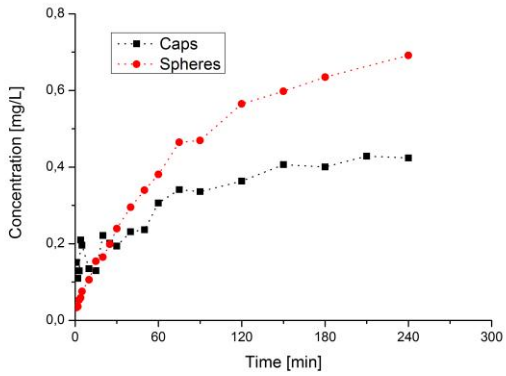

Figure 2. Caffeine release profiles from nanocaps and nanospheres produced by aerosol-photopolymerization.

Release profiles of higher concentrated hybrid particles and other material combinations will be illustrated as well.

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