Poster 13

Responsive Nanoparticles Based on Organic Polysulfide Structures

Giona Kilcher[a], Craig Duckham[b], Nicola Tirelli[a]

[a] School of Pharmacy and Molecular Materials Centre, University of Manchester, MI3 9PI Manchester (United Kingdom)
[b] Micap plc, WN5 8AA Wigan (United Kingdom)

Rendering colloidal objects responsive to environmental factors may allow their use as carriers for enhanced (targeted) delivery and imaging applications.

In this frame, our group has developed oxidation-sensitive objects, vesicles [1] and nanoparticles [2], whose responsiveness is based on chemical and morphological changes that occur during the oxidative conversion of hydrophobic, organic polysulfides (namely poly(propylene sulfide)) into hydrophilic sulfoxides and sulfones. The biological rationale resides in the fact that most inflammatory reactions and certain tumors are characterized by an oxidative environment [3], which therefore, by triggering profound reorganizations in polysulfide carriers, can determine the release of encapsulated drugs.

In previous papers we have described the preparation of polysulfide nanoparticles through a living emulsion polymerization process that in *one pot* produces a macromolecular structure from monomers and a stable colloidal morphology from an emulsion [2]. In order to produce stable nanoparticles, a curing stage is also necessary, which is performed in the same environment as the final stage of the polymerization. Even if advantageous in its simplicity, this combination suffers from the macromolecular architecture being poorly defined, since it is not isolated and characterized before crosslinking.

In this research we have overcome this drawback, developing a new two-step method for preparation of nanoparticles from preformed (and purified) macromolecular precursors. The latter have a narrow polydispersity and a well-defined number of functional groups.

We here present the new preparation method as well as the characterization of the oxidative response mechanism.

References:

[1] Napoli A, Valentini M, Tirelli N, Müller M, Hubbell JA.; *Nature Materials* **2004**; 3: 183-189.

[2] Rehor A, Tirelli N, Hubbell JA.; *Journal of Controlled Release* **2003**; 87: 246-247.

[3] Coussens, L. M.; Werb, Z. *Nature* **2002**,420,860-867.