Stimuli responsive hybrid nanomaterials: applications in drug delivery and imaging

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Organic-inorganic nanoparticles are an appealing class of colloids to be used in nanopharmaceutics. Recently their great potential not only for imaging and diagnosis but also for clinical therapeutics has started to flourish. Adequately choosing the constituents leads to systems that can response to external stimuli (magnetic or electric field, light, temperature…) [1-4]. These stimuli responsive hybrid nanomaterials proved to be useful materials in nanomedecine to control the activity of nanovectors towards a specific application (diagnostic or therapeutic).[5]

In the context of neurodegenerative diseases, e.g., Alzheimer's disease, copper is a key biological co-factor. Exogenous supply of Cu to brain is one of the therapeutic approaches for addressing such deficien-cy symptoms. However, Cu needs to be transported into the central nervous system (CNS) and bypass the blood-brain-barrier (BBB), which remains an unsolved problem. Promising systems for this purpose are nanocarriers, which can bind Cu-ions selectively and release them specifically into the cellular environment in response to biochemical triggers, such as altered pH that is existing in the pathological tissues. Hyperbranched nanohybrids based on the use of pH responsive polymers were thus designed for the transport and triggered release of Copper ions in the context of Alzheimer disease. By designing new core-shell and core-multishells polymeric structures, we were able to get nanocarriers presenting a high binding affinity for copper ions and able to release these ions at low pH. We demonstrate that the exact architecture of the core-shell system is a paramount parameter to control the maximum loading, the strength of com-plexation and the release profile of copper into the solution. Their low toxicity may open a new way to balance the Cu-homeostasis in neurodegenerative diseases, e.g., Alzheimer's disease.[4]

Another example takes advantages of stimuli responsive polymers for the stabilization of $GdPO_4$ nanoparticles obtained from microwaves synthesis with application as magnetic resonance imaging contrast agent. The critical effect of nanoparticle size, morphology, temperature, polymer structure and concentration on *in vitro* and *in vivo* relaxivity properties of the as-synthesized hybrids will be discussed.

References

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