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Mesoporous Silica-coated Iron Oxide Nanoparticle (20140249, Dr. Christy Haynes)

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Iron Oxide Nanoparticles

Iron oxide nanoparticles are being widely investigated for use in a variety of biomedical applications, but their potential has been limited due to their inability to maintain structural integrity under certain biological conditions. Aggregation, degradation and colloidal stability are a few problems that affect the robustness of the inner core of iron oxide nanoparticles.

Improved Colloidal Stability, Minimized Aggregation and Degradation

Coating iron oxide nanoparticles in silica increases their vivo stability by minimizing aggregation, protecting against degradation, and allowing the nanoparticle to be further functionalized. An innovative hydrothermal treatment method for coating iron oxide nanoparticles with a mesoporous silica shell layer results in the optimal thickness of the silica layer and spacing (gap) between the silica shell and iron oxide core, thus protecting the inner core. The silica layer is further functionalized with a polyethylene glycol (PEG) layer to improve colloidal stability.

Mesoporous Silica Coated Iron Oxide Nanoparticle Applications

The structure and composition of the mesoporous silica coating is critical in maintaining the advantageous properties of the iron oxide nanoparticle core. By leveraging the favorable pore size and structural stability of the hydrothermally-treated mesoporous silica-coated nanoparticle, researchers envision a number of potential applications for this technology, including MRI imaging, cancer therapies (both magnetic hyperthermia as well as delivery of anti-cancer drugs and/or chemotherapeutic agents), cell tracking, drug delivery and more.

BENEFITS AND FEATURES OF MESOPOROUS SILICA-COATED IRON OXIDE NANOPARTICLES:

- Retains magnetic and thermal properties of the iron oxide core
- Minimizes aggregation, degradation and oxidation of the nanoparticles, remaining stable in biological fluids
- Facile Synthesis
- Offers potential for further functionalization and drug loading of the mesoporous silica shell

Phase of Development Proof of Concept - nanoparticles made and characterized, thermal and magnetic properties measured.

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