Functionalized Nanoparticles for Magnetically-Guided, Heat-Induced Drug Delivery (12087)

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Technology description

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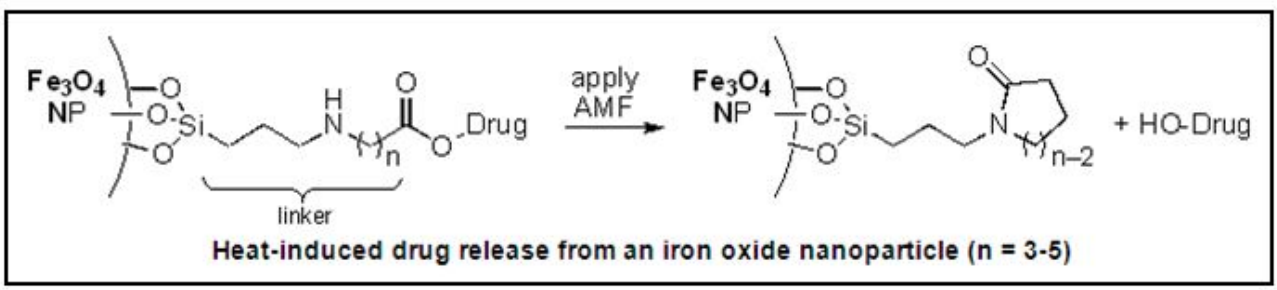
University of Louisville researchers are developing a nanoparticle drug delivery system featuring a thermally responsive linker that covalently binds a drug molecule to an iron oxide nanoparticle. The linker reacts to release the drug payload on application of an alternating magnetic field (AMF) as a result of the heat generated by the nanoparticle under AMF irradiation. The linker (tethering chain between silicon anchor group and ester-bound drug) responds to heat generated by the iron oxide nanoparticle when an AMF is applied. Specifically, the linker undergoes an intramolecular reaction (lactamization) to release the drug, as depicted below. The team's initial design used lactam formation as the trigger for drug release. The drug can be any drug with an alcohol or amine group suitable for attachment to the acyl terminus of the linker.



Heat-induced drug release from an iron oxide nanoparticle (n = 3-5)

The linker design allows for tuning of the energy of activation required to initiate cyclization. Thus, optimization for drug delivery can be achieved by modifying linker chain length, amine position, gem-dimethylation, and/or tethering functionality. By using an AMF-initiated release mechanism, this technology enables drug release "on demand" at precise locations to affect only target tissue (e.g., tumors) with minimal damage to surrounding healthy tissue.

Markets Addressed

This nanoparticle drug delivery system could potentially be used to delivery therapeutic agents that would otherwise be too toxic for administration using conventional delivery methods. In addition, the technology provides considerable flexibility as various linkers can be utilized to facilitate delivery of different drug types.

Advantages

Improves localization and release of therapeutic drugs in target tissues by utilizing an externally applied magnetic field to trigger drug release at target sites
Addresses problem of premature drug release (i.e., leakage) associated with prior nano-based drug delivery systems

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