ARISTOTLE UNIVERSITY OF THESSALONIKI

RESEARCH COMMITTEE

ADVANCED INORGANIC-BASED NANOMATERIALS FOR BIOAPPLICATIONS

Advanced inorganic-based nanomaterials with combined properties can be used for sophisticated bioapplications. The well-established know-how to tune the nanosize, morphology and the physiochemical properties of individual nanoparticles (NPs) enables us to construct more complex nanostructures (nanocapsules, hetero-nanocomposites, nanoplatforms) with active components. Magnetic, bimetallic, metal and metal oxide NPs, synthesized through microwave and solvothermal eco-friendly methods, comprise the primary building blocks for the novel nanoarchitectures. These secondary nanoformulations serve as biocide agents, multimodal imaging probes and for imaging and therapy.

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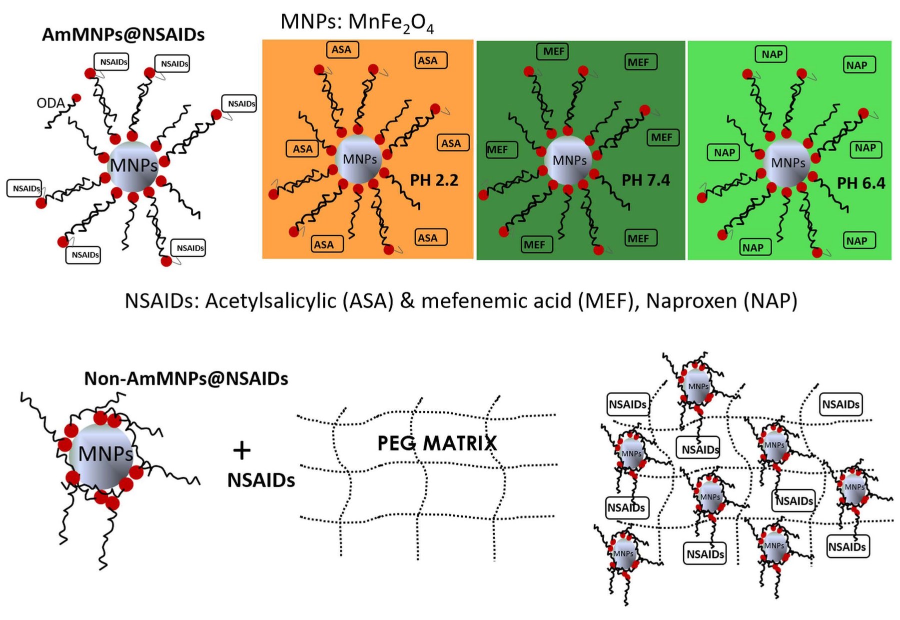

Figure 1: Nanoplatforms of manganese ferrite nanoparticles functionalized with anti-inflammatory drugs.

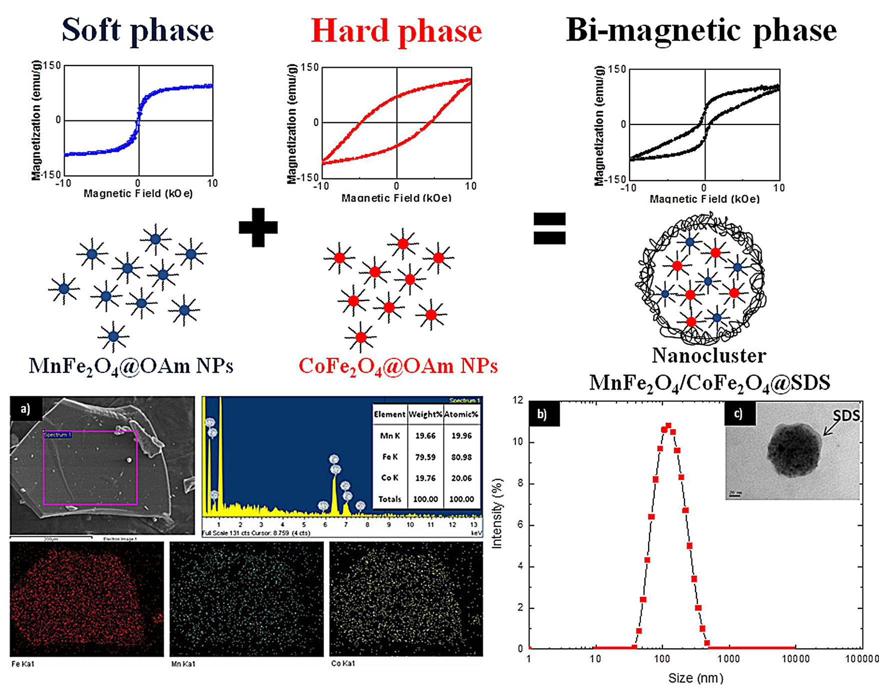

Figure 2: Magnetic hyperthermia efficiency and MRI contrast sensitivity of colloidal soft/hard ferrite nanoclusters (NCs). (a) Indicative EDS elemental map images; (b) DLS measurements of aqueous suspensions of the NCs; (c) arrow indicates SDS coating on the surface of NCs.

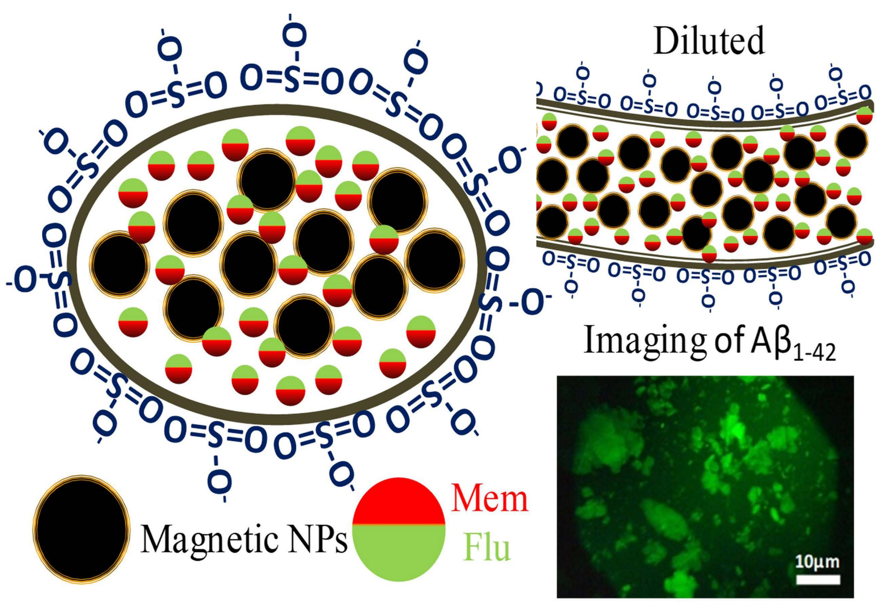

Figure 3: A multimodal (MRI, fluorescence imaging, drug carrier) magnetic nanoemulsion presented as an Alzheimer's disease theranostic candidate. The zinc ferrite magnetic nanoparticles and fluorescein-labeled Memantine (Mem-Flu) were encapsulated in sodium dodecyl sulfate micelles. High encapsulation (77.5%) and loading efficiencies (86.1%), sufficient relaxivity (48.7 $mM^{-1}s^{-1}$) and fluorescence imaging of $A\beta_{1-42}$ peptides were achieved.

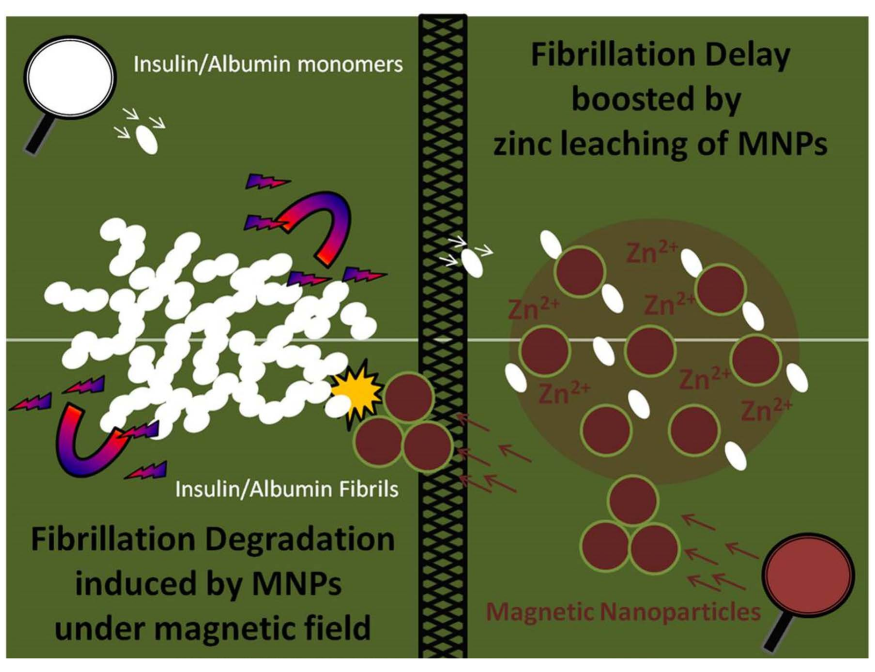

Figure 4: Interplay between Amyloid Fibrillation Delay and Degradation by Magnetic Zinc-doped Ferrite Nanoparticles.

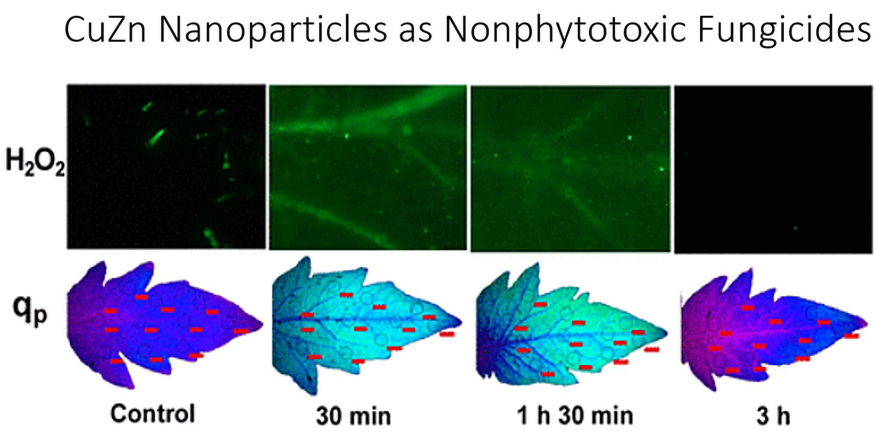

Figure 5: Tomato leaves sprayed with 30 mg L^{-1} of CuZn Nanoparticles (20 nm) and photosystem II (PSII) functionality at low light (LL) was similar to control, indicating nonphytotoxic effects. The Chlorophyll fluorescence imaging analysis is utilized as an effective and noninvasive phytotoxicity evaluation method.

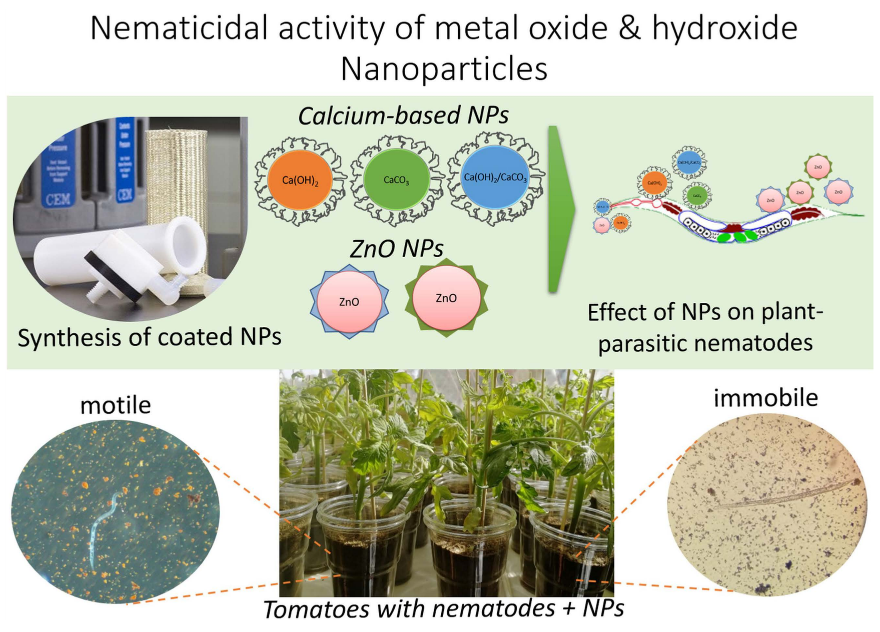

Figure 6: Tailoring Ca-based and ZnO Nanoparticles by polyol process for use as nematicidas. The in vitro nematicidal activity proved that $Ca(OH)_2$ and $CaCO_3$ NPs appeared to be the most and the least effective ones, respectively. The nematicidal impact seems to be boosted by the release of $[OH]^-$ anions, which immobilizes the mobile nematodes.

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