ADAPTIVE IRON OXIDES NANOFLOWERS: STRUCTURE OPTIMIZATION FOR ENHANCED HYPERTHERMIA THERAPY

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Abstract

Multicore iron oxide nanoflowers (NF) exhibit tunable structural and magnetic properties, making them promising candidates for biomedical applications, including magnetic hyperthermia (MH) [1]. In this study, the effect of synthesis duration on the crystallization process, morphology, and magnetic behavior of iron oxide NF was investigated. X-ray diffraction analysis revealed that after 2 hours of synthesis, the expected maghemite (γ-Fe_2O_3) phase had not yet formed. Prolonged treatment (4–8 hours) resulted in the formation of maghemite structures (Figure 1). Transmission electron microscopy revealed that NF4 exhibited well-defined nanoflower morphology, while NF8 and NF12 showed signs of aggregation. The NF4 sample had the smallest core size (12 ± 2) nm and the best dispersion stability (Figure 2). Magnetic measurements revealed that all samples exhibited superparamagnetic-like behavior with narrow hysteresis loops, but collective magnetic interactions within the multicore structure contributed to enhanced magnetic properties [2]. Heating experiments demonstrated that NF4 exhibited the highest specific loss power (SLP) and intrinsic loss power (ILP), confirming its superior efficiency in MH applications. Due to their uniformity, NF4 particles were coated with citric acid and radiolabeled with ^{68}Ga. Biodistribution studies conducted on tumor-bearing mice revealed significant differences in nanoparticle accumulation depending on the administration route: intravenous, intraperitoneal, or intratumorally. Notably, a high concentration of radiolabeled nanoparticles was observed in tumor tissues after intratumoral administration, highlighting their potential for brachytherapy and diagnostic applications [3].

Acknowledgement

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References

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Figures

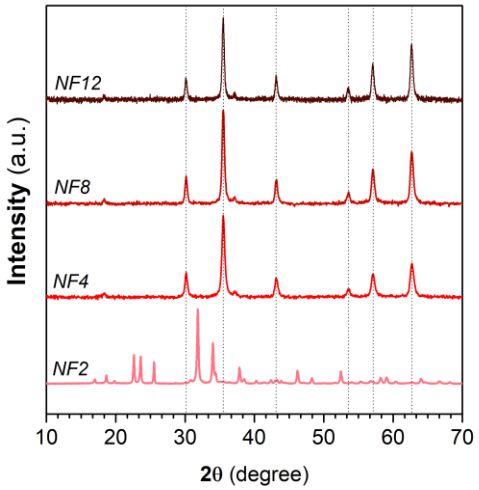

Figure 1. XRD patterns of nanoflowers.

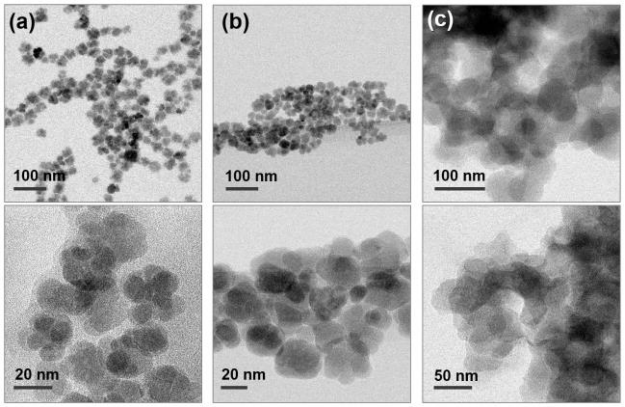

Figure 2. TEM micrographs of the NFs prepared for (a) 4 hours; (b) 8 hours and (c) 12 hours at different magnifications.