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Casein-coated iron oxidemagnetic nanoparticles– preparation and evaluation for possible application in hyperthermia treatment

Stanislava Simeonova[1], Tsenka Grancharova[2], Plamen Zagorchev[2,3], Bissera Pilicheva[1, 3]

[1]Medical University of Plovdiv, Faculty of Pharmacy, Department of Pharmaceutical Sciences, Plovdiv, Bulgaria
[2]Medical University of Plovdiv, Faculty of Pharmacy, Department of Medical Physics and Biophysics, Plovdiv, Bulgaria
[3]Research Institute at Medical University of Plovdiv, Plovdiv, Bulgaria

Magnetic iron oxide nanoparticles have been thoroughly investigated for a wide variety of applications, including diagnostics and therapeutics. The aim of this study was to develop casein-coated iron oxide nanoparticles with optimized characteristics for further application in hyperthermia therapy. Three models of bare magnetic nanoparticles were developed at varied operating conditions such as temperature, stirring speed and reagent addition sequence during the synthesis. The obtained bare nanoparticles were analyzed for particle size and size distribution, and for their tendency for aggregation. The magnetic properties were confirmed by magnetic separation of the solid phase from the resulting suspension using a permanent magnet. Based on the results, optimized process parameters were outlined for further research.

For casein coating, impregnation of casein micelles with iron salts with subsequent precipitation was applied. For the characterization of the obtained casein-coated iron oxide nanoparticles scanning electron microscopy, transmission electron microscopy, dynamic light scattering, and infrared spectroscopy were used. Nanoparticles were in the range around 10-60 nm, revealing nonuniform size distribution, tendency for aggregation and uneven protein coating. Further optimizations of the coating procedure are needed to obtain satisfactory wrapping of the magnetic cores regarding their physical stability.