FP-04

DOI: 10.14232/syrptbrs.2023.59

y-F_2O_3 nanoparticles as a mediator for photothermal therapy – preparation, characterization and heating ability in muscle tissue phantom

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

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

Photothermia is an experimental antitumor therapy in which nanoparticles convert infrared laser irradiation into heat to produce local hyperthermia. Nanoparticles that mediate this therapy must have biocompatibility, acceptable conversion efficiency, and good accumulation and distribution in tumor tissue. Iron oxide superparamagnetic nanoparticles (SPIONs) are a good candidate that also have various medical applications. The magnetic properties determine their potential as a theranostic agent and as a tool for hybrid therapy (such as combining magnetic hyperthermia with photothermia).

The aim of the present work was to develop SPIONs as a conversion agent for photothermal therapy, and to investigate their heating ability. Co-precipitation method was used to prepare y-F2O3 and casein was selected as the stabilizing polymer. The process parameters were varied in order to produce particles of suitable size and lower tendency to agglomerate. Particle size was determined by scanning electron microscopy, transmission electron microscopy and dynamic light scattering. Mössbauer spectroscopy was used to study the crystal structure and magnetic properties. The heating profile of the nanoparticles under laser irradiation was observed trough aqueous suspensions of y-F_2O_3 nanoparticles in distilled water as well as trough phantom muscle tissue . A thermal camera was used to monitor the temperature changes and temperature gradient in the samples. The increase in temperature was considered sufficient for mild hyperthermia and showed a concentration dependence.