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Light-Emitting Diode Assisted Synthesis of Ag@Fe3O4 Nanoparticles and Their Application in Magnetic and Photothermal Hyperthermia Therapy

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Abstract : Cancer has been one of the leading causes of human death for centuries. Considerable effort has been devoted to developing new treatments to reduce and control cancers. Magnetic particle hyperthermia and near-infrared photothermal therapy are the promising strategies to treat cancers due to its effectiveness with only mild side effects. This study focused on synthesizing magnetic Ag@Fe3O4 nanoparticles applicable for both of magnetic hyperthermia and near-infrared photothermal therapy. The hydrophilic poly(diallyldimethylammonium chloride) polymer was utilized to prepare superparamagnetic Fe3O4 clusters and to promote silver nanoparticles grown on Fe3O4 surfaces, obtaining Ag@Fe3O4 nanoparticles. The morphology (shape and dimension) of Ag nanoparticles was subsequently tailored using commercial LED lights. Therefore, the resulting Ag@Fe3O4 nanoparticles can absorb specific wavelength of light ranging from 400 nm to 800 nm by adjusting the wavelength of LED lights and the free silver ions in reaction solution. Heating performance tests confirmed that the synthesized Ag@Fe3O4 nanoparticles show appreciable heating capability for both of magnetic particle hyperthermia and near-infrared photothermal therapy. The findings in this study could provide new ideas to design functional materials to treat cancers.

Keywords : light-emitting diode assisted synthesis, magnetic particles, photothermal materials, hyperthermia
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