The peculiarities of obtaining hollow nanoparticles of magnetite

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Drugs based on Fe_3O_4 are characterized by controlled drug release, minimal side effects, increased efficacy, and improved bioavailability. Therefore, the development and implementation of new methods for the synthesis of Fe_3O_4-based nanoscale materials with predicted parameters and properties remain relevant. Hollow structures are of great interest because their large surface area and hollowness facilitate the loading of more drugs or the increase in active sites. Among the chemical methods for obtaining monodisperse hollow/mesoporous Fe_3O_4 nanoparticles, the solvothermal method is of particular importance because it allows obtaining particles with satisfactory magnetic characteristics, morphology, and size suitable for biomedical applications.

Monodisperse magnetite (Fe_3O_4) nanospheres with hollow or porous internal structures were synthesized via the one-pot solvothermal method. The synthesis process was carried out using iron (III) chloride ($FeCl_3$) as the source of iron ions and hydrous sodium acetate ($NaAc{\cdot}3H_2O$) as a structure-regulating agent in ethylene glycol solution, without the involvement of any matrices or surfactants [1]. The mixture of salts Fe^{3+}/Ac^- (1:4 and 1:8 molar ratio) was transferred into a teflon-lined stainless steel autoclave (100 ml capacity) for hydrothermal treatment at 200°C for various durations 5, 10 and 15 h. After the autoclave had cooled down to room temperature, the precipitate was collected by magnetic separation and subsequently washed several times with water and ethanol. The sizes and structures of Fe_3O_4 hollow nanoparticles were characterized by IR-spectroscopy and transmission electron microscopy (TEM). Preliminary results indicate that the optimal synthesis conditions are 1:4 on molar ratio of ions, and a synthesis duration of 10 h, as 5 h does not suffice for the formation of porous structures.

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