

Optimization of the Enzymatic Synthesis of the Silver Core-Shell Nanoparticles

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Abstract : Considering an enormous increase of the use of metal nanoparticles with the exactly defined characteristics, the main goal of this research was to found the optimal and environmental friendly method of their synthesis. The synthesis of the inorganic core-shell nanoparticles was optimized as a model. The core-shell nanoparticles are composed of the enzyme core belted with the metal ions, oxides or salts as a shell. In this research, enzyme urease was the core catalyst and the shell nanoparticle was made of silver. Silver nanoparticles are widespread utilized and some of their common uses are: as an addition to disinfectants to ensure an aseptic environment for the patients, as a surface coating for neurosurgical shunts and venous catheters, as an addition to implants, in production of socks for diabetics and athletic clothing where they improve antibacterial characteristics, etc. Characteristics of synthesized nanoparticles directly depend on of their size, so the special care during this optimization was given to the determination of the size of the synthesized nanoparticles. For the purpose of the above mentioned optimization, sixteen experiments were generated by the Design of Experiments (DoE) method and conducted under various temperatures, with different initial concentration of the silver nitrate and constant concentration of the urease of two separate manufacturers. Synthesized nanoparticles were analyzed by the Nanoparticle Tracking Analysis (NTA) method on Malvern NanoSight NS300. Results showed that the initial concentration of the silver ions does not affect the concentration of the synthesized silver nanoparticles neither their size distribution. On the other hand, temperature of the experiments has affected both of the mentioned values.

Keywords : core-shell nanoparticles, optimization, silver, urease

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