Preparation of silver nanoparticles in the presence of α-cyclodextrin

M.A. Ihnatouskaya, M.N. Nichick
Belarusian State University, Minsk, Belarus, e-mail: *bpftkkf93@gmail.com*

Interest in silver nanoparticles (NPs) is unabated due to their unique physicochemical and antibacterial properties. However, there is an acute issue of directed growth of silver NPs or their targeted delivery. Therefore, the ability of α-cyclodextrin (α-CD) to influence on particles' shape or to penetrate into the cell and transport silver nanoparticles is currently in demand [1].

Silver nanoparticles (NPs) have been obtained by a modified Turkevich method [2]. Ag_2SO_4 of analytical grade was used as a precursor for NPs. Addition of Na_3Cit solution and α-CD was followed by pouring a freshly prepared solution of $NaBH_4$. The synthesized sol has been purified from byproducts by dialysis. The study of the obtained sol was carried out by UV-Vis spectroscopy, TEM, Zeta potential has been studied also.

As a result of the synthesis, along with spherical particles with a size of 7–14 nm, a great number of silver particles with clear cylindrical shape with a cross section of 10–12 nm and a longitudinal section of 5 nm were obtained. It can be seen on TEM images that cylindrical particles are separated from each other. The absorption spectrum of the colloidal solution shows a single peak at 400 nm. The observed flux value of zeta potential of the purified sol (from –21.9 mV to +23.6 mV) means that sol has high stability and resistance to aggregation.

It can be consumed that the reason for the inhomogeneous morphology of particles, lies in the high sensitivity of α-CD to the pH of the medium. Dissolution of $NaBH_4$ is accompanied by hydrolysis, that leads to a partial destruction of α-CD. It can be suggested that undestructed part of α-CD promoted the directed growth and stabilization of silver nanoparticles with cylindrical shape.

References

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