# EFFECT OF SYNTHESIS CONDITIONS ON THE FORMATION OF SPHERICAL SILICA PARTICLES WITH AMINO GROUPS AND THEIR INVESTIGATION IN SORPTION AND AS ANTIBACTERIAL AGENTS

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**Abstract**

Spherical silica particles with amino groups are simple and unique, as well as convenient materials for application in catalysis, nanomedicine, separation processes, adsorption, or energy-storage technology. Usually, the procedure of producing aminosilica particles includes two stages: (1) production of pure silica particles and (2) their post-synthetic grafting using aminopropyltriethoxysilane (APTES). In our research we considered one-pot synthesis technique of obtaining aminosilica nanoparticles with different sizes, content of amino groups, specific surface areas, and combinations of hydrophobic and amino groups on the surfaces. Particles' morphology and composition of the surface layers were analyzed using SEM, IR spectroscopy, XPS, elemental analysis, z-potential measurements, and adsorption methods. Depending on the structure-forming (tetraethoxysilane or bridged silanes) and functionalizing agents (silanes with amino, methyl, and phenyl groups), the surfaces of such particles contain silanol, hydrophobic, and amino groups. Therefore, different types of interactions are possible during the adsorption processes on the surfaces of such materials. Such material could adsorb up to 3.2 mmol/g of copper(II) ions from aqueous solutions, as well as organic dyes, such as Acid red 88 (262 mg/g) and Methylene blue (146 mg/g). It was shown that 1% (v/v) water suspension of Cu(II)-containing silica nanoparticles demonstrated up to 98.7% of antibacterial activity against *S. aureus* in 120 min, 99.9% - *E.coli*, 99.9% – *P. aeruginosa*, 84.5% – *C. albicans*. In conclusion, the proposed approaches provide control over the properties of the final materials necessary to create sorptive nanomaterials.

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