

***In situ* generated 5-(2-mercaptoethyl)tetrazole as a novel capping ligand for silver nanoparticles**

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Tetrazole derivatives have received much attention in the recent years in the field of nanostructured materials [1,2]. In particular, they were studied as suitable capping ligands for semiconductor and metal nanoparticles (NPs). So, 5-(2-mercaptoethyl)tetrazole (**1**) was successfully applied to the aqueous synthesis of CdTe and Au NPs [2]. A notable feature of obtained NPs is their ability to build 3D structures in a metal ion assisted gelation process in aqueous solution.

Here we report synthesis and characterization of Ag NPs capped by ligand **1**. It was found that stable aqueous Ag sols can be obtained by reduction of Ag_2SO_4 with NaBH_4 in the presence of disulfide **2** (Fig.). In this case, ligand **1** is generated *in situ* by splitting of the S–S bond of **2** upon the addition of reducing agent.

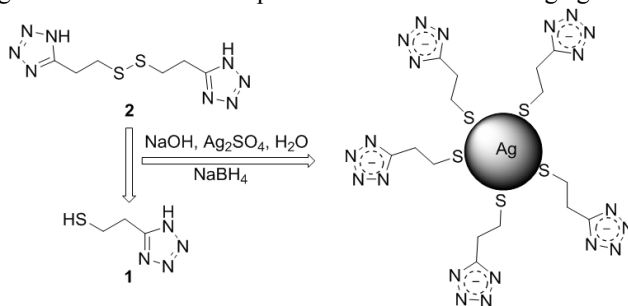


Fig. Scheme for the synthesis of Ag NPs capped by ligand **1**

Synthesized NPs were characterized by transmission electron microscopy (TEM), FTIR and UV-visible spectroscopy, thermogravimetric analysis (TGA). According to the TEM obtained NPs are nearly spherical with a diameter of ~3-5 nm. Yellowish-brown aqueous Ag sols show a single peak at 420 nm in UV-Vis spectra. Comparative analysis of the IR spectra of the powdered NPs and free ligand **1** indicates that the surface of the NPs is covered by thiolate anions. In particular, S–H bands at $2500\text{--}2600\text{ cm}^{-1}$ observed for ligand, are disappeared in the NPs spectra. TG curves of **1** and Ag NPs show that thermolysis of the ligand bound to the NPs proceeds at higher temperatures in comparison with the free ligand, which is due to the presence of tetrazolate form of ligand on the surface of NPs.

References

- [1] M.N. Nichick et al. J. Phys. Chem. C. (2011) 115: 16928.
- [2] S.V. Voitekhovich et al. Chem. Eur. J. (2016) 22: 14746.