ABSTRACT

Functional nanoparticles constitute one of the most important groups of nanomaterials, with wide-ranging applications in the biomedical field. Silver nanoparticles (AgNPs) are of particular interest, as they combine unique physicochemical properties with a broad spectrum of biological activities, including antimicrobial, virucidal, and immunomodulatory effects. A crucial factor influencing these properties is the presence of surface ligands, which ensure the stability of colloidal and provide biological functions. Among them, polyphenols such as tannic acid (TA) – a natural plant compound with antioxidant, reducing, anti-inflammatory, and virucidal properties, as well as the ability to form complexes with metals – are of particular importance.

This dissertation is devoted to the investigation of tannic acid transformations in silver nanoparticle colloids (TA-AgNPs) and their impact on physicochemical properties and potential biological activity. It was assumed that the processes occurring during the storage of TA-AgNPs may lead to transformations of tannic acid, and modulating the functionality of the entire colloidal system. A set of analytical methods was used to investigate the transformation of tannic acid in TA-AgNPs colloids, including Fourier transform infrared spectroscopy (FT-IR), ultraviolet–visible spectroscopy (UV-Vis), dynamic light scattering (DLS), electron microscopy (SEM), thin-layer chromatography (TLC), and liquid chromatography coupled to mass spectrometry (LC-MS). This approach enabled the characterization of nanoparticle morphology and stability, as well as the monitoring of polyphenol transformations occurring during system conditioning in time.

The obtained results allows the dipper understanding of the polyphenol transformation in the colloidal systems containing silver nanoparticles and highlighted the key role of those transformations and its influence on the the physicochemical and biological properties of the final functional nanoparticles.