Nanocomposites and nanomaterials

Green synthesis of silver nanoparticles using plant extracts

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The development of reliable and eco-friendly methods for the synthesis of nanoparticles is an important step in the field of nanotechnology. Silver nanoparticles are widely used for their exceptional chemical, physical and biological properties. "Green" synthesis of nanoparticles has received considerable attention as cost-effective method for large-scale nanoparticles production versus chemical and physical methods. "Green" synthesis is a method for preparing metallic nanoparticles from salts of the corresponding metals using plant extracts as reducing and stabilizing agents.

In this work silver nanoparticles (AgNPs) colloids were synthesized using *Stevia rebaudiana* extracts from three different types of raw material: leaves of plants grown *ex situ*, leaves of plants grown *in vitro*, callus culture tissue formed on damaged leaves. Composition of the extracts was studied using LDI mass spectrometry, HPL chromatography, and methods of chemical analysis. SEM method was used to estimate the shape and size of silver nanoparticles.

Flavonoids, hydroxycinnamic acids, and steviol glycosides were found to be the main groups of bioactive compounds available in the *Stevia* leaves, with the amount of these compounds in the extract being dependent on the type of raw material.

All the extracts revealed significant activity in AgNPs synthesis, the particles of predominantly spherical shape with the average sizes of 16 – 25 nm were formed. Extracts reducing properties were found to correlate with total phenol content, the activity of extracts in Ag^+ ions reduction was in a row: Extract from the leaves of plants grown *ex situ* ≈ Extract from callus culture >> Extract from the leaves of plants grown *in vitro*.

Quantum chemical calculations of adiabatic ionization energy for several bioactive compounds available in the *Stevia* leaves extracts were carried out to analyze their reducing properties. The reducing properties of various bioactive compounds of the extracts were found to be in a row: Chlorogenic acid > Caffeic acid > p-Coumaric acid > Luteolin-7-glucoside > Quercetin > Epigallocatechin gallate > D-glucose.