Rapid biological synthesis of pure and bimetallic nanoparticles using plant leaf extracts

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Five plant leaf extracts (Pine, Persimmon, Ginkgo, Magnolia and Platanus) were used and compared for their extracellular synthesis of pure and bimetallic silver, gold, and platinum nanoparticles. Stable nanoparticles were formed by treating aqueous solution of AgNO3, HAuCl4 and H2PtCl6·6H2O with the plant leaf extracts as reducing agent. Magnolia leaf broth was the best reducing agent in terms of synthesis rate and conversion to nanoparticles. Only 11 and 3 min were required for more than 90% conversion to silver and gold nanoparticles, respectively, at the reaction temperature of 95 oC using Magnolia leaf broth. The synthesized silver nanoparticles were characterized with ICP, EDS, SEM, XPS, and particle analyzer. The particle size could be controlled by changing the temperature and composition of the reaction mixture. Competitive reduction of Au3+ and Ag+ ions present simultaneously in solution during exposure to Persimmon leaf extract leads to the formation of bimetallic Au/Ag nanoparticles. SEM images showed that large Au/Ag particles of 50 – 500 nm were formed with some cubic structure, while pure Ag particles obtained by reduction of only Ag+ ion were smaller with diameter of 15 – 90 nm and predominantly spherical.