

Synthesis of Silver Nanoparticles Using Brown Alga *Sargassum Angostifolium* on the Coast of the Persian Gulf (Bushehr Province)

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Abstract

This study shows that algal extract solution can be an excellent biological reducing agent and easily accessible source for the biosynthesis of silver nanoparticles. This protocol can be used to synthesize large amounts of silver nanoparticles. Nanoparticles synthesis occurs in a single step, which gives simple operation and reduces costs. This is an economic approach and eliminates the need to use external stabilizer agents. In addition, this method does not use any reagents or toxic solvent. The obtained colloids have characterized by UV-vis spectroscopy, TEM, XRD, and FTIR. TEM image of the silver colloids shows that the AgNPs are predominantly spherical around average particle diameters of 32 nm. XRD result clearly shows that the AgNPs are crystalline in nature. Biomolecules present in the extract, such as proteins, are responsible for the reduction of silver ions to silver nanoparticles. FTIR study indicates that bio-organic components in algal extract might act as a stabilizing agent of AgNPs. The effects of various influencing parameters on the formation of silver nanoparticles were investigated. In alkaline pH, the formation of AgNPs was instantaneous and an intense SPR band observed. Drop wise addition of the reducing agent into AgNO₃ solution resulted in reduced particle size as compared to fast addition protocols. In addition, AgNPs synthesized by the direct method (addition of algae extract to an aqueous solution of silver nitrate) are smaller than those synthesized by the inverse one (addition of an aqueous solution of silver nitrate to algae extract). This work may prove to be of great value in synthesizing nanoparticles with well-controlled sizes in chemical, pharmaceutical, and materials production processes.

Keywords: Silver nanoparticles, *Sargassum angostifolium*, Alga.