Contribution ID: **124** Type: **not specified**

One step synthesis and antimicrobial activity of silver, copper nanoparticles and silver-copper nanoalloys

Abstract

Bacterial infections are an increasing public health concern. Each year, forty-eight million people get sick from a foodborne illness, from which three thousand people die, as estimated by the U.S. Centers for Disease Control and Prevention (CDC)[1]. In this context, attention has increased on the production of novel nanoparticle-based materials with effective antimicrobial properties. The use of nano-sized silver and its alloys represents an interesting alternative to common food preservation methods. However, common methods used for the synthesis of metal nanoparticles (NPs) require a multi-step approach and the use of toxic solvents and reagents[2]. Our synthesis method was conductive to the formation of the isolated metallic nanoparticles in a single step, in just 2 min at 175oC, using a modified polyol (ethylene glycol) method and a microwave heating route. We have successfully synthetized spherical silver (Ag) and copper (Cu) nanoparticles with a crystallite size of less than 10 nm as well as irregular silver-copper (AgCu) nanoalloys with a crystallite size of less than 15 nm, as confirmed by X-Ray Diffraction and HRTEM. The synthesis of AgCu nanoalloys was confirmed using EDS mapping technique that evidenced a 51.74% of copper and 48.26% of silver atomic percent composition. The AgNPs and AgCu nanoalloys exhibited more stability in suspension, in comparison to CuNPs, as observed by monitoring absorbance by UV-vis spectroscopy over a period of 12 days. Furthermore, the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of AgNPs, CuNPs and AgCu nanoalloys in presence of *Escherichia coli, Staphylococcus aureus* and *Salmonella typhimurium* were determined. The obtained MIC and MBC results show that AgCu nanoalloys are more effective in inhibiting the growth of the studied microorganisms.

Keywords: foodborne illness, nanoalloy, silver, copper, nanoparticles, antimicrobial properties.

References:
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emphasized text

Ciencias de materiales

Ciencias de la Salud

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