

## Continuous synthesis of silver nanoparticles using green chemicals and microreactors and its evaluation as bactericidal agents

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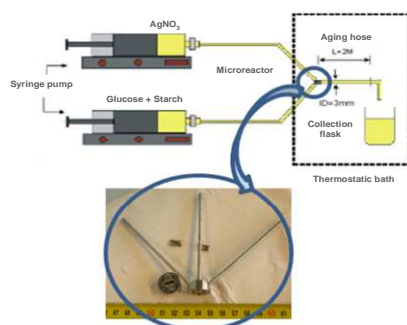
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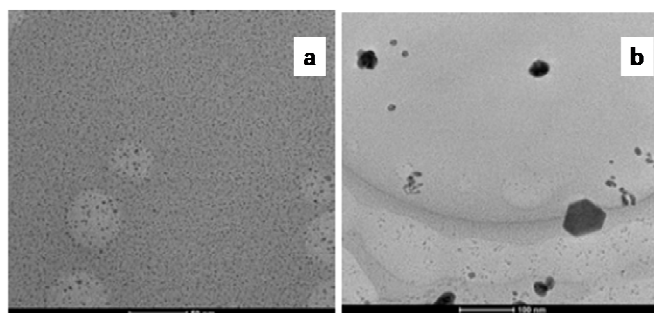
Silver nanoparticles have been extensively studied in medicine and microbiology mainly because of their bactericidal properties [1]. There are many methods for the synthesis of these nanoparticles but only a few of them are really reproducible and use protocols and reactants that are environmentally friendly. In this work, the synthesis of silver nanoparticles using green reactants is described. Moreover, a continuous production method is proposed based on the use of microreactors [2]. Green chemicals such as glucose and starch are used as reducer and stabilizing agents, respectively. Different synthesis parameters such as reactant ratios and temperatures are thoughtfully evaluated and optimized to maximize the production of silver nanoparticles. The synthesized materials are fully characterized by TEM, UV-Vis and XPS. Likewise, the bactericidal activity of selected nanoparticles has been evaluated against *Escherichia coli*.

### References

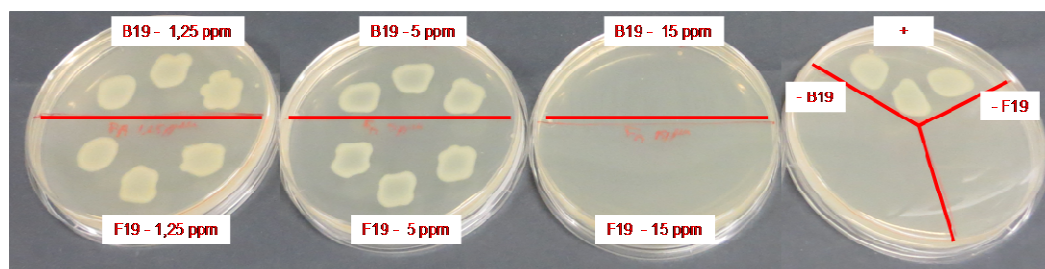
- [1] Knetsch, M.L.W. and L.H. Koole. *Polymers. New Strategies in the Development of Antimicrobial Coatings: The Example of Increasing Usage of Silver and Silver Nanoparticles*, (2011) p.340-366.
- [2] Sebastian, V., M. Arruebo, and J. Santamaria. *Small. Reaction Engineering Strategies for the Production of Inorganic Nanomaterials*, (2014) p. 835-853.



**Figure 1.** Scheme of continuous synthesis device.



**Figure 2.** TEM micrographs of AgNp synthesized with Ag / Gluc = 1: 5 at 40°C. a: Flow, b: Batch.



**Figure 3.** Results of the exposure of different concentrations of the selected particles (1.25, 5 y 15 ppm) against *E.coli* ( $10^6$  UFC/ml). Positive control (+: culture medium with bacteria) and negative control (- B19 and -F19: culture medium with nanoparticles) were also made.