EXTRACELLULAR BIOSYNTHESIS OF GOLD NANOPARTICLES USING SUGAR BEET PULP

L. Castro, M.L. Blázquez, A. Ballester, F. González and J.A. Muñoz
Department of Materials Science and Metallurgical Engineering,
Complutense University of Madrid, Avda. Complutense s/n 28040 Madrid, Spain.
lauracr84@hotmail.com

Nowadays precious metal recovery technologies use harmful chemicals that may represent a risk to the environment and public health. This is the reason why it is necessary to develop clean, non-toxic and environmentally friendly procedures to recover precious metals. The use of biological organisms in synthesis and assembly of nanoparticles has received increasing attention. There are eco-friendly "green" methods for the synthesis of noble metal nanoparticles using bacteria, actinomycetes, yeast, fungi, and plant extracts. Sugar beet pulp, an industry waste, has been shown effective in the reduction of Au(III) to Au(0) and extracellular synthesis of nanoparticles.

The interest in nanoparticles synthesis research is now focused on the shape selectivity and size monodispersity. In this work, we report on the biological synthesis of several shape gold nanoparticles. Many properties of metal nanoparticles such as optical, electronic, magnetic and catalytic properties strongly depend on their size and shape.

It is shown that nanoparticles shape can be controlled by varying the initial pH value. The shape varies from triangular and geometrical nanoparticles to nanorods and nanowires. For long reaction times, gold biosorption instead of nanoparticle formation took place. UV-vis spectra and transmission electron micrographs showed nanoparticles of several shapes and sizes. Gold biosorption on biomass surface was detected by scanning electron microscopy. In order to resolve the mechanism of reduction of gold (III), the evolution of pH and potential was measured.

References:

Chandran, S. P.; Chaudhary, M.; Pasricha, R.; Ahmad, A.; Sastry, M. Synthesis of gold nanotriangles and silver nanoparticles using *Aloe vera* plant extract. Biotechnol. Prog. 2006, 22, 577-583.

Mohanpuria, P.; Rana, N. K.; Yadav, S. K. Biosynthesis of nanoparticles: technological concepts and future applications. J. Nanopart. Res, 2008, 10, 507-517.

He, S. Y.; Zhang, Y.; Guo, Z. R.; Go, N. Biological synthesis of gold nanowires using extract of *Rhodopseudomonas capsulate*. Biotechnol. Prog. 2008, 24, 476-480.

Figures:

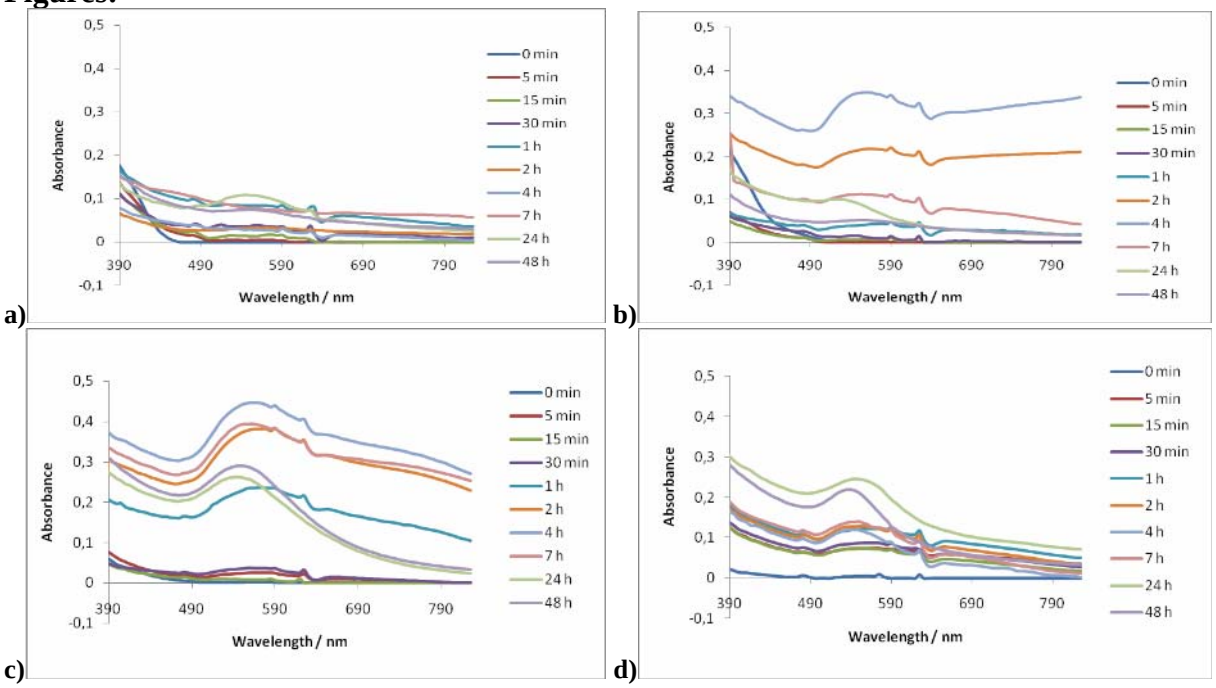

Figure 1. UV-Visible spectra as a function of time at different pH: a) pH 2, b) pH 4, c) pH 7; d) pH10.

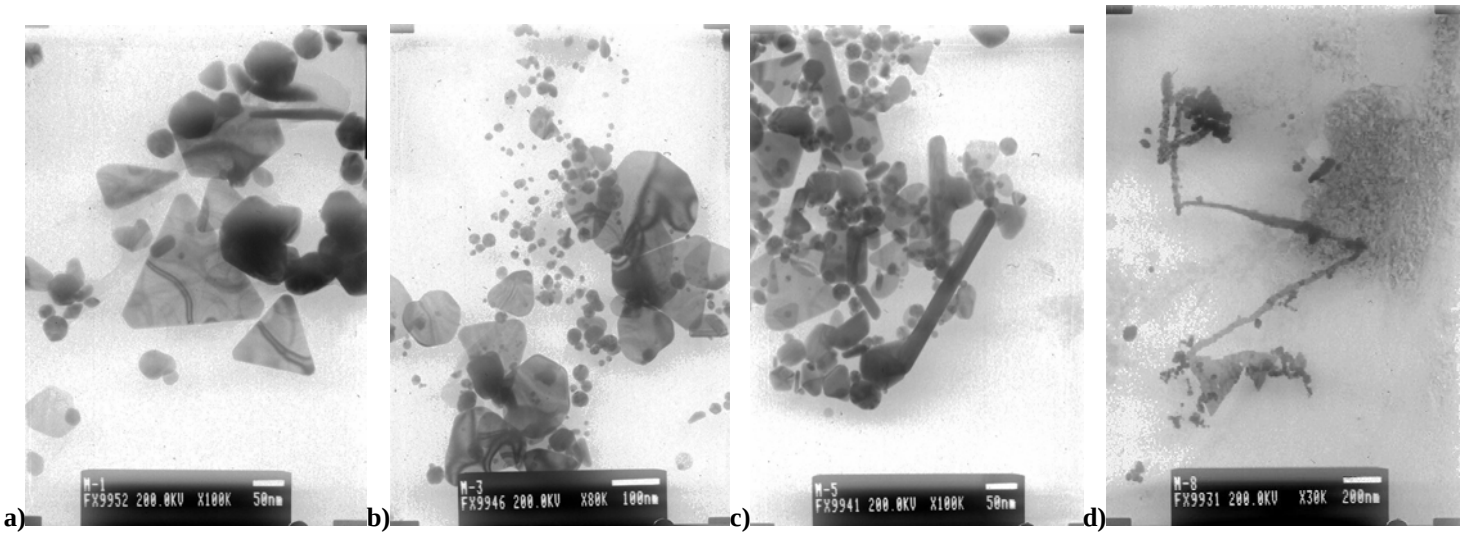

Figure 2. TEM images of gold nanoparticles synthesized using sugar beet pulp at different pH: a) pH 2, b) pH 4, c) pH 7, d) pH 10.

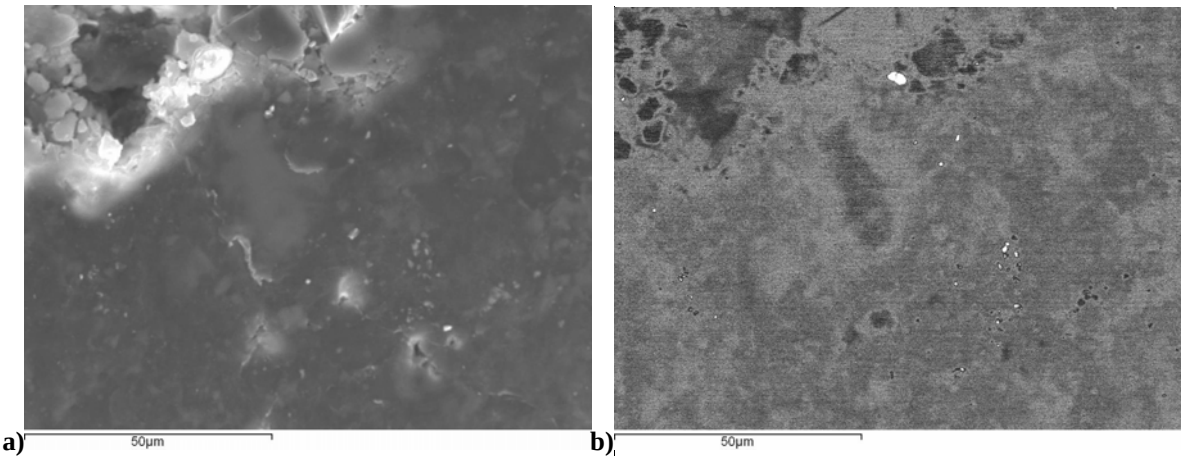

Figure 3. Secondary (a) and backscattered (b) scanning electron micrographs.