1740
doi:10.1017/S1431927618009182

Microsc. Microanal. 24 (Suppl 1), 2018

Green Synthesis of Gold Nanoparticles Using *Taraxacum officinale* Extract

A. Del Moral[1], S. E. Borjas-Garcia[2] and G. Rosas[1]

[1.] Instituto de Investigación en Metalurgia y Materiales, UMSNH, Morelia, Michoacán, Mexico.
[2.] Instituto de Física y Matemáticas, UMSNH, Morelia, Michoacán, Mexico.

In recent years, the development of nanotechnology has increased, which has led to the need to optimize the synthesis methods of nanomaterials. In this sense, conventional chemical synthesis has become increasingly important [1], although the main problem with the use of this method is a significant amount of toxic and dangerous waste. An alternative derived from this method is the so-called "green synthesis" [2], which promotes the reduction of precursor salts of the metals through organisms to produce and stabilize nanometric materials (1-100nm) in a more efficient way, economical and friendly with the environment [3].

In the present study, the synthesis of gold nanoparticles was carried out using *Taraxacum officinale* extract which grows in environments with low humidity and sunlight, on the other hand, the corresponding precursor salt used was Tetrachloroauric Acid (HAuCl4). The extract was prepared using the whole plant from the stem to the vilane, which was mechanically triturated by ball mill, later the infusion was done mixing 100 ml of distilled water with different concentration of plant powder (1, 1.5 and 2 g), it was heated at 55 ° C for 30 minutes and then it was filtered, the gold solution was elaborated with a concentration of 5 mM in distilled water. On the other hand, for the synthesis process 6 ml of *Taraxacum officinale* extract were mixed with 3 ml of gold solution at room temperature without agitation, generating a volume ratio of 2:1, the main indication of the synthesis was the change of color in the mixture of light brown to purple, the size and size distribution was analyzed by Ultraviolet-Visible (OceanOptics USB 4000), later the morphology and size of the nanoparticles were determined using Scanning Electron Microscopy (JEOL JSM- 7600F) and Transmission Electron Microscopy (Phillips Tecnai F20), finally with the objective of corroborating the composition and crystal structure, the samples were analyzed by X-ray diffraction (Bruker D8 Advance, DAVINCI Lynx eye). Figure 1 shows the UV-Vis spectra associated with gold nanoparticles at characteristic wavelengths between 500 and 600 nm, indicating that the Taraxacum officinale plant is efficient to synthesize nanomaterials. These results were obtained by varying the concentration of the extract (0.02, 0.015, 0.01 g / ml), in which can be seen that the band corresponding to 0.02 g / ml indicates smaller and more homogeneous particle sizes and shapes compared with the other bands. These samples were analyzed by SEM technique which allows corroborating the information obtained by UV-vis spectra. Figure 2 shows in section a) that the nanoparticles synthesized with 0.02 g ml of extract have spherical shapes and of smaller size compared with sections b) and c), corresponding to the lower concentrations of extract. These results can be attributed to the fact that the higher the quantity of extract used, the more significant the amount of stabilizing substances present in the plant extract to obtain nanoparticles. On the other hand, by decreasing the organic compounds coming from the plant, the reducing agents and stabilizing agents also lower which generates coalescence of the nanoparticles. These results lead to an increase the particle size and shape from spherical to triangular and some rods (Figs 2 a-b). To observe in detail the morphology of the nanoparticles, the sample with smaller and larger sizes (0.02, 0.01 g / ml) was analyzed by TEM. Figure 3 a) correspond to AuNPs synthesized with 0.02 g/ml. This Figure shows that the nanoparticles are spherical with an average size of 15 nm. However, Fig. 3 b) that correspond to 0.01

g/ml displays a distribution of shapes such as spheres, triangles, and rods with an average size of 43 nm. These results agree well with the Uv-vis and SEM techniques.

Finally, the sample synthesized at a concentration of plant extract of 0.02 g / ml and 5mM of the Tetrachloroauric Acid solution by X-ray diffraction. Figure 3c shows the XRD pattern that corroborates the crystalline structure of the synthesized AuNPs indexing the planes 111, 200 and 220 at angles 37 °, 44.5 °, 64.8 °, of the fcc lattice [4].

References:

[1] M. Quintana *et al*, Journal Ciencia y Desarrollo **34** (2008), p. 62.

[2] V. Sanchez -Mendieta *et al*, Journal InTech **1** (2012), p. 391.

[3] N. Castro *et al*, Journal Ciencia e Ingeniería Neogranadina **21** (2011), p. 169.

[4] The authors acknowledge funding from Consejo Nacional de Ciencia y Tecnologia (CONACyT), México.

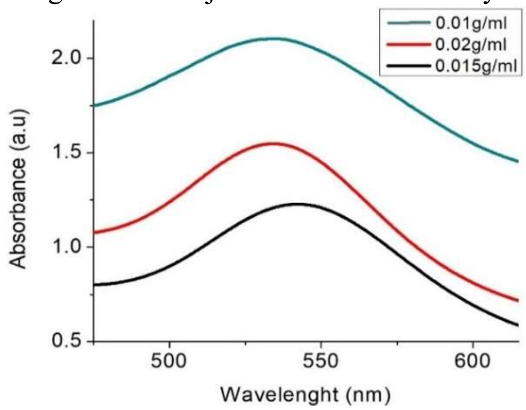

Figure 1. UV-Vis spectra of gold nanoparticles synthetized varying the concentration of extract.

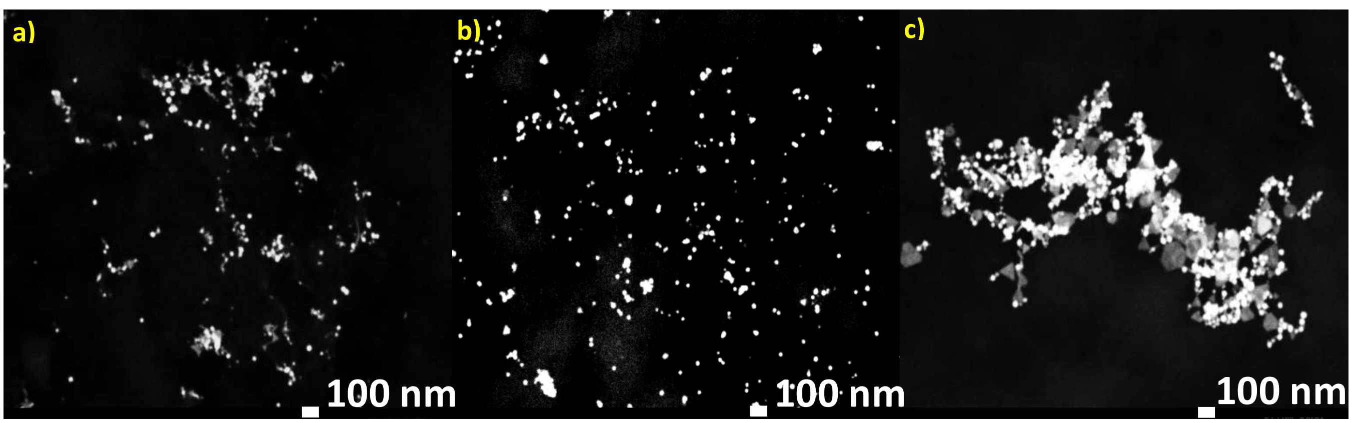

Figure 2. SEM micrographs of gold nanoparticles, a) 0.02g/ml, b) 0.015 g/ml and c) 0.01 g/ml.

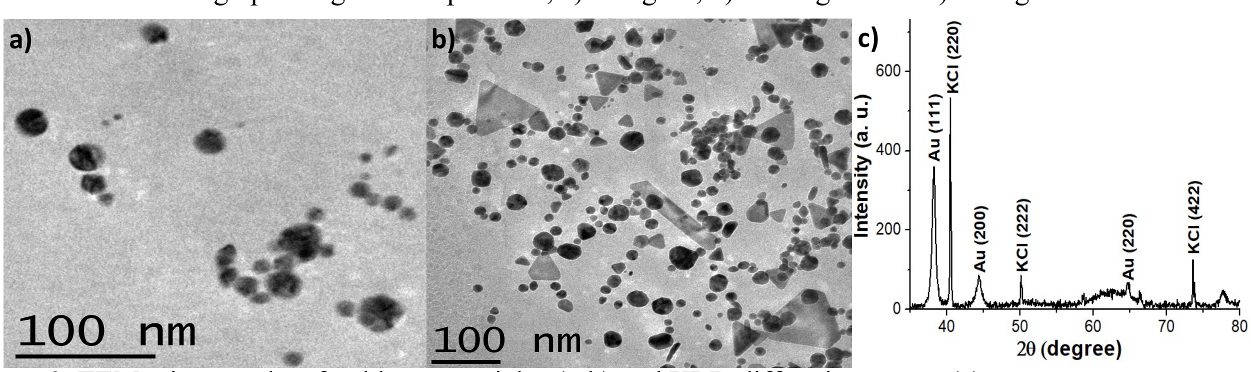

Figure 3. TEM micrographs of gold nanoparticles (a-b) and XRD diffraction patern (c).

https://doi.org/10.1017/S1431927618009182 Published online by Cambridge University Press