Green biosynthesis of gold and silver nanoparticles obtained from the Antarctic algae *Palmaria Decipiens* and *Desmarestia menziesii*

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Over the last decades there has been a great surge of interest on the green synthesis of gold and silver nanoparticles due to their interesting properties and wide number of applications (Majdalawieh et al. 2014). Seaweeds have shown a huge potential in this field, having also been named as "bionanofactors" (Bhimba and Kumari 2014). The present study is the first dealt with an eco-friendly synthetic route that uses aqueous extracts from the red Rhodophyte *Palmaria* decipiens (Reinsch) Ricker 1987 (hereafter PD) and the Phaeophyta *Desmarestia menziesii* Agardh 1848 (hereafter DM) in obtaining gold (Au@PD and Au@DM) and silver nanoparticles (Ag@PD and Ag@DM). The reducing power and the concentration in soluble phenols of the extracts were measured. A direct relationship between the phenolic content and the reducing activity was found, with DM showing almost three times more reducing activity than PD, and the double of phenolic content.

The synthesis of nanoparticles was conducted through the reduction of $HAuCl_4$ and $AgNO_3$ led by the seaweed extracts with different reaction conditions. Their formation was confirmed by UV-Vis spectroscopy by the presence of the characteristic surface plasmon resonance band. In the case of Au@PD the maximum appears at 548 nm whereas in Au@DM show up at lower wavelength at 527 nm. Silver nanoparticles appeared at lower wavelength, 425 nm for Ag@PD and 405 nm for Ag@DM. Transmission Electron Microscopy was used for a better featuring of the size and shape spectra. Au@PD and Au@DM present mean diameters of 36.8 ± 5.3 and 11.5 ± 3.3 nm respectively. Ag@PD were the smallest particles synthesized, with a mean diameter of 7.0 ± 1.2 nm, compared with Ag@DM, with mean diameter of 17.8 ± 2.6 nm. The extracts appear to act as a reducing and stabilizing agent preventing the aggregation and precipitation of the nanoparticles.

Even though the mechanism of reaction led by seaweeds is not fully known and more studies should be conducted, our results suggest that hydroxyl and sulfonic groups from polysaccharides and amino and carbonyl groups from proteins could be involved in the metal reduction and in the nanoparticle formation.

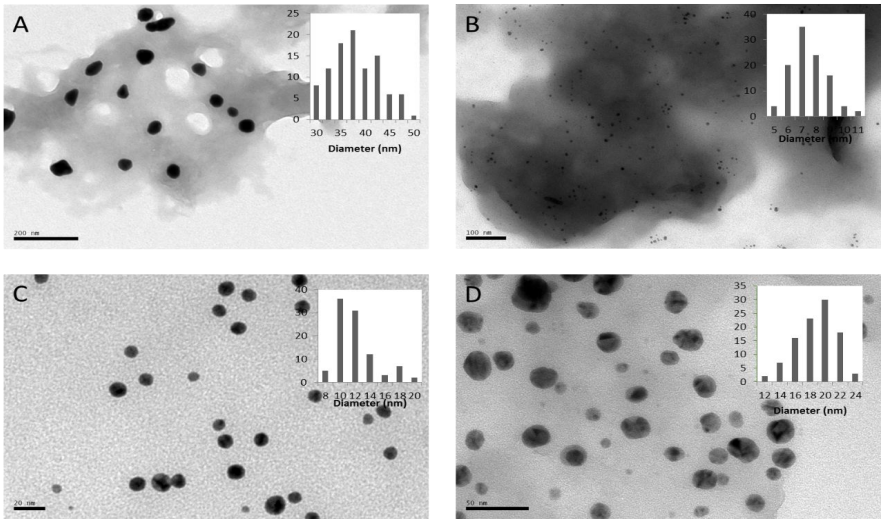

Figure 1. Transmission electron images of A) Au@PD, B) Ag@PD, C) Au@DM and D) Ag@DM. Inset size distribution of the nanoparticles obtained.

References

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