Nature is source of a great number of biomaterials, such as bovine bone, capable of being used as template in the synthesis of biocomposites. Hydroxyapatite, being represented by the formula Ca$_{10}$(PO$_4$)$_6$(OH)$_2$ [1], is the most ubiquitous compound of the family of calcium phosphates, well-known for being the main compound in bones and teeth structure. Furthermore, bovine bone is a natural, cheap, very resistant and waste material. Even more, it is biodegradable and renewable material. [2] In other hand, mono- and bimetallic Au, Ag, Pt, Pd, Fe and Cu nanostructures can be synthesized by reduction of their corresponding ions assisted by aqueous extract green tea (Camellia sinensis) [3]. Bio-reduction technique involves biomolecules present in green tea extracts for reducing the metallic precursor to obtain different kind of nanostructures, in size, shape and composition. The phenolic compounds and terpenoids are responsible for the formation and stabilization of nanoparticles, thus the concentration of these metabolites can serve as control of the size and shape of the nanostructures formed. This ecofriendly bioreduction method allows the formation in solution and in-situ support of metallic nanostructures on bovine bone and others biomaterials.

In this work, bovine bone is employed as a template to direct the nucleation and growth of mono (Au, Ag, Pt, Fe and Cu) and bi-metallic (Ag-Au and Au-Fe) nanostructures (micro-, submicro- and nanostructures to obtain, thus, the low cost and renewable metal/bovine bone nanocomposite. Novel biocomposites were analyzed by SEM, TEM and STEM (HAADF and BF) techniques. Microscopy studies of metal nanoparticles/bovine bone composite show their average size is under 10 nm for Au, Pt and Ag (Figure 1). Diffuse reflectance UV-Vis spectroscopy (DRS) was used to probe surface plasmon resonance behavior in the biocomposites.

One of the most promising area of application for nanotechnology is that related to environmental sciences, it is well known that the focus is towards green and viable methods that allow the remediation and treatment of wastewater, based on this, this project intends to obtain biocomposites build from metallic nanoparticles supported on bovine bone and use them as catalysts in the reduction of phenolic compounds presents in contaminated water. Bionanocomposites obtained have also promising future applications as catalyst, sensor and medical bone replacements.

References

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Fig. 1: Figure 1. HAADF and BF-STEM images of platinum nanoparticles supported on bovine bone.