Development of a biodegradable magnetic nanoprobe using SPIONs and Amazonian essential oils

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Abstract

Currently, the demand for higher quality magnetic nanoparticles for use as a magnetic nanoprobe to assist in medical imaging techniques and cancer therapy by hyperthermia has been high [1]. Moreover, recent results regarding the phytochemistry benefits that some Amazonian essential oils possess have sparkled great interest in developing methods to use these oils in various medical treatments [2].
The main objective of this work is to develop a biodegradable magnetic nanoprobe which allies the superparamagnetism versatility of iron oxide nanoparticles with the benefits associated with Copaiba and Andiroba's oils.
In order to improve the capabilities of this biodegradable magnetic nanoprobe, the synthesis method that originates the superparamagnetic iron oxide nanoparticles (SPIONs) [3] [4] was studied and certain paths were tested in order to improve that reaction product. Also, the cytotoxicity of the SPIONs was studied as well as the ability and effects of incorporating the SPIONs in Amazonian essential oils.
Particle size obtained for SPIONs was around 6 nm (figure 1). Mössbauer and XRD analysis indicate maghemite as their main iron oxide phase (figure 2). Also, small traces of magnetite proved to be present in some samples. VSM results showed a magnetization saturation of 57 emu/g, at 7 K, and 42 emu/g, at 300 K (figure 3). After incorporating the SPIONs in Copaiba and Andiroba essential oils these values dropped which indicates that a blocking effect occurs when the Amazonian oils are incorporated with SPIONS.
All the obtained results from the characterization data performed on the various samples seem promising towards having a biodegradable magnetic nanoprobe of SPIONs incorporated in Amazonian essential oils (figure 4).

Keywords: SPIONs; Amazonian essential oils; Copaiba; Andiroba; biodegradable magnetic nanoprobe; Mössbauer spectroscopy; XRD; VSM.

References

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Figures

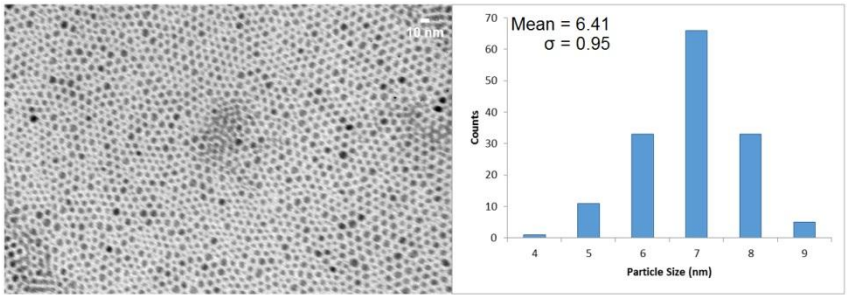

Figure 1 - TEM image and respective size distribution calculation for the SPIONs.

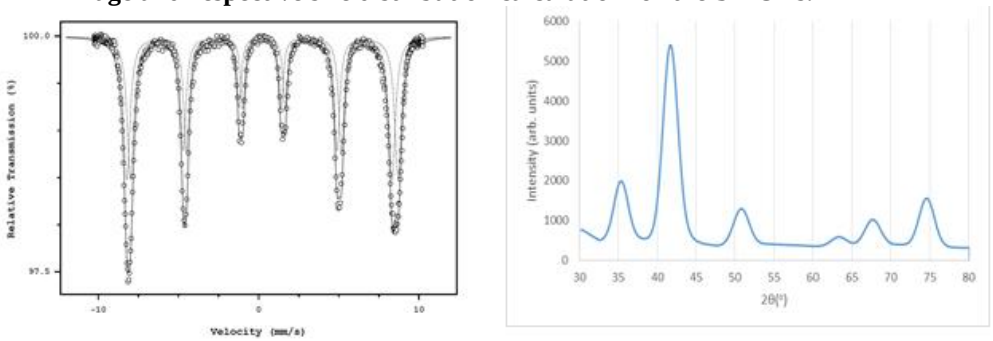

Figure 2 – Mössbauer spectroscopy and XRD diffractogram of the SPIONs.

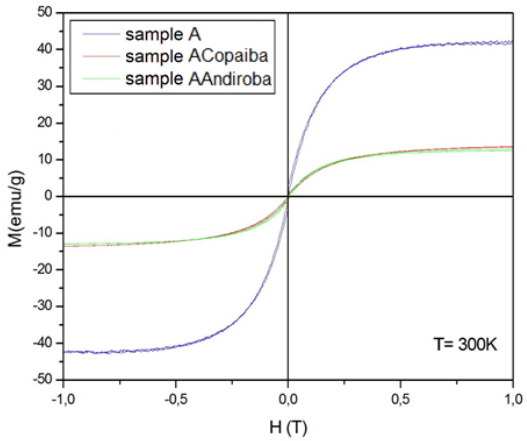

Figure 3 – Magnetization measured as function of an applied field, at 300 K, to the SPIONs incorporated in Amazonian essential oils.

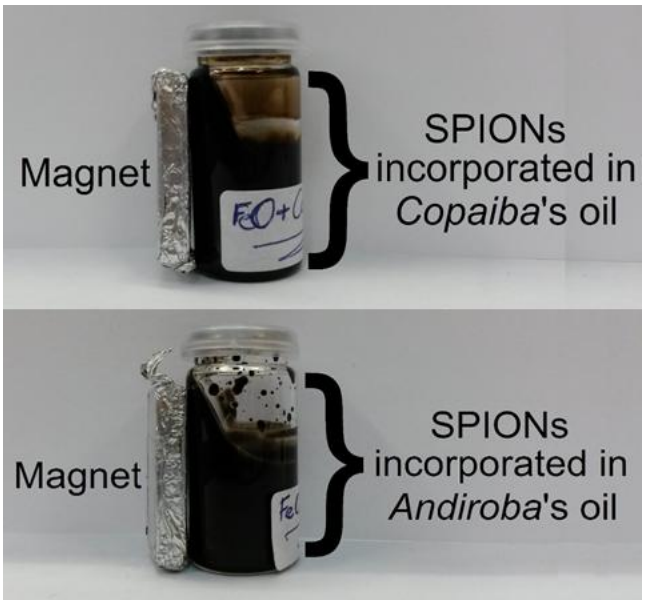

Figure 4 - Application of an external magnetic field to SPIONs incorporated in Copaiba (top) and SPIONs incorporated in Andiroba (bottom).