

Hyperfine interaction study of iron oxide nanoparticles coated with Amazon ucuúba, bacaba and açai, oils by PAC spectroscopy using ^{111}In - ^{111}Cd nuclear probe nuclei

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The use of nanoparticles coated with different materials have been the subject of study by many researchers to improve the quality of nanomaterials for biomedical applications such as controlled drug delivery, image contrast and treatment of cancer by magnetic hyperthermia [1]. In this work we used ucuúba (*virola surinamensis*), bacaba (*Oenocarpus bacaba* Mart.) and açai (*Euterpe oleracea* Mart.) oils to coat Fe_3O_4 nanoparticles. The ucuúba, bacaba and açai are native tree of the Amazon forest, whose oils are rich in fatty acids present in different proportions, such as, lauric, myristic, steatic, oleic, palmitic, and linoleic acid. These pure oils, free of solvents, were obtained by the extraction method with carbon dioxide in the supercritical state [2], and added during the synthesis process of iron oxide nanoparticles by thermal decomposition method [3]. The samples were characterized by X-ray Diffraction (XRD), Transmission Electron Microscopy (TEM) and Perturbed Angular Correlation (PAC) spectroscopy. The XRD results confirmed the formation of Fe_3O_4 phase. The TEM results determined the average size to be (> 5 nm) and possible spherical morphology of the magnetite nanoparticles. In order to perform the PAC measurements, ^{111}In - ^{111}Cd probe nuclei were diffused in the powder samples at 973 K for 2.5 h. PAC measurements permitted the determination of electric quadrupole and magnetic dipole -hyperfine parameters as a function of temperature. The Curie temperature in each case was determined to be ~ 855 K.

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