# Study by perturbed angular correlation spectroscopy with $^{111}$In-$^{111}$Cd of iron oxide nanoparticles synthesized using Amazon ucuúba, bacaba and açaí, oils

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The use of nanoparticles coated with different materials are also a subject of study by many scientists 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 was used ucuúba (*virola surinamensis*), bacaba (*Oenocarpus bacaba* Mart.) and açaí (*Euterpe oleracea* Mart.) oils to coat $Fe_3O_4$ nanoparticles. The ucuúba, bacaba and açaí are native tree of the Amazon forest, whose oils is rich in fatty acids present in different proportions, such as, lauric, myristic, steatic, oleic, palmitic, and linoleic acid. These pure oils, free of solvents, was obtained by the extraction method with carbon dioxide in the supercritical state [2], and added to the synthesis process of iron oxide nanoparticles by thermal decomposition method [3]. The samples were characterized by X-ray diffraction (XRD), it was possible to verify the formation of $Fe_3O_4$ nanoparticles by the position and width of the intensity peaks. Transmission electron microscopy (TEM) were used to observe the average size (> 5 nm) and possible spherical morphology of the magnetite nanoparticles. In order to perform perturbed angular correlation spectroscopy (PAC) the powder samples were heated at 973 K for 2,5 h to diffuse the $^{111}$In-$^{111}$Cd probe nuclei. Using this technique, it is possible determine the electric quadrupole and magnetic dipole hyperfine parameters of the samples as a function of temperature, and it was determined the Curie temperature of ~ 855 K for both samples. The results showed that it is possible synthesized $Fe_3O_4$ nanoparticles using ucuúba, bacaba and açaí oils.

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