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Synthesis, Activation and Application Testing of Gold Nanoparticles for Nanobrachytherapy

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For more than 50 years, the Energy and Nuclear Research Institute IPEN, has been offering solutions to Brazil through nuclear technology. Thus, one of the main areas where IPEN has contributed assertively is medicine. Reaching the level of 32 radiopharmaceuticals and radioactive sources intended both for therapy and for the diagnosis of several pathologies, including cancer, which are obtained with the help of the two nuclear reactors and two cyclotrons present in the institution. The Institute has a team for the development, production and distribution of radioactive sources for brachytherapy, such as 192 Ir wires and 125 I seeds. Brachytherapy is a cancer treatment technique where the radioactive source is placed close to or in contact with the lesion. The great advantage of the technique is to save healthy tissues. Currently, we are working on obtaining nanometric materials that can be applied in the emerging nano brachytherapy, because of its properties and characteristics at the nanometric level, gold has been the subject of studies and tests. Elemental Au gold can be activated 198 Au inside a nuclear reactor, and has β- decay and a half-life of 2.7 days, which makes it ideal for short-term irradiations. In addition, gold in the form of nanoparticles has a completely different chemistry, with gold nanoparticles (AuNPs) being easily functionalized by a large part of molecular and polymeric binders, which may present favorable characteristics for the studies, and together with AuNPs they are able to work synergistically to achieve greater efficiencies. Currently, AuNPs have been successfully functionalized with gum arabic (GA), a coating widely used in the cosmetic and food industry, which is low cost and along with nanoparticles has shown biocompatibility with different cell groups and has been shown to be very stable over time. The project includes studies regarding the synthesis of nanoparticles, coating, cytotoxicity of AuNPs in vitro "cold" (non-radioactive) and the development of activation protocols in the nuclear reactor. In the next phase, after activation, in the reactor, "hot" tests will be performed in vitro and in vivo.