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Multipurpose Gamma Irradiator and Mobile Unit with an Electron Beam Accelerator Developed in Brazil

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The radiation processing technology for industrial and environmental applications has been developed and used worldwide in the fields of water treatment, advanced materials, nanotechnology, medicine, tissue engineering, disinfestations and disinfection of books and documents, processes and industrial production and natural resources, among others.

The Radiation Technology Centre in Nuclear Energy Research Institute (IPEN), of the National Nuclear Energy Commission (CNEN) developed a small size continuous run and multipurpose industrial gamma irradiator with a revolutionary design and national technology to be used as a demonstration facility for manufacturers and contract service companies that need economical and logistical in-house irradiation system alternatives. In addition, it will be useful for supporting the local scientific community on development of products and processes using gamma radiation, assisting the traditional and potential users on process validation, and for training and qualification of operators and radioprotection officers.

The developed technology for this facility consists of continuous tote box transport system comprising a single concrete vault, where the automated transport system of products inside and outside of the irradiator utilizes a revolving door integrated with the shielding, avoiding the traditional maze configuration.

Covering 76 m² of floor area, the irradiator design is product overlap sources and the maximum capacity of cobalt-60 wet sources is 37 PBq, tote boxes, Category IV, wet storage. The performed qualification program of this multipurpose irradiator was based on AAMI/ISO 11137 standard, which recommends the inclusion of the following elements: installation and process qualification. Nowadays, installed activity in the multipurpose irradiator is 7.4 PBq (200 kCi) with cobalt-60 sources. For irradiator dose optimization, the source distribution was done using the software Cadgamma developed. The poly-methylmetacrylate (PMMA) dosimeters system was used for irradiator dose mapping. The economic analysis and performance, concerning to the dose uniformity and cobalt-60 utilization efficiency were calculated and compared with other commercial gamma irradiators available in the market.

Nowadays, the Radiation Technology Centre is involved in the establishing of a mobile unit with an electron beam accelerator to treat industrial effluents for reuse purposes. The mobile unit will be equipped with an electron beam accelerator (0.7MeV and 20kW) with safety requirements (BSS, IAEA and CNEN Safety Standards), and can be used for treatment of effluent from petroleum production, for petroleum desulfurization, and, in addition, for degradation of toxic organic compounds in wastewater for reuse. This project is supported by the IAEA (TC Project BRA1035 - 2016-2018) and by the Brazilian Financial of Studies and Project (FINEP). To enlarge the national capacity to treat industrial effluents using electron beam accelerators, the mobile unit treating effluents on site from 1m³/h up to 1,000m³/day, will provide an effective facility between a laboratory-scale plant to a large-scale plant, with the objective to demonstrate the efficacy and to transfer the technology. Studies have taken place in various productive sectors in the country and in other foreign laboratories to prove that the radiation treatment offers technological and economic benefits over the conventional techniques for treating recalcitrant pollutants.

Country/Organization invited to participate

Brazil

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