STATUS OF CURRENT DEVELOPMENTS AND APPLICATION OF TWO ACCELERATORS AT MEXICO.

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The Instituto Nacional de Investigaciones Nucleares (ININ) is the national laboratory of México. Amongst the irradiation facilities there are three accelerators with the following characteristics: A home made electron accelerator Pelletron type, with a beam energy from 0.15 to 1.1 MeV, a maximum beam intensity of 50 μA, an scan beam system with a variable frequency from 0 to 200 Hz, which provides an electron beam size of 5 cm wide and 60 cm long; a mixture of 80% N_2 and 20% CO_2 is used as dielectric gas. The accelerator has several experimental facilities some of them are an X ray Bremsstrahlung converter, a waste water and sewage sludge irradiation system, and a vertical conveyor system.

There is a Tandem Van de Graaff accelerator with a SNICS ion source, a variable voltage at the central terminal from 1 to 6 MV, an external proton beam which allow PIXE analysis of large samples under atmospheric conditions, a versatile irradiation chamber with the associated electronics to perform RBS, PIGE, ERDA, NRA, a high energy neutron beam from (d,n) and (p,n) nuclear reactions and a micro-beam line.

A multipurpose Tandetron accelerator with a maximum terminal voltage of 2 MV, a SNICS and a Duoplasmatron ion sources; at present a PIXE line is fully operating and in the near future all nuclear analytical techniques will be set up.

The accelerators are used for biological, material, environmental and industrial applications. The research teams are multidisciplinary and the general objective is the applications on nuclear analytical techniques to the above fields. This paper presents a general panorama of two accelerators and some applications using the electron accelerator Pelletron type.

Three studies are presented which were performed with the accelerator Pelletron type: 1) radiation effects on sewage sludge and waste water samples 2) simulation of both heavy ions and gamma radiation, and 3) basic research in polymers.

1) Test runs were performed to evaluate the effects of e-beam system on sewage sludge and waste water samples, under different operating conditions. A contaminated water simulates and samples from waste water treatment plant from Toluca city were studied, at laboratory level for determining the reduction of chemicals and biological pollutants, to establish the radiation and operation parameters required for a feasibility study of irradiation plant as an alternative treatment of these wastes in Mexico.

Typical pollutants in waste water and sewage sludge are benzene, toluene, and phenol, initial experiments with these toxic organics were intended to determine reliable dose/destruction relationships, when present as single compounds in solution or as mixtures.

This is accomplished by dissolving the organic compounds of interest in water and then irradiated with an electron beam, in small stainless steel chamber. Benzene (5 mg l^{-1} and 20 mg l^{-1}), toluene (5 mg l^{-1} and 20 mg l^{-1}) and phenol (10 mg l^{-1} and 50 mg l^{-1}), for studying the degradation effect produced by an electron beam of 0.5 MeV and a beam intensity of 24 μA, each contaminated water sample (CWS) had a volume of 1.5 ml and pH values of 5 and 9.

An absorbed dose of 12 kGy, reduced more than 99.7% Benzene concentration, more than 98% toluene and more than 88% phenol. Similar contaminants, concentrations, irradiation conditions and results were obtained for treatment sewage sludge samples. This paper provides details of the removing benzene, toluene, and phenol from water and sewage sludge samples with different pH and doses.

2) The Pelletron type accelerator has being useful also in simulating gamma irradiation for qualification of paint coatings with an electron beam. The radiation test on paint coatings were performed as a request from our nuclear power facility with doses defined by the Safety Analysis Report of a BWR Type Mark II.

A comparison of two sets of paint-coating specimens irradiated one set with a gamma beam and second one with an electron beam was made. A commercial Cobalt 60 gamma source at a dose rate of 4.55 kGy/h, 8 kGy/h and 10 kGy/h and doses up to 725 kGy were used for gamma irradiation whereas an electron beam of 0.8 MeV produced dose rates from 5 MGy/h to 10 MGy/h according with the electron beam intensity.

3) In order to study alternative dose determination methods, the bulk etching velocity and the latent track annealing of LR115 track detectors was studied during electron irradiation runs from electron accelerator Pelletron type. For this purpose alpha irradiated and blank detectors were exposed to increasing electron doses from 10.5 to 317.5 kGy. After irradiation with electrons the detectors were etched under routine conditions, except for the etching time, that was varied for each electron dose in order to reach a fixed residual thickness. The variation of the bulk etching velocity as a function of each one of the electron doses supplied, was interpolated in order to obtain dosimetric response curves. The observed annealing effect on the latent tracks is discussed as a function of the total electron doses supplied and the temperature.