

ANALYSIS OF THE POWER SYSTEM FROM AN ELECTRON BEAM ACCELERATOR AND THE CORRELATION WITH THE THEORETICAL DOSIMETRY FOR RADIATION PROCESSING

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Dynamitron DC1500/25/04 type electron beam accelerator (EBA), model JOB 188, was manufactured by IBA Industrial (Radiation Dynamics, Inc.) and installed at IPEN/CNEN-SP in 1978. The technical specifications of the EBA are: energy 0.5 to 1.5 MeV; beam current: 0.3 to 25.0 mA; beam scanning: 60 to 120 cm; beam width: 25.4 mm and frequency: 100 Hz. Nowadays, this accelerator has been used for innumerable applications, such as: for sterilization of medical, pharmaceutical and biological products; treatment of industrial and domestic effluents and sludge; preservation and disinfestations of foods and agricultural products; lignocellulosic material irradiation as a pre-treatment to produce ethanol bio-fuel; decontamination of pesticide packing; solid residues remediation; organic compounds removal from wastewater; treatment of effluent from petroleum production units; crosslinking of foams, wires and electric cables; composite and nanocomposite materials and carbon fibers irradiation; irradiated grafting ion-exchange membranes for fuel cells application; natural polymers and multilayer packages irradiation, and biodegradable blends production. The energy of the electron beam is calculated as a function of the current in the accelerator high-voltage divisor, taking into account the thickness and density of the material to be irradiated. This energy is calculated considering the electron through the entire material and the distance from the titanium foil window, so that the absorbed doses at the point of entrance and exit are equivalent on the material. The dose is directly proportional to the beam current and the exposure time of the material under the electron beam and inversely proportional to the scan width. The aim of this paper is to analyze the power system parameters of the EBA Dynamitron DC1500/25/04 accelerator, such as, voltage and root-mean-square (RMS) current in the oscillator system, high voltage generator and waveform, using software developed in the Radiation Technology Center at IPEN/CNEN-SP to simulate the energy efficiency of this industrial accelerator. Finally, it is also targeted to compare theoretical dosimetry using parameters of energy and beam current with data from the accelerator power system. This knowledge and technology will be very useful and essential for the control system upgrade of EBA, mainly Dynamitron DC1500/25/04, in view that radiation processing technology for industrial and environmental applications has been developed and used worldwide.