DEVELOPING RADIATION TREATMENT METHODOLOGIES FOR DECONTAMINATION FOR FIRST USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) USING TUNISIAN ELECTRON BEAM ACCELERATOR

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Keywords: Dosimetry; E-beam accelerator; Personal Protective Equipment (PPE).

The Tunisian irradiation infrastructure was reinforced in end of 2009 by a high-energy electron beam accelerator with three energy levels (5, 7.5 and 10MeV). The electron beam facility represents the first semi-industrial scale in Tunisia and in North Africa. The facility is composed of RF linear accelerator of electrons, type CIRCE III, (Fig.1.) and an electromechanical conveyor system. The main characteristics of this Linac are three energy levels of the E-beam with a maximum power of 5 kW. The E-beam is pulsed (12.5µs). The conveyor is able to transport boxes from size 40 × 30 × 20 cm3 to size of 80 × 50 × 50 cm3 for a weight range of 1-35 kg for and a speed range of 15-500 cm/min. [1,2]

The productivity estimated of this new facility is 2.2 m3/h for medical products irradiated at 25 kGy and 360 kg/h for spices at 10 kGy, 3.15m3/h for surgical masks at 5kGy and 3.52 m3/h for Face Shields at 5kGy.

For (IQ), (OQ) and (PQ) Qualifications [3, 4], two dosimetry films were used for the dose measurements: CTA (type FTR-125, dose range: 0.1–100 kGy) film measured at 280 nm [4] using the Aerial Equipment [5] and GEX B3 dosimeters 1 to 80 kGy [6]. A medium size box (60×40×40 cm3) filed with rock wool, as reference materials, is used in the following experiment.

Tunisian Electron irradiation facility is used for decontamination and sterilization of Personal Protective Equipment (PPE), including surgical masks and Face Shields. Five sept of samples were selected from each received batch and treated with different electron irradiation doses (5, 10, 15, 20 and 25 kGy). A post irradiation inspection and evaluation of irradiated devices in relation to mechanical and Colorimetric change were carried out by the suplier in concordence with related regulations and standards. Microbiological characterization of the protective devices were carried out in CNSTN laboratories. The results showed that all treated samples are cleaned with 5 kGy dose and the survival rate of bacteria was significantly reduced function of the dose increases compared to non-treated samples. Results obtained by colorimetry show small change hardly discernible to the naked eye in the color properties of Face Shields after irradiation at 5kGy for higher doses the color becomes more and more dark a progressive loss in tensile strength was detected after irradiation especially for surgical Mask for dose up to 25kGy.

An appropriate methodology for the facility operating parameters (conveyor speed, beam current, scan width…) were developed for such kind of product.

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FIG.1. Tunisian E-Beam Accelerator