2011 International Nuclear Atlantic Conference - INAC 2011
Belo Horizonte,MG, Brazil, October 24-28, 2011
ASSOCIAÇÃO BRASILEIRA DE ENERGIA NUCLEAR - ABEN
***ISBN:* 978-85-99141-04-5**

RESEARCH OF THE LIMIT OF THE DOSAGE OF GAMMA IRRADIATION SUPPORTED BY RFID TAGS

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ABSTRACT

Good manufacturing practices (GMP) has as its premise the traceability of a product. The use of barcode readers to identify boxes containing products to irradiate, in large irradiators, to enter and leave the radiator is common practice and low cost. However, if the products inside the box of irradiation have labels (tags) with Radio Frequency IDentification (RFID) would be appropriate, therefore, all products inside the box, would be identified to go through a portal to reading these tags both on input and output of the irradiator. However, sample tags under different irradiation dosages range from 1 to 50 kGy, showed that the chip implanted in the tag does not stand up to gamma irradiation above 1 kGy. It was concluded that, for this threshold of irradiation, the use of RFID tags would be appropriate for small irradiators for doses below 1 kGy, due to the destruction of the chip within the tag for irradiation above 1 kGy

Key Words: Gamma Irradiation, Irradiators, GMP, RFID.

1. INTRODUCTION

The process of irradiation of products in large range of irradiators must follow Good Manufacturing Practices (GMP) in order for certifying the quality of the process. Product traceability in irradiation environment is crucial. The main quality of the process is the fact to identify the product being processed in the irradiator, i.e., to register of unequivocal form that the product entered and left the irradiator and that the same it received the dosage specified for the product.

The identification of products for bar code labels is widely used to allow traceability in logistics (material handling). However, the radiated products being in a box of irradiation are only possible to affirm of indirect form that the same was submitted to the irradiador. However, tags with Radio Frequency Identification will have been used (RFID) all the products inside of the box of irradiation could be identified directly by a vestibule of reading of tag of RFID. This form of traceability would be the best way to affirm that the product really was radiated without any assumption in the opposite. To use tags of RFID, the

principle, it is necessary to certify itself that the same ones are not destroyed by the radiation gamma. To verify the viability using common RFID tags the present study was become fulfilled. It was broken of the estimated that the tags must resist the superior doses of irradiation gamma 10 kGy.

2. DOSIMETRY

The service of dosimetry carried through in the Laboratory of Dosimetry in Processes of Irradiation (LDPI) of the IPEN is carried through in agreement with the norms of the American Society for Testing and Materials - ASTM [1].

2.1. Routine Dosimetric System

For the experiment was adopted the Routine Dosimetric System for verification of the amount of absorbed dose. The following dosimeters had been used: Gamachrome YR-Harwell Batch 64, Amber 3042 Batch R and Red Perspex Batch HL. As irradiation source gamma ^{60}Co was used the irradiator Gammacell 220 Series number 142. The measurements of the specific absorbance of the dosimeters had been carried through in spectrophotometer Genesys 20. The thickness was measured by Mitutoyo micrometer. The measures of dose are made by intercomparison of Dose Measurements from curves of calibration carried through using the same equipment. The guarantee of the calibrations is kept by the intercomparison with the Service of Guarantee of Dose offered for the International Agency of Atomic Energy [1] [2] [3].

2.2. RFID tag

The verification of the viability of use of RFID tags for processes of irradiation with dosage above of 10 kGy was carried through assay of dosimetry for a lot of passive RFID tags This type of tags are energized by external source through the antenna tag (Fig.1) is composed for a long antenna connected to one chip with capacity of storage of its code and some data. These tags are printed matters in self-adhesive labels of use joint in packing of commercial products. A total of seven tags for the test were used. They had been identified in accordance with the amount of dose of waited irradiation: 1, 5, 10, 20, 30, 40 and 50 kGy. One for control was reserved.

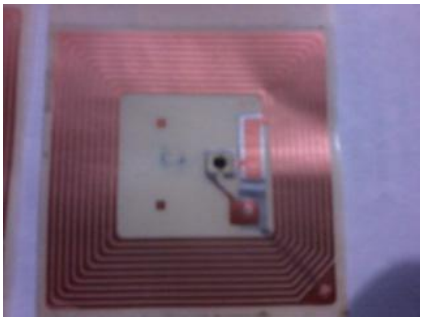

Figure 1 – RFID Tag

2.3. Reading of RFID Tags

In Table 1 are related the following information: the number of the dosimeter, the amount of waited dose, the amount of dose deals [2] and if chip of tag survived or the irradiation not after. It can be evidenced that, unfortunately, the dosimeter number 1 was only unbroken. The interval between 1 kGy and 5 kGy was not carried through as a more refined experiment to verify which amount of kGy for which tag leaves to function.

Table 1. Dose measurements received by tag and the destruction of the chip of the tag[2]

Dosimeter nº	Expected Dose (kGy)	Amount of Dose (kGy)	Destruction of chip inside of RFID tag after irradiation
1	1	1.0	NOT
5	5	5.1	YES
10	10	10.4	YES
20	20	20.7	YES
30	30	30.6	YES
40	40	41.0	YES
50	50	51.3	YES
Control	-	-	NOT

Before the experiment was certified that all tags had been read by a RFID reader. For being tags virgin its code of manufacture was only available. Tag of control was kept unbroken to certify the reading of the reader of RFID tag.

In this experiment labels with bar code had been also radiated, with respective tags, to observe, visually, if the labels would support the radiation gamma. These had been unbroken as was expected.

3. CONCLUSIONS

The present experiment demonstrated that, the use of RFID tags printed on self-adhesive labels common element of traceability of products in the environment of irradiation of large irradiators, if showed impracticable due to destruction of chip contained in tag for irradiation above of 1 kGy.

During the feasibility study of the use of RFID tags the costs of installation of the equipment of reading and writing of RFID tags had been studied that, compared with costs of equipment installation to track labels with bar codes, had been very above of acceptable (R$ 100,000 for RFID tags against R$ 5,000 for bar code) [4].

ACKNOWLEDGMENTS

Thanks you the Towers Industry and Commerce of Labels and Adhesives Ltda by providing the RFID tags will be testing.

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