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INVESTIGATION OF RPL IN NATURAL CORN STARCH BIOPOLYMERS

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1. Introduction

In this work we present a study on the production and photoluminescent characterization of corn starch biodegradable polymer after exposure to ionizing radiation. In this context, an analysis was performed on the radio-induction of photoluminescent properties in the corn starch films, a material without photoluminescent properties, which after being irradiated, show photoexcited luminescent features.

2. Methodology

The dosimetric characterizations of these films were made using UV-Vis and FTIR spectrophotometry, DRX and photoluminescent (PL) emission spectroscopy techniques. The irradiations were done in the Gamma Irradiation Laboratory of the CDTN (Source of Co-60, 60,000 Ci). The corn biofilms were irradiated with doses ranging from 1 to 1000 kGy.

3. Results and Discussion

The results indicated an increase in the intensity of the photoluminescence presented by the samples after being irradiated, thus revealing a linear relationship between PL x Dose. The phenomenon involved in the photoluminescent emission observed in the corn starch biofilms after exposed to high doses of gamma radiation is quite similar to another phenomenon, which is observed just in inorganic crystals. It is known elsewhere as radiophotoluminescence (RPL). This phenomenon was first reported by Schulman et al. (1951), where the characteristics of radiophotoluminescent Ag-activated phosphate glass are described [1]. Still nowadays it is among the best RPL dosimeters used for environmental and radiological dosimetry. We note that in inorganic RPL materials the PL signal is obtained when an electron is photoexcited from the defect's ground state to an excited state. Relaxation back to the ground state results in the emission of luminescence. The phenomenon was first observed in organic materials just in 2014 by Schimitberger et al. [2]. Ag-activated phosphate glass emits luminescence when exposed to UV light when irradiated with ionizing radiations, whereas the Poly(butylene adipate-co-terephthalate) [PBAT] copolymer irradiated with gamma doses, emits huge luminescence emission (PL) at 490 nm when photoexcited with Blue LED of 405 nm.

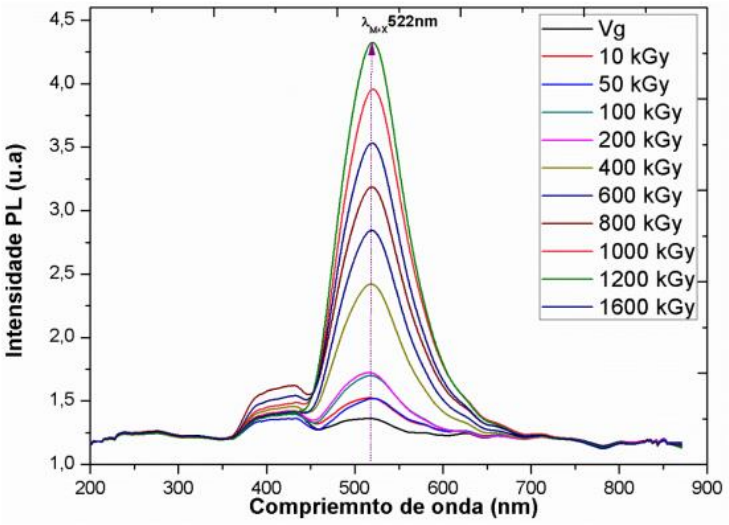

Figure 1: PL intensity for doses studied.

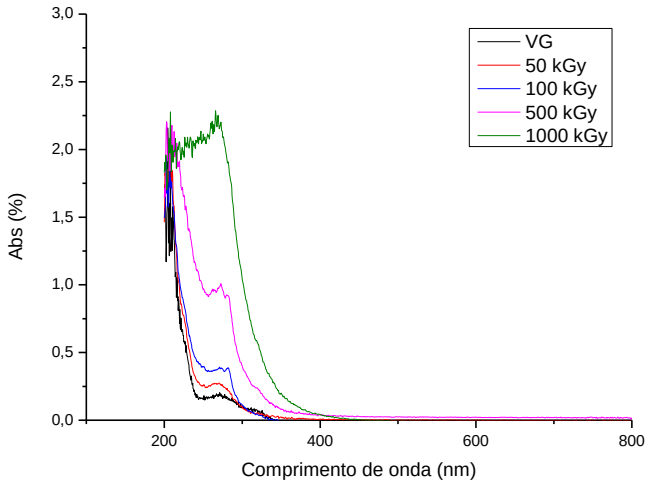

Figure 2: UV Vis characterization for different irradiation doses.

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