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POLY(BUTYLENE ADIPATE CO-TEREPHTHALATE)/POLY (LACTIC ACID) (PBAT/PLA) BLEND CHARACTERIZATION PROCESSED BY ELECTRON BEAM

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ABSTRACT

The aim of this research was to check the changes in the mechanical and thermal properties of poly(butylene adipate co-terephthalate)/poly(lactic acid) (PBAT/PLA) polymeric blend, which commercial name is Ecovio®, after radiation processing in different absorbed doses. PBAT and PLA are biodegradable polymers and the Ecovio® polymeric blend consists of at least 80% of polymers from renewable resources. The irradiation was performed in a Radiation Dynamics Inc. electron beam accelerator, with 1.5 MeV of energy and electric current of 25 mA. Samples were prepared for micrograph, mechanical and thermal analyses. These samples were irradiated with absorbed doses of 5 kGy, 10 kGy, 15 kGy, 25 kGy and 50 kGy. The samples, after irradiation, were submitted to experiments of ultimate strength, tensile strength, ultimate elongation, differential scanning calorimetry (DSC) and scanning electron microscopy (SEM). The results showed a good interaction between the components of the polymeric blends and the radiation effect on polymeric blend promoted changes in PBAT and PLA polymers, increasing tenacity of these biopolymers and consequently facilitating yarn formation in processing. In conclusion, these irradiated blends could be used to make environmental friendly products.

Keywords: (PBAT/PLA) polymeric blend, electron beam, biodegradable polymers, Ecovio®.

1. INTRODUCTION

The polymers are present in our life, as in films, textile fibers, rubbers, among other products (LENI, 2007).

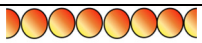
The use of polymers is strongly linked to humanity as society has evolved the use and scientific advances of polymers have also evolved (PITT, BOING and BARROS 2011).

In the 21th century there is a concern about the development of biodegradable polymers, with the launch of PLA [Poly (lactic acid)] in 2003, Ecovio® in 2006 and Ecoflex®, produced from renewable sources in 2010, among others (PEREIRA, 2014). In the 21th century, attention is also being paid to biodegradable polymers in several searches, it can be highlighted the work of BASTIOLI (2005) a handbook of biodegradable polymers, the research by POVEDA (2008) that verified the effects of ionizing radiation on Ecobras® and PBAT [Poly(butylene adipate co-terephthalate)] and ROSALES (2015), who studied the effects of this radiation on PLA. There are many study of biodegradation in biopolymers, as example, AZEVEDO, *et al.* (2016), who evaluated the degradation of composites with natural fibers, it was too studying by KODAMA (2013), among other studies, and the standards:

ASTM – G160 – 12 – STANDARD PRACTICE FOR EVALUATING MICROBIAL SUSCEPTIBILITY OF NONMETALLIC MATERIALS BY LABORATORY SOIL BURIAL (2012) and ASTM – D5338 – 15 – STANDARD TEST METHOD FOR DETERMINING AEROBIC BIOLOGICAL CONTROLLING DIFFERENTIAL DEVELOPMENT TEMPERATURES (2015),

Polymer blends or polymer composites can also be found on the market, a brief description of each mixture of polymers is shown in Table 1. The first column being the type of mixture, the second column a brief description of this mixture and the last column an illustration of the said polymer mixture. In the illustrations the circles represent the polymer molecule, the colors the chemical function and the rectangles chemical substances which are not classified as polymers.

Table 1: Classification of mixture of polymers (Adapted from CALLISTER JUNIOR and RETHWISCH, 2012; MOURA, DIAZ and RANGARI, 2019).

Classification	Description	Illustration
Copolymer	Polymer formed by different monomers	 RODA (2015).
Composite	Mixture of compounds of different natures with the intention of printing new properties to the materials	 MARTINS (2013).
Blend	Polymer blends by definition are physical mixtures of homopolymers and or copolymers with different chemical structures	 SILVA (2019).

When there is a mixture between a polymer and another type of material, this mixture is classified as composite, since when there is a mixture between two polymers, this is denominated a blend, both being heterogeneous mixtures. The focus of this work is to study the effect of ionizing radiation (electron beam) on Ecovio®, which is a polymer blend, composed of two biodegradable polymers. Therefore, the next item of this article presents a contextualization in relation to biodegradable polymers.

In relation to the *per capita* production of polymers in Brazil, in the order of 31.49 kg.year^{-1}, this production is approximately one hundred times higher than the world *per capita* production of polymers, which is 0.30 kg.year^{-1}.person^{-1} (CALIXTO, 2017; EDGARD JÚNIOR, 2017). However, the production of polymers in Brazil is still below in a number of countries, such as the North American Free Trade Agreement (NAFTA) group of countries - the United States, Mexico and Canada - whose value is 91.20 kg.year^{-1}.person^{-1}. Already in relation to the group of countries that make up the European Union (EU) production per capita of this group of countries is of the order of 79.90 kg.year^{-1}.person^{-1}. Finally, in relation to these data, it is important to note that China has a production of 71.78 kg.year^{-1}.person^{-1}, among others (ABIPLAST, 2019 and INDEXMUNDO, 2018).

2. PETROCHEMICAL POLYMERS, GREEN POLYMERS, BIOPOLYMERS AND BIODEGRADABLE POLYMERS

Of the total plastic produced worldwide, about 79% were discarded directly into the environment (LEITE, 2018). Therefore, 6.5 billion tons of plastics may have caused negative

environmental impacts, denigrating the image of the plastics, as well as damaging the environment and global sustainability. To solve the problem above one of the ways is the use of biodegradable polymers which are used for making consumer goods and when discarded are degraded faster than products made with non-biodegradable polymers, thus contributing to global sustainability. However, what are biodegradable polymers?

For ASTM-D883 – TERMINOLOGY RELATING TO PLASTICS (1999) *apud* PLATT (2006, p.11) biodegradable polymers have their degradation resulting from the natural action of microorganisms such as bacteria, fungi or algae. BRITO, *et al.* (2011, p.128) adds the time of biodegradation in the definition of biodegradable polymer, for a polymer to be considered biodegradable, it is necessary for natural microorganisms to degrade in a maximum of six months. FRANCHETTI and MARCONATO (2006, p. 812) add the definition of biodegradable polymers as the chemical substances of the decomposition of these polymers. For the authors biodegradable polymers are polymeric materials that degrade by releasing carbon dioxide, water and biomass as a result of the action of living organisms or enzymes. However, polymers can also be classified as: biopolymers and sustainable polymers (also called green polymers). For BRITO, *et al.* (2011, p. 127) biopolymers are polymers or copolymers produced from renewable raw materials such as maize, sugar cane, cellulose, chitin, among others, which may or may not be biodegradable, in relation to sustainable polymers. These polymers are polymers which during their synthesis, processing or degradation produce less environmental impact than conventional polymers (polymers whose monomer is from petrochemical origin and the polymer is not biodegradable, which may also be referred to as a petrochemical polymer) (EUROPEAN BIOPLASTICS, 2019 b and BASTOS, 2007). Thus it can be noticed that there are more than one classification of polymers related to its environmental characteristic.

In Figure 1 is shown in a playful way the classification of the polymers in relation to the environmental criterion. In the horizontal axis the polymer is evaluated in relation to its biodegradability and in the vertical axis considered the raw material of this polymer evaluating if this comes from sources renewable or not.

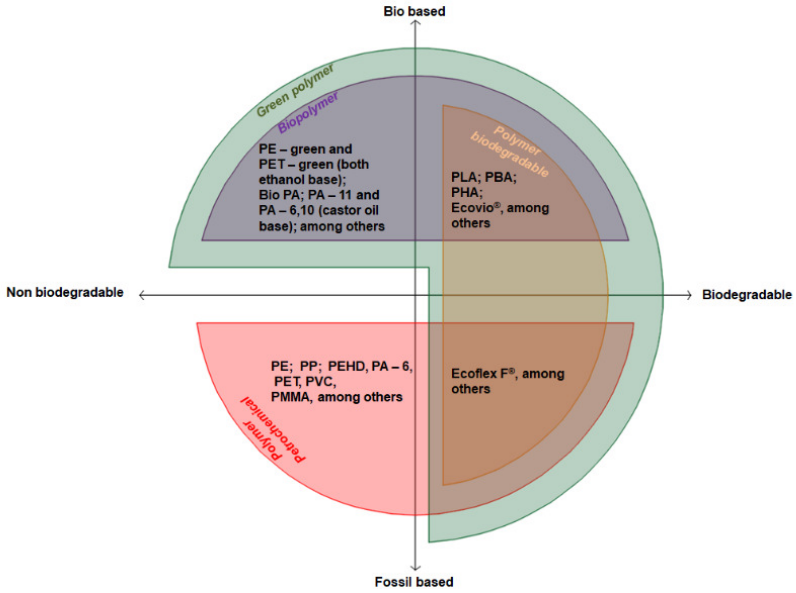


Figure 1: Classification of polymers for environmental criteria (Adapted from PLATT, 2006; BRITO, *et al.*, 2011; BASF, 2013; CHUWARTEN, TORRES and JESUS, 2013 and EUROPEAN BIOPLASTICS, 2019 b).

It can be seen that in Figure 1, the first, second and fourth quadrants represent the green polymers. The first and second quadrants represent the biopolymers, the biodegradable polymers are represented by the first and fourth quadrants. Finally the third and fourth quadrants represent the petrochemical polymers. Afterward, the denomination of green polymers is used to differentiate any polymers from the petrochemical polymers. When a polymer is classified as biodegradable this should automatically be classified as a green polymer. That is, any biodegradable polymer is a green polymer, it may be a biopolymer if this biodegradable polymer was produced from a renewable source. Therefore, the PBAT/PLA [Poly(butylene adipate co-terephthalate)/Poly(lactic acid)] polymer blend whose trade name is Ecovio®, both polymers can be classified such as biodegradable, biopolymers and green polymers. The concern with the environment may have generated a higher consumption of biodegradable polymers, and consequently an increase in the production of this type of polymer, as shown in Figure 2.

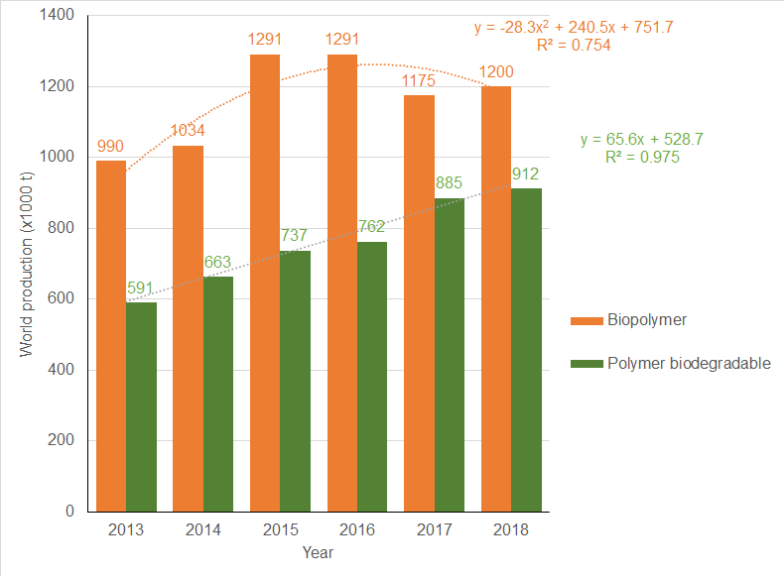


Figure 2: Evolution in world production (EUROPEAN BIOPLASTICS, 2016 and EUROPEAN BIOPLASTICS, 2019 a).

Considering the biodegradable polymers, it can be seen from Figure 2 that there was an increase of approximately 54% in the world production of this polymer from 2013 to 2018. When considering the world production of biodegradable biopolymers and polymers, this represented 37% of such production in 2013, biodegradable polymers represent 43% of the global production of biodegradable biopolymers and polymers in the year 2018, one increase by 6 percentage points. As shown in Figure 2 there is a tendency to increase the percentage of the production of biodegradable polymers in relation to the production of biopolymers. In this trend, the production of biodegradable polymers will exceed the production of biopolymers by the year 2020, according to demonstrated. The production of biodegradable polymers in 2013 represented about 0.2% of the world production of polymer resin, EUROPEAN BIOPLASTICS (2016) and ABIPLAST (2015), but in 2018 the production of biodegradable polymers jumped to 0.85% of production according to ABIPLAST (2019) and EUROPEAN BIOPLASTICS, 2019 (b). If this trend is maintained until the year 2030, biodegradable polymers will represent approximately 2.7% of the world polymer production and 3.7% by

2040. Therefore, it is interesting to verify the effects of ionizing radiation on biodegradable polymers, since it is possible to observe the increase in the worldwide consumption of such polymers, while it is known that Ecovio® is one of the most widely used biodegradable polymer blends, worldwide effect of ionizing radiation on such material.

2.1. Radiation effects on polymers

Radiation is part of everyday life of individuals, whether it warms a food, hears a radio or makes a medical treatment.

However, what is radiation? What are the types?

DIAS (2019) defines radiation in a didactic way, such as: *"[...] a physical process of emission (output) and propagation (displacement) of energy by particles or moving electromagnetic waves*". The radiation can be classified according to the criterion of ionization: non-ionizing and ionizing. The non-ionizing radiation does not change the inherent characteristics of the molecular structure of the material, and can be classified in: electromagnetic and cosmic, are examples of non-ionizing radiation microwaves and radio waves, among others. Already ionizing radiation alters the inherent characteristics of the molecular structure of the material, and can be classified in: electromagnetic, natural and artificial, BREVIGLIERO, POSSEBON and SPINELLI (2015). Radiation applications are numerous, such as: mapping of organs, hematological studies, radiotherapy, evaluation of homogeneity of parts and welds by means of gammagraphy, increase tire performance, smoke detectors, food irradiation for fungal elimination, fruit and vegetable maturation delay, sterilization, study of river dynamics, soil fertility study, treatment of effluents, modification of properties of materials, such as polymers, among others (NASCIMENTO, 2013; AZEVEDO, 2019 and CARVALHO, 2019).

The effects of radiation on materials, particularly polymers, should be considered since they are much more sensitive to the effects of radiation than metal materials and other inorganic materials. Polymers, like other organic materials, are constituted mainly of hydrogen and carbon bonded by electron exchange forces, or chemical bonds. TURNER (1961) explains that in the polymers, when subjected to radiation, two processes take place: degradation and crosslinking. When polymer crosslinking takes place, its molar mass increases and may cause an increase in the physical properties of such polymer. When the polymer scission or degradation occurs, there is a decrease in the molar mass and may cause a decrease in the physical properties of this polymer. It is worth noting the comment made by TURNER (1961) that the two effects of crosslinking and chain scission in the polymer always occur when it is treated by radiation, however one effect prevails over the other. Industrial applications involving polymer irradiation depend essentially on two radiation processes: electron acceleration and photons generated from high intensity (DROBNY, 2003, p.1). The radiation doses for the polymer modification may range from 0.4 kGy to 40 MGy, depending on the type of polymer. Therefore, it is necessary to determine practically the dose of radiation for the modification (chain scission or crosslinking) of each type of polymer (TURNER, 1961, p. 127 and DROBNY, 2003, p. 72-77).

MANAS, *et al.* (2018) represent in a playful manner the dose quantity as a function of the type of polymer, as shown in Figure 3.

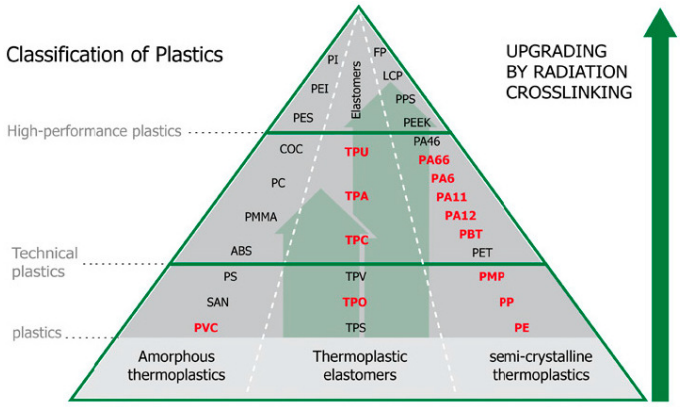


Figure 3: Degree of modification of several types of polymers as a function of absorbed dose (MANAS, *et al.*, 2018).

It can be seen from Figure 3 that high performance polymers require a higher radiation dose than engineering plastics, to cause modifications in its molecular structure. However, for polymers classified as *commodites*[1], the dose of radiation to cause changes is smaller, compared to engineering plastics.

2.2. Effects of radiation on PBAT/PLA polymer blends

The polymeric blend Ecovio® was the material used in this research. It is composed by 80% of renewable compounds, since the PLA is made with 100% of renewable resources and the PBAT is made with at least 64% of renewable resource. The Ecovio® is completely made from biodegradable products, and can be classified as a biopolymer, green polymer and biodegradable polymer (BASF, 2015), also has a translucent semi-crystalline structure and good thermal stability up to 230ºC (BASF, 2019). By means of Figure 4 it is possible to observe the polymeric blend Ecovio®.

Figure 4: Ecovio® (OWN AUTHOR, 2019).

[1]*Commodities* are polyethylene (PE), polypropylene (PP), polystyrene (PS), polyvinyl chloride (PVC), among others (GORNI, 2003).

Note the scale in Figure 4 is only illustrative. The granules (plastic pellets[2] or pellets only) have a white coloration and this format is necessary for thermal processing of the polymer. The composition of Ecovio® is approximately 45% PLA and 55% PBAT, this blend is obtained by means of the twin-screw extruder process of the two polymers mentioned. In relation to PBAT, an aliphatic polyester, its environmental degradation is due to the presence of oxygen in the main chains of the said polymer and its molecular flexibility, HARADA (2007) *apud* POVEDA (2008). This type of chain is hydrolysable, thus facilitating the biodegradation of the polymer. A second polymer composing Ecovio® is PLA, which is also an aliphatic polyester. In both PBAT and PLA biopolymers, there is an oxygen atom in the main meridian chain facilitating the biodegradation of these polymers (LÜTKE-EVERSLOH *et al.*, 2001).

The mechanical and thermal properties of Ecovio® are presented in Table 2. The first column shows the main properties of said biodegradable polymeric blend, and the last column, brings the unit of measure of this property in the International System. The central column shows the range of values that Ecovio® presents for its property.

Table 2: Properties of Ecovio® (Adapted from BASF, 2019).

Property	Value	Unity
Specific mass	1240 – 1260	$kg.m^{-3}$
Melting point	110 – 155	ºC
Modulus of elasticity	2240 – 2680	MPa
Tensile strength	40 – 56	MPa
Ultimate strength	20 – 27	MPa
Elongation	38 – 56	%

It can be concluded that Ecovio® has the values of mechanical and thermal properties, close to the properties of high impact polystyrene (HIPS), which has a specific mass of 1050 $kg.m^{-3}$, modulus of elasticity of 2030 MPa, resistance to tensile strength of 25 MPa, ultimate strength of 21 MPa and elongation of 35% (BASF, 2013).

The methodology used on this research work was qualitative. Regarding the toxicity of Ecovio® the biodegradable polymer is practically non-toxic in case of a single ingestion. It is intended to irradiate said Ecovio® polymer blends with the absorbed doses of 5 kGy, 10 kGy, 15 kGy, 25 kGy and 50 kGy, using a medium energy electron beam accelerator, IAEA category II, and to present the effects of ionizing radiation in polymers. It is also possible to determine the changes that occur in each molecule of the polymer, since these can be calculated by means of Equation 1 (CLEGG and COLLYER, 1991, p.44).

$$\Delta = D \times G \times M \times A^{-1} \quad (1)$$

In which: Δ are the changes, crosslinking or scission, caused by radiation in the molecule of the polymer; D the radiation dose; G represents the average number of reactions of a specific

[2]*Plastic Pellets*: are granules of plastics which correspond to the main form with which the resins are produced and marketed to be used as raw material in transformation industries for the creation of the most varied objects, produced after they are melted and shaped according to the final product (MANZANO, 2009).

type per 100 eV of absorbed energy; M is the average molar mass of the polymer and A is Avogadro's number. Knowing that $1\ \text{kGy} = 6.24\times10^{18}\ \text{eV}\times\text{g}^{-1}$ and $A = 6.023\times10^{23}\ \text{molecules}\times\text{mol}^{-1}$, replacing both values in Equation 1:

$$\Delta = 1.04\times10^{-7}\times D\times G\times M \quad \left[\text{reactions}\times\text{molecule}^{-1}\right] \tag{2}$$

Since D of Equation 2 represents the absorbed dose in kiloGray (kGy). Assuming that for the polymer blend, PBAT/PLA, the G value is equal to 3 (CLEGG and COLLYER, 1991, p.44), knowing that the average molar mass of the Ecovio® polymer blend is equal $7{,}8\text{x}10^5$ g.mol^{-1} (CURTI e SOUZA, 2015, p. 8328), and that 60% of the dose is assumed to be absorbed by the polymer, CLEGG and COLLYER (1991, p.44). It is theoretically possible to determine how many crosslinking or chain scission reactions will occur in the polymer blend for each of the doses that will be used in the irradiation process, as presented in Table 3, and in the first column the absorbed dose is presented and in the second column the number of crosslinking that will occur in each polymer molecule.

Table 3: Theoretical number of crosslinks or chain scissions per PBAT/PLA molecule as a function of absorbed dose (OWN AUTHOR, 2019).

Dose (kGy)	Changes (crosslinks or chain scissions.molecule^{-1})
5	0.70
10	1.40
15	2.11
25	3.51
50	7.02

Therefore, it is expected that a greater crosslinking or chain scission of the Ecovio® blend with a maximum and minimum absorbed doses of 50 kGy and 5 kGy, respectively, may not be detected changes in the mechanical, thermal and optical properties of the polymer blend. The effectiveness of polymer irradiation depends on a number of factors, such as polymer type, chemical structure, molar mass and its distribution, polymer configuration, radiation dose, radiation source strength, parameters (nitrogen, oxygen and vacuum), ambient temperature (MANAS *et al.*, 2018). When the polymers are irradiated with an electron beam, using an electron accelerator, two main processes occur: crosslinking and/or degradation of the polymer chain (LANDI and SILVA, 2004). The chemical structure of the polymer affects the ratio of crosslinking and degradation (MANAS *et al.*, 2018).

Both polymers (PBAT and PLA) may undergo changes with electron beam irradiation, thus causing changes in mechanical, thermal and biodegradation properties (POVEDA, 2008; ROSALES, 2015). Therefore, it is expected that the ionizing radiation can alter the mechanical, thermal and biodegradation properties of the PBAT/PLA blend, because when the Ecovio® is exposed to a radiation dose, the polymers present in the blend might make crosslink (TAMADA, 2014), due to the opening of the double bonds of the ester function (COOC), with no reduction in degradation time (POVEDA, 2008), as presented in Table 4.

The same, apparently happens with PLA, because when this polymer is irradiated with absorbed doses of 20 kGy, 40 kGy, 60 kGy, 80 kGy and 100 kGy with a radiation dose rate of 4.98 $kGy.h^{-1}$, their properties change (ROSALES, 2015), as presented in Table 4.

Table 4: Properties of PBAT and PLA as a function of radiation absorbed dose (Adapted from POVEDA, 2008; ROSALES, 2015 e SILVA, OLIVEIRA e ARAÚJO, 2014).

Polymer	Doses (kGy)	Ultimate strength (MPa)	Elongation (%)	Melting point (ºC)	Heat of fusion ($J.g^{-1}$)
PBAT	0	41.20 ± 9.26	821.82 ± 40.01	125	19.8
	10	35.56 ± 1.47	732.36 ± 45.23	126	19.4
	40	37.64 ± 2.42	879.52 ± 66.93	124	20.8
PLA	0	6.07 ± 0.32	64,16 ± 1.04	146	3.2
	20	5.78 ± 0.26	64.54 ± 1.15	148	4.1
	40	5.63 ± 0.44	63.19 ± 0.93	148	3.8
	60	4.91 ± 0.41	62.69 ± 0.43	147	4.3
	80	4.71 ± 0.50	63.24 ± 1.17	146	3.5
	100	4.44 ± 0.33	63.34 ± 0.74	145	3.1

It is noted that PBAT when irradiated with a radiation dose of 40 kGy has its tensile strength reduced by approximately 8.64%. However, there is a rise in elongation by approximately 7% as presented in Table 4. When analyzing the PLA (another Ecovio® polymer) irradiated at the same absorbed dose, there is a reduction in ultimate strength of approximately 7%, in addition to the 2% reduction in elongation of this polymer. As Ecovio® is a blend formed between PBAT and PLA, it will be interesting to study the effect of absorbed doses of 5 kGy, 10 kGy, 15 kGy, 25 kGy and 50 kGy, since such doses of radiation may cause the elongation is altered due to changes in the main chain of PBAT/PLA polymers.

Also, POVEDA (2008) found that when a radiation dose of 40 kGy is applied to the PBAT polymer, micrograph changes do not occur in polymer, as shown in Figure 5.

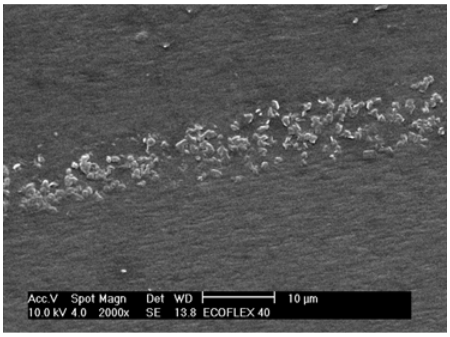


Figure 5: Micrograph of PBAT film irradiated with 40 kGy and an increase of 2000 times, approximately (POVEDA, 2008).

POVEDA (2008) assumed that the materials at the center of the micrograph shown in Figure 5 were contaminations of the film forming process, concluding that there are no changes in the

micrograph of the PBAT, when it is subjected to a radiation dose of 40 kGy. ROSALES (2015) also concludes that there is no change in the micrograph of the PLA when it is submitted to a dose of radiation of 100 kGy, as shown in Figure 6.

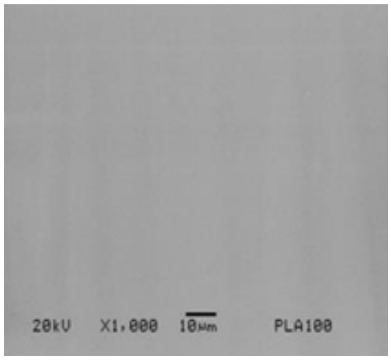


Figure 6: Micrograph of PLA film irradiated with 100 kGy and an increase of 1000 times approximately (ROSALES, 2015).

Therefore, based on the images shown in Figure 5 and Figure 6, it is not expected to see significant changes in the microscopy of the PBAT/PLA polymer blends, when subjected to a radiation dose of 50 kGy. Assuming that the tendency for ultimate strength is maintained for both PLA and PBAT, and that 45% of the PLA rupture force and 55% of this PBAT strength, are transferred to the Ecovio® polymer blend, the rupture stress of this material can be estimated as a function of the radiation dose, as shown in Figure 7.

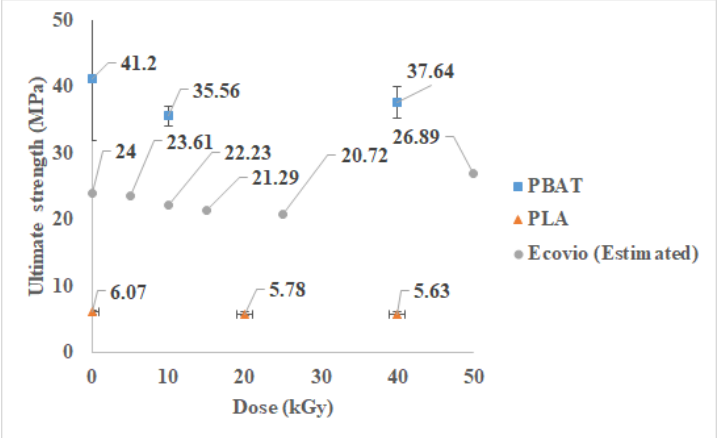


Figure 7: Ultimate strength as a function of radiation dose (OWN AUTHOR, 2019).

It can be seen from Figure 7, an increase of 12%, approximately, in ultimate strength is expected, when the PBAT/PLA blend was irradiated with 50 kGy. However, a reduction around 13.6% in this property is estimated when the blend is irradiated with 25 kGy. Assuming also that the tendency observed in Table 4 in relation to the elongation property is maintained for other radiation doses, and that 55% of the value of this PBAT property is transferred to PBAT/PLA blends, we can estimate the elongation in function of the radiation dose to Ecovio®, as shown in Figure 8.

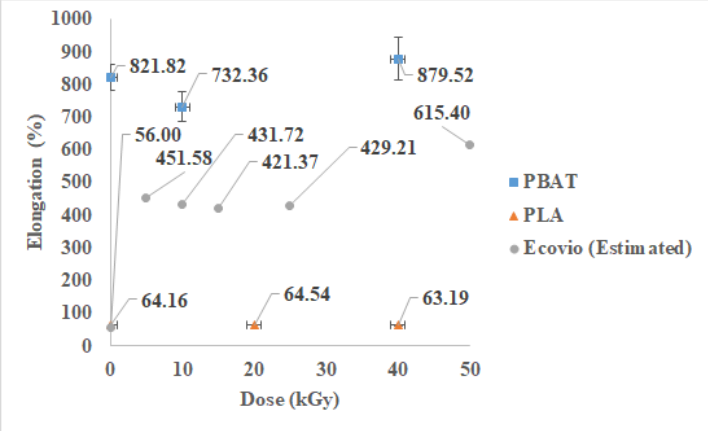


Figure 8: Elongation in function of the radiation dose (OWN AUTHOR, 2019).

Therefore, an approximately 1000% increase in the elongation of the PBAT/PLA polymer blend is expected to occur when a radiation dose of 50 kGy is applied, thereby increasing the applications of blend.

Another property that may be influenced by radiation is the melting point. Assuming that the tendency of this property, as presented in Table 4, is maintained and that the Ecovio® melting point is 55% of the PBAT one and 45 % of the PLA melting point, it can be seen, as shown in Figure 9, to estimate the melting point of the PBAT/PLA polymer blend as a function of the radiation dose.

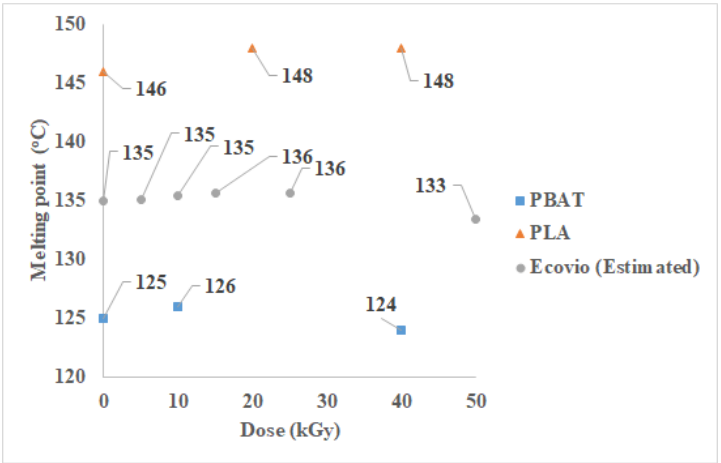


Figure 9: Melting point in function of the radiation dose (OWN AUTHOR, 2019).

An approximately 1.5% reduction in the melting point of the PBAT/PLA polymer blend is expected, thus facilitating the processing of said blend. Also in relation to the thermal properties, the heat of fusion of Ecovio® can be estimated as a function of the radiation dose, as shown in Figure 10, assuming that the tendencies, shown presented in Table 4, of this property are maintained and that the heat of fusion of PBAT/PLA blend is 55% of the PBAT and 45% of the PLA ones.

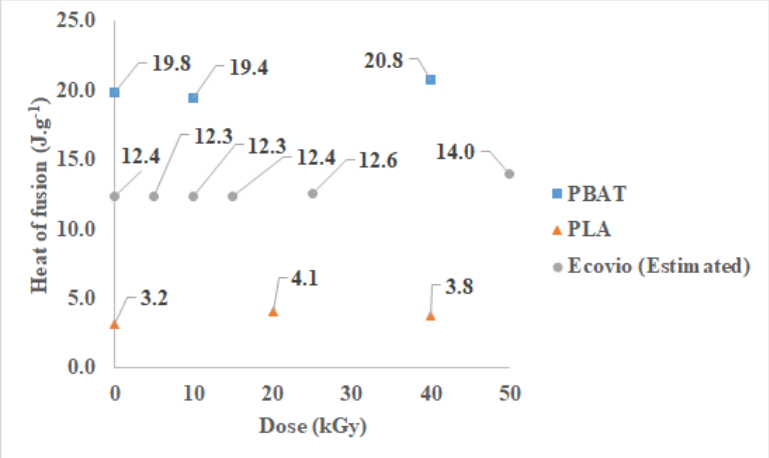


Figure 10 - Heat of fusion in function of the radiation dose (OWN AUTHOR, 2019).

Therefore, an approximate 13% increase in the heat of fusion of the PBAT/PLA blend is expected, implying an increase in the energy consumption required for the processing of blend.

The modifications in the material properties shown in Figures: 7, 8, 9 and 10, occur due to changes in the polymer chain of PBAT and PLA, as presented in Table 5, polymers that are part of the Ecovio® blend.

In order for such estimations of changes in the Ecovio® blends to be verified, it is necessary to irradiate this blend and to characterize its. Therefore this research work has been carried out.

3. CONCLUSION

Due to the fact that the PBAT/PLA properties are modified by 55% of PBAT and 45% of PLA ones, it is expected that the PBAT and PLA properties changes with respect to the radiation dose. The ultimate strength of the Ecovio® blend increases by 12% when subjected to an absorbed dose of 50 kGy, and that the elongation increases by 1000% when subjected to the same dose. Regarding the optical properties, no significant changes are expected when the PBAT/PLA polymer blend is subjected to a radiation dose of 50 kGy. However, at this absorbed dose the melting point of blend is expected to reduce by approximately 1.5% and the energy required for Ecovio® fusion to increase around 13%. The increases of elongation of the polymer blend will therefore enhance the industrial applications of the PBAT/PLA polymer blend. However, in order to confirm the hypotheses formulated in this research, a practical work is necessary, irradiating the Ecovio® with absorbed doses of 5 kGy, 10 kGy, 15 kGy, 25 kGy and 50 kGy, applying an electron beam accelerator and characterizing the polymer blends before and after irradiation.

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