Bioplastics taxonomy: Concepts and definitions from the perspective of productive sustainability

Taxonomia dos Bioplásticos: Conceitos e definições na perspectiva da sustentabilidade produtiva

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Abstract

The present article corresponds to the first part of the research on the economic and technological performance of polymers qualified as 'bioplastics', based on the parameters of sustainability. The main objective of the research is to analyze the bioplastic production scenario, aiming at explaining uses and applications of this group of materials in substitution of synthetic plastics. This part of the research adopted as a methodological line the taxonomic analysis, where concepts and definitions about the types of bioplastics and their relations with the environment will be presented and discussed, especially with regard to origin, processing and disposal. As a conclusion, were established, at first, some thoughts about the technological potential of bioplastics for the manufacture of products.

Keywords: *Bioplastics 1; Biobased plastics 2; Biodegradable plastics 3; Natural Polymers 4; Classification of Polymers 5*

Resumo

O presente artigo corresponde à primeira parte da pesquisa sobre o desempenho econômico e tecnológico dos polímeros qualificados como ‘bioplásticos’, tendo como base referencial os parâmetros da sustentabilidade. O objetivo central da pesquisa é analisar o cenário produtivo dos bioplásticos, visando explicitar usos e aplicações deste grupo de materiais em substituição aos plásticos sintéticos. Esta parte da pesquisa tem como linha metodológica a análise taxonômica, onde serão apresentados e discutidos conceitos e definições sobre os tipos de bioplásticos e suas relações com o meio ambiente, principalmente, no que tange à origem, processamento e descarte. Como conclusão, foram estabelecidas, a princípio, algumas reflexões a cerca das potencialidades tecnológicas dos bioplásticos para a manufatura de produtos.

Palavras-chave: Bioplásticos 1; Plásticos biobaseados 2; Plásticos biodegradáveis 3; Polímeros Naturais 4; Classificação de Polímeros 5

1. Introduction

The history of technology shows that polymer materials have always participated in the production of the most varied types of utensils. Among the several examples found, the use of lacquer with dyes (mineral fillers) for the production of paints stands out; amber (fossilized lignin) for the manufacture of decorative ornaments; the use of bone, horns and hides for the production of game; the latex (natural rubber) was used for the production of utensils or as a waterproofing agent; several artifacts use vegetable fibers (cellulose) and animal fat (fatty acids), obtaining a material similar to the composites; fibers derived from animals, such as wool and silk, are transformed into yarns and fabrics.

Besides the production of various artifacts and utensils, it is also possible to find examples of the use and applications of natural materials in the construction of houses, such as: the use of bamboo as water pipes and the technique of mud that joins clays, cellulose fibers and gums for the production of bricks for “taipa” or even for construction in “Pau a pique”. These materials were used in an *in natura* way or submitted to basic improvements that over time were improved, from the modifications in the characteristics of the natural materials, allowing gains of properties and, consequently, new uses and applications. Most of these examples used materials categorized as natural organic or inorganic polymers, most of which are organic, this is "biopolymers", as they came to be called.

With the advent of industrialization the natural polymers modified or not have gained more space in the manufacture of products, as ‘cellulose’ and ‘shellac’ (KATZ, 1984). These materials had significant importance both in the industrial and environmental context, since if on the one hand they enabled the development of the plastic transformation industry, demonstrating the diversity of use, on the other they replaced the ‘ivory’ and the ‘tortoise shell’ in the manufacture of objects. In the mid 19th century, there was an industry dedicated to the production of polymer products (plastics, rubbers and composites), based mainly on the chemical modification of natural polymers. Among the main polymers used in this period are latex-based materials (Ebonite and Gutta-percha), vegetable and animal gums and resins (Casein, Lignin, Chitin etc.) and, mainly, cellulose derivatives as ‘Cellulose Nitrate’ and ‘Cellulose Acetate’.

Polymers of natural origin have actively participated in industrial production until the invention of “synthetic polymers” derived from petroleum. The decline in the use of natural polymers was caused by the growth in the demand for industrial products and by the technological evolution itself that demanded a greater supply and better performance of the raw materials. Despite the limitations of use and application, some natural polymers remained active in the 20th century, participating in some productive segments. However, from the late 1970’s, there was a resumption of interest in the natural polymers, with a view to obtaining materials with “ecological footprint” and were called “biopolymers”.

The first experiments were aimed at verifying whether biopolymers could replace synthetic polymers with the same quality and supply. Among the studied materials, polysaccharides (starches) obtained from α-glucose, derived from renewable sources, showed real possibilities of industrial applicability, encouraging other lines of research destined to the polymers with the environmental approach. Introducing new technological proposals in addition to the recycling processes of synthetic polymers, as a resource to reduce the impact caused to the environment, of which two research lines stand out: 1- the production of polymers from renewable sources (“green polymers”); 2- and the production of “biodegradable polymers”.

These “new” polymers would arouse the interest of certain industrial segments, especially those with low value-added products, where the life cycle is extremely short (disposables, packaging and films). Other segments were also interested in research in this group of materials, such as the medical area, due to biocompatibility for the production of drugs, prostheses, stents and catheters. In addition, segments using expanded polymer or composite technologies have sought biopolymers for biomass production as an alternative to composite recycling techniques using synthetic polymers.

These aspects have lately stimulated the research and development of new materials, as well as discussions about the validity of these materials in social, technological and economic contexts. Therefore, this research is divided into three parts (conceptualization, technology and economics), with the general objective of analyzing the productive panorama of materials qualified as "bioplastics", in order to compose a prospective framework for application in manufactured products in relation to the precepts of sustainability. Because of the variety of existing denominations, this part of the research is intended to study the concepts and definitions applied to bioplastics, with the purpose of proposing understandings about the possibilities of use and application of bioplastics.

2. Classification in (Bio)polymers

It is not too much to remember that polymeric materials are macromolecules, obtained by repeating smaller molecules that will form molecular structures. However, it should be noted that not all macromolecules are polymeric materials, as not all polymers have ideal mechanical properties for the manufacture of products. In order for a polymer to be processed, it is necessary to present a significant amount of elements (mers) forming the molecular chain, that is, they must have molecular weight (Mw) between 10^3 and 10^6, allowing their application as an engineering material.

Polymeric materials, in general, form a complex group in terms of definitions and conceptualizations, since they are subject to several constraints in their molecular structure. For this reason, the taxonomic classification method has been used to define the groups of parameters that characterize the polymeric materials. Based on the classification system presented by Mano & Mendes (1999), some classification criteria stand out because they are directly linked to the origin of the polymers and the transformation of the material into manufactured products. However, there are other classification criteria, no less important, but will be omitted in this work. Therefore, were selected the following classes:

A- Classification by origin in:

- **Natural polymers**- are found in nature and generated by reactions of spontaneous polymerization (biogenesis); examples: cellulose, lignin, chitin, latex, proteins, polysaccharides, casein etc;
- **Synthetic polymers**- are produced artificially under controlled polymerization conditions, and can be generated by various polymerization

methods; examples: Polyethylenes, Polypropylenes, Poly (vinyl-chloride), Polyurethane, Polybutadiene, etc;

B- Classification by Fusibility and / or solubility in:

- **Thermoplastic polymers**- present linear or branched chains allowing thermal actions for conformation;
- **Thermoset polymers**- are polymers that have three dimensional or reticuled chains with the presence of the cross-links, rendering them infusible or insoluble.

C- Classification by the mechanical behavior in:

- **Elastomers** - are polymers that exhibit elasticity, presenting low deformation at room temperature when subjected to traction;
- **Plastics** - they are polymers that exhibit mechanical behavior in long strips, exhibit mechanical behavior from flexible to rigid, especially when thermoplastic;
- **Fibers** - are polymers that presents high ratio between the compliance relation;

Other classifications are commonly employed in polymer studies, but are classifications by ‘market convenience’, as: ‘economic’ and ‘industrial’ (CERQUEIRA & HEMAIS, 2003). The economic classification attributes to the polymer value in relation to the distinctions and market applications, from the qualification in groups ‘commodities’, ‘pseudo-commodities’ and ‘specialties’ (*Op cit*, 2003), these latter two also qualified as, in general terms as 'engineering plastics', given the indexes of their properties. The industrial classification qualifies the polymers in relation to their technological applicability in: homogeneous (homopolymer) or heterogeneous (copolymers or 'blends'), composites, cellular (expanded), compounds, films/films and fibers. In general, these classifications consider the behavior of polymers due to the existing variety of technologies and diversity of applications in manufactured products.

Mano & Mendes (2013) propose a new classification, with scientific basis, to relation the nature of the polymers, in "Geopolymers", "Phytopolymers" and "Zoopolymers", as:

- **Geopolymers**- are natural mineral organic or inorganic polymers (polycarbonates - graphite and diamond, polyoxides and polysaccharides). These polymers are the main components of rocks that will give rise to other materials, such as silicates (glass and ceramics);
- **Phytopolymers**- are organic, naturally occurring polymers of vegetable origin (polyacetals, polyamides, cellulosic fibers, etc.). These polymers are the formers of all vegetables in the form of resins and fibers;
- **Zoopolymers**- are natural organic polymers, occurring in animals (polyesters, polyamides, polyacetals, and nucleic acids) that form the most diverse types of tissues present in organisms.

Although these three classes refer to natural polymers, only polymers of an organic nature can be called biopolymers because they are linked to plant or animal life. All polymers, whether natural or synthetic, are obtained by condensation (polycondensation) or addition (polyaddition) polymerization processes. However, natural polymers display complex systems, called "biogenesis", being replicated making it difficult to repeat in artificial conditions. Figure 1 shows the scale of molecular complexity present in some natural and synthetic polymers, starting from polyethylene as the simplest and DNA as more complex.

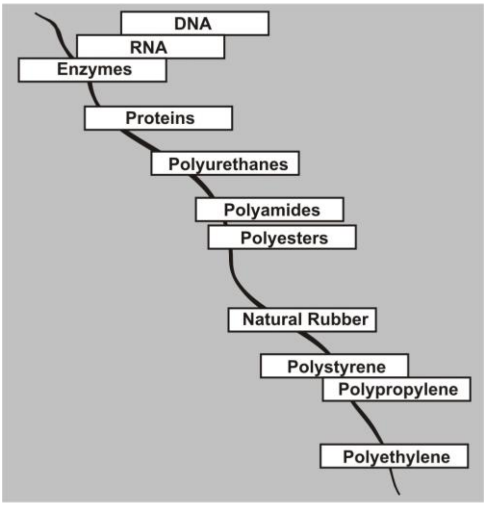

Figure 1- Molecular Complexity Scale (Based: Mano & Mendes, 2013:37)

Recently, other groups have been based on environmental criteria, defining specific classes according to the sources of production, whether renewable or non-renewable, or, in relation to the type of decomposition, in: degradable, degradable and biodegradable. These polymers were grouped into two functional classes: 1- "biobased polymers", when they are obtained from renewable sources, mainly derived from plants; and 2- "biodegradable polymers", when their degeneration occurs spontaneously in the environment without causing damage to the environment.

These 'new classes' of polymers have been applied, more often to the 'bioplastics' materials, to qualify groups of polymers plastics, derived from renewable sources or when they are considered environmentally degradable. However, it is observed that the broad application of the term bioplastic still presents certain incongruity and has led to certain misunderstandings, among them the use as a synonym for biopolymers or even natural polymers.

3. Concepts and definitions in 'Bioplastics'

It is possible to observe in the bibliography referring to the topic bioplastics definitions that seek to qualify this category of materials, demonstrating that besides the great interest for the development of these polymers, there is the intention to understand how they work in economic, technological and environmental terms. This is evidenced when we observe certain groupings that adopt concepts, often based on superficial information, focused mainly on promotional attributes of marketing, for example the called 'green plastics', in reference to the use of renewable sources recourse on the incorporation of phytopolymers in the final material. It is a consensus among several organisms that materials known generically as bioplastics maintain direct relationships with aspects of 'biomass' production, both in obtaining 'base polymers' and in renewing the 'polymeric material', being classified into two groups – "biobased" and "biodegradable".

The 'European Bioplastics Association' qualifies bioplastics in two categories, namely: 'biobased' and 'biodegradable'. This classification considers the relationship established with the parameters of productive sustainability, defining as biobased the "plastics derived or partially derived from renewable sources", usually of vegetable origin. While the biodegradable ones correspond to the polymers that have specific chemical characteristics that in the presence of certain conditions are possible of environmental integration.

While, the 'International Union of Pure and Applied Chemistry-IUPAC' defines Biobased as polymers derived from monomers obtained from biomass. Whiles the 'American Society of Testing of Materials –ASTM' conceptualizes biobased polymers as materials "... whose carbon in their composition comes from renewable sources and not from fossil sources ..." (*Apud* MEI, 2016: 31), offsetting the impact of carbon emissions.

3.1 Biobased plastics

The biobased polymers (plastics) are obtained by means of synthesis systems using biofuel derived hydrocarbons (ethanol, methanol etc), usually from sugarcane, maize, manioc or other polysaccharide plants. The called "green plastics", as Polyethylene-PE, Polypropylene-PP, and Poly(ethylene terephthalate)-PET of vegetable origin have the same characteristics and properties as their peers derived from petroleum and can be applied in the manufacture of products homogeneously or integrated into 'conventional plastics', thus reducing dependence on petroleum products. Some vegetable oils, too, are used for biobased production. The best example is the production of 'pre-polymers' derived from castor (*Ricinus communis*) oil for the production of Polyurethanes for the resins and cellular (expanded) plastics, composites and other applications.

The other category of bioplastics refers to the biodegradability of the polymers. Typically, this characteristic is associated with biopolymers. However, it should be noted that the degradation condition of the polymer is a property that derives from its chemical structure, regardless of its origin, petroleum polymers such as polycaprolactone - PCL are biodegradable, while 'green plastics', even if they are of biological origin, behave as their petrochemical equivalents, that is, they are not biodegradable.

Biopolymers are defined by IUPAC itself as "polymers produced by living organisms", such as: starch, cellulose, chitin, gums and others, which are derived from renewable sources of animal or vegetable origin and which are degradation in the environment by biological action. However, a significant part of the biopolymers requires chemical modifications in their structure to acquire technological properties, that is, that can be transformed into products. Just as biodegradability will in many cases not be spontaneous and will depend on favorable physical conditions to cause the decomposition of the polymer product, usually obtained in composting systems, generating energy (Biogas) and organic fertilizers.

In addition to biopolymer modification technologies, there are other processes to obtain 'bioplastics' with biodegradable characteristics, such as the use of microorganisms that consume sugar causing the polymerization. In figure 2, colony of bacteria *Burkolderia* *sacchari* is verified with the formation of granules of Poly(hydroxyalconoato)-PHA polymer in its interior.

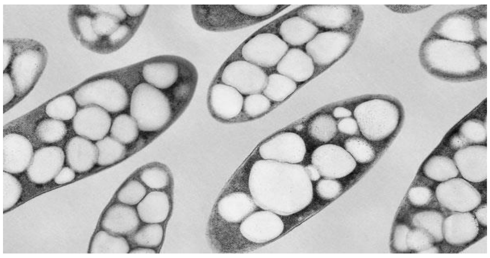

Figure 2 - Bacteria Burkolderia sacchari existing in the cane growing soil used for the production of biodegradable polymers, such as PHA, PHB and PTT.
(Source: https://materialdesigns.wordpress.com/2010/07/15/green-plastics-from-grass)

On the other side, some biopolymers do not present plastic conditions (mass and/or molecular weight) that allow their use in transformation, but are widely used in industry as additives for conventional plastics, acting as plasticizers, substrates, while others are used with great frequency in the food industry, as thickeners, binders, or even generating edible plastic products (gelatins, gums, albumin, etc.)

Therefore, the biobased plastics refer to the conditions of obtaining the polymers, in response to current problems to reduce the demand for petroleum and the emission of greenhouse gases. On the other hand, biodegradable plastics refer to the conditions of post-use and disposal, as well, in response to the flaws present in the reverse logistics system in conventional recycling systems, mainly in reference to low value added products. The figure 3 shows in simplified form the origin of qualified polymers with biobased.

3.2 Degradation, Oxidegradation, Biodegradation and Oxo-biodegradable

Most of the materials used in the manufacture of industrial products are susceptible to degradation by physical or chemical action and in the case of polymers the degradation ratios also occur, in a different way. Among the most common criticisms regarding the use of polymer materials is pollution caused by inappropriate disposal and time for decomposition and integration into the environment.

3.2.1 Degradation

According to the type of polymer, composition and environmental conditions degradation may occur at different times, and may be relatively rapid, six to eight months or extremely slow, taking up to hundreds of years, because the polymers are stable chemical structures. It should be noted that total or partial degradation of the material does not mean integration into the ecosystem, as there is a need for biological compatibility between the degraded material and the environment without contaminating or saturating.

The polymers (elastomers, plastics or fibers) are subject to degradation by action of oxygen (oxidation), exposure to ultraviolet rays, action of solvents (and other substances), to mechanical stresses cause degradation to the material. These actions subject the polymer to a degeneration process by breaking the intermolecular bonds forming the polymer chains and, therefore, the material to degradation.

In general, the degradation process of the polymers consists of levels, which begins with the gradual loss of properties, leading to ‘microcracks’, until the fragmentation occurs and, finally, the formation of small-solid particles called as 'microplastics', being imperceptible when deposited in the environment. Therefore, degradation corresponds to the irreversible alteration of the structure, with losses of properties and performance in relation to environmental conditions.

3.2.2 “Oxidegradation”

The oxidegradation is derived from the incorporation of metallic base additives (iron, cobalt, nickel, etc.) to the synthetic polymers, with the purpose of accelerating the oxidation process together with the action of UV rays on the structure of the material, caused by the known phenomenon such as ‘ageing’ of the plastic product.

The oxidegradation principle has been widely used as a 'solution' for several products, mainly those of large production, low value added and/or short life cycle, such as: plastic bags, packaging, films, etc., where traditional recycling processes become difficult to consolidate given the dispersion in disuse. However, there are several criticisms regarding the application of oxidegradable plastics, mainly in relation to the use of synthetic polymers derived from petroleum and the deposition of residues generated during the decomposition process (dyes, metals, etc.) in nature.

Oxidation degradation, too, is a principle used for water-soluble plastic materials, such as poly(vinyl alcohol)-PVA used in bags and packaging. Other water-soluble plastics come from natural polymers (gums, cellulose, gelatin) modified or applied *in natura* and, in function this characteristic, have restrictions of use and application.

Although several suppliers of raw materials and products claim that the ‘organo-metallic’ additives are inert and non-polluting, there are controversies regarding their use for the constitution of bioplastics, due to the lack of biological activity in the oxidegrading process. Among the plastics that incorporate with called ‘environmental additives’ are the PEHD, PELD, PS, PVC e PP, all plastics commodities, large scale production and applied in a wide variety of products segments.

3.2.3 Biodegradation

In order to reduce post-use impacts, the biodegradation is defined by the United States Environmental Protection Agency as "a process in which microbial organisms alter the structure of chemicals (including polymers) introduced into the environment by metabolic or enzymatic action. "

Unlike the oxidation process, the biodegradation is not related to the use of additives or other substances that cause the decomposition of the plastic product, but to the chemical structure of the polymer itself. This characteristic is present in most biopolymers obtained by microbiological or biotechnological action, as Poly(hydroxy-alkanoates) - PHAs, PHBs; Poly(lactic acid) - PLA; or even of petrochemical origin, as polycaprolactones - PCL, for examples. The biodegradation present in some polymers has been exploited for the production of various medical products due to their ‘biomimetic properties’, that is, they can be absorbed by the organism allowing the interaction with live cells, as well as in certain types of packaging.

For a polymer (plastic) to be qualified as biodegradable it is necessary to first present environmental integration and provide "organic recycling" conditions by means of composting or biomass production and, in case of disposal in the environment, they can decompose without causing damage to the ecosystem. This process of degradation approaching the biodegradable plastics to the 'Cradle to Cradle' concept presented by McDonough & Braungart (2010) when commenting on the need to establish eco-efficient procedures for the economic-productive system.

Biodegration is established through levels of environmental interaction until the total absorption of carbon into the environment. The standard ASTM D 6954-4 establishes tests for the evaluation of 'biodegradability', from three levels: Level 1- Evaluation of oxidative degradability, from the loss of mechanical properties and alteration of molecular weight; Level 2 - Evaluation of the biodegradability in a certain time interval and in uncontrolled environment (nature) and controlled (composting) to verify the occurrence of residues or solid particles; and Level 3 - Evaluation of the 'ecotoxicology' present in the soil and the possibility of fertilization by the decomposition of the material.

3.3.4 "Oxi-biodegradable"

Currently, it is possible to verify a series of products with indications of 'oxy-biodegradable' polymeric material, mainly in plastic bags, disposable products and cosmetic packaging. Despite the ecological appeal, this type of polymer material has been the subject of debates and discussions about its effectiveness and environmental efficiency.

The concept of 'oxy-biodegradation' corresponds to a process that associates 'oxy' and 'biodegradation' with the purpose of accelerating the process of degradation and 'supposed environmental integration'. However, according to European Bioplastics (2015), products that use this technology adopt procedures and specifications outside the standards and requirements set by most environmental organizations, limiting themselves to testing the material by the process of 'physical degradation', without assessing integration issues and the toxicity of 'micro-fragmentation'.

The European Commission for Environment has been discussing the application of self-described 'oxy-biodegradable polymers' and their impacts on the environment. These discussions have three basic assumptions: 1 - whether there is biodegradation by fungi and bacteria (composting); and 2- if the additives used cause damage to the environment; and 3- whether the conventional recycling processes suffer some sort of technical problem. Therefore, the issues related to oxy-biodegradable plastics still raise doubts as to its use, since oxy-biodegradation without biocompatibility is considered to interfere with environmental conditions, even if degraded products.

4. Discussions on the conceptual sustainability of Bioplastics

In order to minimize the inconvenience caused by the inappropriate disposal of plastic products; reduce dependence on petrochemical derivatives for the production of synthetic polymers; facilitate the recycling of waste from polymeric materials, including composites; develop ecoefficient solutions in manufactured products, the polymer industry, especially that related to the plastic transformation segment, has shown an interest in materials with an ecological approach due to inherent aspects of the production chain, mainly in meeting the expectations of segments consumers downstream.

The natural organic polymers or biopolymers, besides to offering technological answers to environmental issues, have made possible innovative solutions for certain productive sectors. The biopolymers (on condition the bioplastics) have also shown real possibilities of replacing (or reducing) the consumption of petrochemical plastics. However, this category of polymerics act in different situations in the plastic supply chain, that is, in obtaining the polymer - biobased plastics; and in the post-use of the polymer product - biodegradable plastics. Unlike the polymers of petrochemical origin that are fully inserted in the plastic supply chain, including recycling activities. In order to subsidize part of the analyzes and discussions, the classificatory flow (figure 3) was elaborated on polymers qualified as bioplastics, from bibliographic sources.

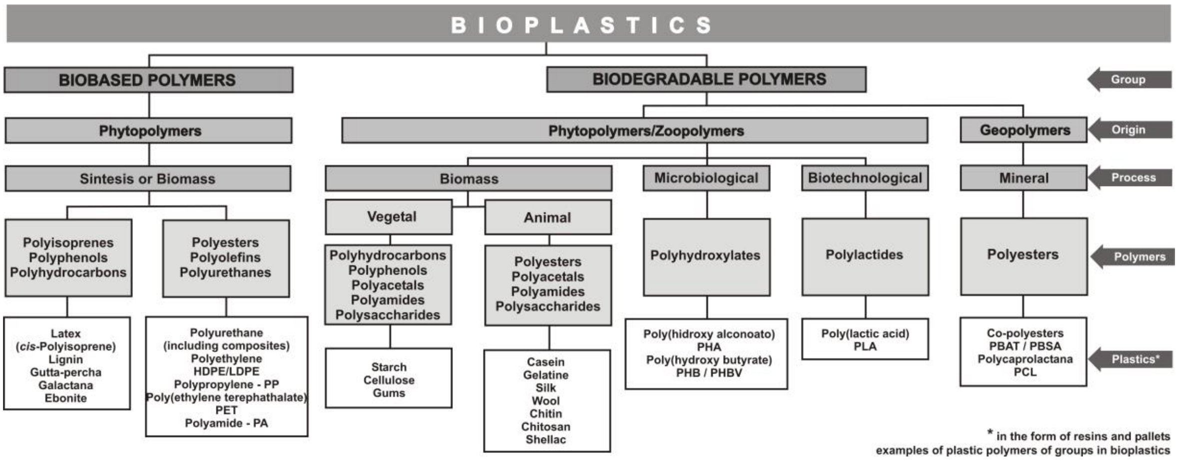

Figure 3- Organization chart for obtaining plastic polymers from renewable sources (Source: own elaboration, 2017 basead on the European Bioplastics)

It is noteworthy that, in world conditions, the biobased plastics already participate in a significant way in the production plastics, resulting in the reduction of the consumption of "petrobased". This group presents identical properties and applications of the plastics petrochemicals. For example: a 'biobased Polyethylene' is equal (and compatible) with a 'petrobased Polyethylene', its use being limited only by the supply to the market. However, the same cannot be said for biodegradable plastics. This group of bioplastics still presents doubts as to its applicability in relation to the disposal in the environment, to the detriment of the advantages of the recycling and regeneration processes applied to the conventional plastic polymers.

As shown, some plastics use metal oxides to accelerate the degradation process, while others require certain environmental conditions (composting) to allow biodegradation to occur, these being the main criticisms made in detriment to the recycling and regeneration processes applied to the conventional plastic polymers.

Biodegradable polymers may take approximately 90 to 300 days to incorporate into the biomass and in the case of oxidegradation solid waste will occur through the "micro-pollution", imperceptible, but contaminating the medium in which it was deposited. Therefore, discarding the material in the environment already corresponds to an unsustainable practice, to the detriment of the process of selective collection (reverse logistics) for recycling and/or regeneration. This is the main argument for the development of new recycling technologies (mechanical, chemical or energy) for conventional or biobased plastics and, more recently, the use of organic recycling (composting) technology for biodegradable plastics in order to produce biomass , thus maintaining the economic cycle of the active material and out of the environment - circular economy.

5. Final considerations

Although the conventional plastics have been inserted in the productive scenario since the decade of 1930's and, currently dominate the production of consumers, there are a number of criticisms regarding its environmental performance due to its petrochemical origin or its deposition in the environment. However, it is practically impossible to think of a world without plastic products and it is for this purpose that studies and research on the application of biopolymers have gained strength in supply chain plastics.

The search for technological solutions in addition to the recycling processes made possible innovations in the field of plastics, especially bioplastics that are biobased or biodegradable from renewable resources.

From the classification studies on the flow of bioplastics, it was possible to show two discussions about the use of this group of polymers with focus on productive sustainability: The first question concerns agricultural relations involving the production of biofuels necessary to obtain hydrocarbons for the production of biobased polymers; and the second refers to the levels of biodegradability / biocompatibility in relation to the discharge in nature, against the point of recycling and regeneration processes.

Bioplastics - biobased or biodegradable -, can be applied to a large number of products, provided that certain cautions are taken regarding the specification of the type of selected biopolymer, because in certain cases the properties of the material can be compromised due to several aspects, from premature wear to attack of micro-organisms and in both cases the life cycle will be compromised.

Finally, the bioplastics already occupy a significant space in the world production of plastic products with approximately 57% in biobased and 43% of biodegradable in certain polymers (European Bioplastics, 2017), participating in many segments of products, such as: packaging, domestic utensils, agricultural and livestock products, medical and hospital products, electronic components, among others. Although bioplastics have been available commercially for more than 30 years, in Brazil they still cannot compete directly with conventional plastics due to insufficient supply to market demand, relatively high production and marketing costs and lower performance and properties for application certain product segments.

Therefore, this part of the research had the purpose of analyzing the classificatory structure of the bioplastics in order to establish relations of obtaining the biopolymers. Therefore, the present article does not intend to exhaust, since the research is still in progress, but it was tried to clarify some technological aspects referring to this group of materials.

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