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Green Production And New Models For Obtaining Polymers

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Abstract

Climatic and regulatory conditions are currently in evidence have required companies to conceive high-impact strategies in their value chain. Provided that in which priority is to guarantee economic growth of companies and meeting the expectations of different market players, this as a a factor that has led companies to use low-cost raw materials with excellent physical properties, thus warranting a final product with excellent conditions. Synthetic polymer is an input widely used today and although in one way or another meets the demands of the market, it is being a focus of environmental pollution in general, whereas, this document proposed a literature review regarding the possibility of commercial and productive transition of green polymers in the industry. In order to, descriptive methodology was used in which quantitative aspects of use and costs of these elements in the market were detailed, taking references and research provided by other authors linked to the subject in the last five years.

Keywords: Biodegradable; Costo; Partícula; Síntesis; Sistemas.

1. Introduction

The pollution's levels resulting from industrial waste activities and superfluous consumerism in modern society have contributed significantly to the deterioration of biodiversity in ecosystems. (Mera, Pone, & Chilan, 2020)This has generated a problem that is affecting the quality of life of human beings, since in the vast majority of final inputs there is a high participation of chemicals or pollutants, thus demonstrating the excessive exploitation of natural resources, which are used in excessive production systems, lacking environmental control mechanisms. (Torra, 2018) .

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Over the years, the correct handling of materials or inputs has been one of the most relevant issues within organizations, such is the case that within the new industries, the inclusion of research or scientific support units is becoming more and more frequent, since from these, the productive systems acquire added value to their commercial cycle, from the use of materials with better physical, mechanical and mechanical conditions. (Alcívar-Vélez & Rodríguez-Borges, 2021)This is the case that within the new industries, the inclusion of research units or scientific support, are becoming more and more frequent, since from these, the productive systems acquire added value to their commercial cycle, from the use of materials with better physical, mechanical and economic conditions existing in the market, which are complemented with a lower degree of contamination to the environment, therefore green or environmentally friendly processes are obtained.

Polymeric materials, due to their high chemical structural stability and low prices, have recently acquired a high degree of participation in the daily life of human activities (food industry, medical supplies, packaging, etc.). To such a degree that their presence in the vast majority of things surrounding the environment seems imperceptible. (Carrion & Gonzales, 2017)etc.), to such a degree that their presence in the vast majority of things that surround the environment seems imperceptible, from this is that the contraindications that these materials represent to the environment, due to the generation of non-degradable waste, are usually omitted.

In its beginnings, the industry opted for the use of metallic materials, which, despite their complex malleability, gave certain resistance to the products, in addition to the possibility of being reused in new processes. (Portero, 2020)and the possibility of being reused in new processes; For many years this was the first choice of the great majority of industries, for this reason at the beginning of the 20th century it was common to observe toys or other elements elaborated with this type of inputs, however at that time the studies or evaluations with respect to the contraindications or problems that these presented in the consumers were not taken into account, One of the factors for which the companies saw the need to make a transition from these materials to new inputs, was the loss of physical properties due to corrosion and oxidation of the parts in contact with air and water. (Pabón, Benítez, Villa, & Gallo, 2020).

From the above, various industries began to use organic materials such as the commonly known bioplastics (organic polymers), which were obtained from cellulose and vegetable oils that existed at the time. (Jaén, Esteve, & Banos-González, 2019). These materials were used more frequently from the year 1932 at the time of the Second World War, in which the most frequent use was in rolls (acetates) for photographic cameras, it is important to note that the polymers are presented in three types: semi-synthetic, synthetic, and biodegradable, the latter being the most used by industries today to manufacture bags or packaging.

The problems caused by plastic waste from human activities in recent years has generated negative environmental impact indices in aquatic and terrestrial ecosystems worldwide, because the vast majority of synthetic materials generate waste that is difficult to degrade. (Arevalo, 2020)In studies conducted by the UN at the end of 2015, it was estimated that for every ton of plastic waste, only 90 kilograms were recycled, the remaining material was disposed of by fire (12%) and 790 kilograms were thrown into the environment, thus representing a high degree of contamination in the fauna and flora existing in the universe.

The impact caused by the inefficient management of plastic resources in the environment has been so strong that in most cities and towns, the processes of water purification and treatment have been affected due to the existence of large volumes of precipitates that obstruct the water access routes in the pipes. (Arua & Cabrera, 2017) In response to all these problems, various measures have been designed for the control of these wastes, which have been studied for several decades, one of these and perhaps the most recognized is the theory of the 4R (recovery, recycling, reuse and reduction) which poses a fundamental goal, which is to try to create less waste than produced, in order to promote the continuous reuse of plastics by industrial processes and advanced technologies.

A clarification that should be made at this point is that although there are great mechanisms or tools for the reuse of plastics, not all waste of these materials can be reintroduced to processes in the form of raw materials, as is the case of the inputs used in the medical and hospital sector, these elements due to their mode of operation, are subject to contamination by biological agents, which in most cases present a limitation at the time of finding a different use to which they were manufactured. (Gutierrez, 2021).

At the beginning of 2020, mankind experienced one of the most difficult sanitary situations to which it has been subjected in recent years, the SARS Covid-2019, which put in check the vast majority of existing industries and commercial sectors, in which the lack of alternatives to eventualities of such magnitude was noted.

The pandemic situation did not only bring with it uncertainty and globalized economic impacts, but on the contrary in a certain way increased the production or overuse of synthetic plastics in industry, which were used primarily in the manufacture of masks, face masks and virus protection glasses (EPP), such is the case that companies in this economic sector occupied 17% of the total occupation of plastics, only behind activities such as construction and packaging with 20% and 40% respectively. (Ale, Salazar, & Zúñiga, 2020).

This increase PPE production (personal protective equipment), brought with it several environmental questions regarding the handling and frequency of use of each element, since each product could not have a life cycle longer than 72 hours, so that a single individual would be spending an average of 15 masks per month, which due to its design have three parts or layers, inside there is a thin layer of lightweight plastic materials, This is protected by a second layer that contains the filters (melted fibers) and these are joined in the non-woven fibers that are on the outside of the product (blue part of the mask), usually in this last layer the companies use synthetic materials due to its impermeability and high resistance to particles, which is counterproductive to the environment since these elements in the short term are not biodegradable or easily decomposable. (Encina, Truffello, Urquiza, & Valdez, 2020).

The low transition of environmentally friendly elements within the industries has caused that at times when the demand for certain types of products increases so do the waste and purchase of polluting raw materials, since in most of these cases traditional production models and inputs prevail, in which no research aspects are used or that regulate the polluting agents generated by their productive and commercial activities.

Now then, in situations such as the one mentioned above (consumption of mouth masks in a pandemic), one of the most significant dilemmas arises within the industries, this refers to the priorities of the human being, on the one hand there is an individual care input which is necessary to ensure the minimum conditions of non-infection, On the other hand, there is a process of these highly contaminating elements

with damages that will have a negative impact on the environment in the coming years, as mentioned above, products with a certain degree of sanitary or biological contamination a priori cannot be reused. At present the productive systems, are subjected to an important situation regarding the acquisition of supplies, because of the over pollution that has been used in the different ecosystems, thus generating a shortage of raw materials, as a result of the natural resources most used in the industry are in less quantity than required, in this way has been evident the arrest of some productive cycles lacking competitive measures that promote productive, sustainable and economic development (Emith & Daniel, 2018).

Due to the above, it is well known the recurrent discourse that arises regarding the transition from synthetic to biodegradable materials, since in this, there is a certain degree of omission of some endogenous variables that have an impact on this decision. Piza, et al, 2017 exposes that the design or production of materials that replace synthetic plastics, as is the case of bioplastics that resemble synthetic plastics in their physical properties, requires first of all a strong economic and human investment by companies, which should be focused on the continuous support of research on substances and their properties. (Piza, Rolando, Ramirez, Villanueva, & Zapata, 2017) As of the beginning of 2018, the use of bioplastics worldwide stood at 1.6% (approximately seven tons) of the total amount of petroleum-based polymers used in the industry. (López & Durán, 2020).

Modern industry in its eagerness to use efficient production models has integrated various tools, policies and control elements that favour the environment, however, the transition that has occurred with respect to the inputs used has not been so favourable, due to the limited support of the industry in terms of extension, research and technological invention. (Vidal & Usuaga, 2021)

The particular case of biopolymers and their use in production systems are becoming increasingly important within the industrial guild, thanks to the social, environmental and sustainable value they represent for companies. Currently, in developed countries or countries with well-established environmental policies, they are almost compulsorily demanded by the institutions that control the environmental and industrial aspects of each region, as well as by the consumers themselves who are aware of their environmental footprint or the impact they generate with their waste. (Vladimir, Antonio, Funes Guadrón, & José, 2020).

As all these consumption and production considerations are established, a central idea of innovation has been established, which mentions the capacity to generate sustainable, bio-based production processes, where products are obtained from eco-friendly systems with added value with respect to efficiency and the social, environmental and cultural responsibility demanded by the transformation operations.

In accordance with all the situations described above, this article proposes a literature review of the different general aspects of the circular economy and the transition between some types of polymers, determining the areas or stages in which there are shortcomings when opting or not for a more continuous use in the industry, for this, first a documentary compilation was made regarding the definitions of circular economy and its relationship with the new environmental management plans, Then, definitions and some quantitative data regarding polymers, their classification, followed by the different uses for which they are employed, were described in general terms, in order to classify or identify the degree of transition that certain materials may have with respect to others.

2. Material and methods

The review performed in this article was carried out with the purpose of identifying the opportunity for the transition of the synthetic inputs coming from the petrochemical industry used in the great majority of transformation companies, for biodegradable materials of high impact on environmental preservation, in which the care of the environment and each one of the ecosystems integrated in it is considered.

Guevara et al, (2020) conceptualizes the descriptive method as the identification of the characteristics of the object of study that is being analyzed. (Alban, Arguello, & Molina, 2020) In this case, all the assessments made are based on relevant conclusions or the ways in which these interact within the analyzed element.

To carry out the analysis of the study problem, two types of variables have been identified, the first one mentioning the need to transition from synthetic products to biodegradable products in industrial processes and the second one the range of viability that this solution contributes to the general objective of the proposal, for this it was important to detail two variables of analysis (dependent and independent) which are highlighted below.

The analytical variables used in this research are:

2.1. Dependent Variable

It is the feasibility of generating environmentally friendly green processes from the use of biodegradable plastic inputs, due to the high rates of consumption of synthetic materials in the industry today, which is counterproductive with the need for transition of pollutants in the final products obtained, this variable is quantitative, it measures some attributes and qualities of behaviour of green inputs available on the market and their adaptation in the processes that demand them.

2.2. Independent Variable

The needs, trends and current dispositions in the markets are taken into account as independent variables, because they have their own attributes when modeled and analyzed. In this case, all these factors were measured from a qualitative and numerical point of view, rewarding more the quantitative aspect referring to the costs or quantities demanded of plastics in productive systems.

Once the variables and methodology of the study were defined, a literature review was carried out related to the environmental management systems existing in modern production cycles, polymers, their types, ways of obtaining them, different uses and main pollution indicators at present. For this purpose, research databases such as Scielo, SCOPUS, Science Direct and repositories of both national and international universities were consulted, as well as different reports, news and information bulletins generated by the different national and international environmental control entities.

Likewise, the analysis instrument used in this article was structured in the creation of a referential matrix in which different criteria of experts in the subject were contrasted, while the variation and interaction of the variables detailed under different conditions were characterized by means of graphs and descriptive statistical tools.

3. Results

3.1. Circular economy in modern production systems

According to the new trends in the market, the current production models must be structured according to the compliance with environmental care policies, for which the vast majority of institutions use operating mechanisms such as the already known 9R method, this operating tool allows the existence or prioritization of a circular economy concept within the institutions, which beyond thinking about financial aspects focuses on the degree of impact that the industry has on the environment surrounding it. (Galindo & Céspedes, 2021).

The waste generated in industrial transformation operations has been one of the main negative indicators of the environmental status, directly impacting the management of natural resources such as water, wood, fuels, among others, thus causing a general deterioration which is increasingly greater due to the contamination of these resources by chemical agents of difficult degradation or elimination from the environment. (Sanchez, 2021) In view of these situations, the term "circular production" has recently been promoted.

Circular production proposes a new paradigm regarding a change in thinking about the procurement, transformation and use of resources that are available in the environment (Delgado, Mutis, & Noguera, 2022) In the last report presented by the World Bank, it was determined that more than 89% of the resources generated by human activities are burned in the open air, which has allowed fresh water sources to be contaminated at an accelerated rate.

At the same time, when these wastes are collected by the different entities or waste control companies, they are taken and thrown to sanitary landfills where all these inputs enter a decomposition process, in which, due to the thermal situations present in the area, they generate a percentage of humidity, which contains pathogens or pollutants that go directly to the environment. (Stefanía, 2021).

In the circular economic approach, the mechanisms used are designed to promote a longer duration of the product life cycle, in order to eliminate the term *useful life, a* term that contemplates the generation of waste after a certain time interval in the use of the product, which increases the overexploitation of natural resources and denotes negative aspects in the environment and ecosystems. (Rodriguez, 2021).

The loss in monetary utilities caused by the waste of raw materials within the productive cycles is catalogued as a negative externality, in which a lacking configuration and estimation of the market is detailed, due to this, the cost-benefit relation and the different endogenous variables involved in the productive systems are taken into account in a more responsible way, since the emission of waste is totally linked to these cycles or processes used. (Falcón, Melgar, & Silva, 2022).

In the particular case of European industries, circular models are increasingly used, due to the returns that their application generates, in a detailed report of the German Federation of Industries, it was estimated that on average the average economic return for each euro invested in recycling actions brings a reduction of fourteen euros in the total production costs of the companies. (J, F, & P, 2021).

An example of the situation described above is reflected in the agro-industrial industry. Throughout history, this economic sector has been one of those that has suffered the greatest losses due to the non-utilization of resources, in part due to the rapid decomposition of the inputs used in its operating systems or incorrect processing techniques, A clear example of this situation is the Spanish olive oil producing industry, whose main economic reason is the production of virgin oil for public consumption. In this

industry it is estimated that the yield per kilogram of olives used is 25%, i.e. for every 1000 grams there is an average of 750 grams of unusable waste, this unfavourable phenomenon has been a major cause of the loss of resources, which is due in part to the rapid decomposition of the inputs used in their operating systems or incorrect processing techniques. (Luis León Mendoza, 2021)This unfavourable phenomenon has been the promoter of an operational expansion with respect to the models of this industry to such an extent that nowadays processes of reuse of waste are used to obtain other products with high added value such as Thyrozol (a drug used for the treatment of hyperthyroidism), this business model aims to increase the functional use of olive trees, in a market other than Gourmet as is the case of drugs. (Morales, et al., 2021).

At the national level the management of solid waste and inclusion of the circular economic model has been evolving since 2010 in which through the Ministry of Environment promoted the Policy of sustainable production and consumption, which was designed in order to optimize inputs and resources used in production systems, progressively in each coming year the government was promoting environmental care policies according to current trends and needs, for the year 2019 the policy for the Integrated Management of Solid Waste (GIRS) was promoted. (Pérez, 2018).

Integrated Solid Waste Management is made up of 4 important areas, which begin with the care in the generation of waste, followed by the minimization of the amounts discarded at the end of the cycle, in which there must be a high rate of reuse in order to limit the generation of greenhouse gases, in Colombia the annual production of garbage is 11.It is also estimated that 898 (80%) municipalities in the country have not updated their waste management plan, which is affected in some way by the low coverage of the collection and management entities, which is 97.4% in urban areas and 24.1% in rural areas. (León, 2022).

In statistical figures the country has very low indicators (17%) regarding the levels of waste utilization produced in the industry, in contrast to what is evidenced in European countries where there are percentages of waste utilization of 99% (Holland), Spain (37%) and a European average of 67% (Báez, 2020). (Baez, 2021)In response to this situation, this year the national government implemented the Green Growth policy, which promotes the use of green or environmentally friendly activities, in order to ensure the quality of life, social security and the quality of inputs in the consumer market. (DNP, National Planning Department, 2020).

The interest generated by this type of situations within the institutions and companies of the country, goes beyond the reduction of waste since for this to materialize it is not enough to use a circular economy model, but on the contrary it requires the use of various modern production technologies, in the particular case of energy generation, solar systems provide companies with a reduction in the carbon footprint and energy consumption of resources, although it is true that this type of technology only represents 2% of the total of the country. (Alfonso, David, & David, 2019).

In terms of recycling in the country, 20 kilograms of plastics are recycled in the construction sector, 20 kilograms of plastics for every 1000 kilograms of waste generated. Figure 1 shows in detail the percentage distribution of waste by material in the different industries in the country, as well as a projection for the next 3 years, which is made according to the increase proposed by DANE, for this type of waste, which is 2% per year.

Figure 1. Abstract representation of tons of solid waste in Colombian industry.

	Kilogramos al año (2022)	Kilogramos al año (2023)	Kilogramos al año (2024)	Kilogramos al año (2025)
Textiles	38380	39148	39931	40729
Plastico	15240	15545	15856	16173
Madera y plastico	65057	66358	67685	69039
Papel y carton	246979	251919	256957	262096
Metales	232000	236640	241373	246200

Note: Own elaboration.

Above figure shows the materials that are most wasted by the companies. In the case of plastics, according to the projection, they could have a value of 16.17 tons of waste per year by mid-2025, according to the figures previously mentioned, 79% is not recyclable, which would generate a net waste and contamination of 12.7 tons per year.

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3.2. Polymers: Definition, classification, uses and main indicators.

Ontologically, the term *polymer* is linked to the integration of two major concepts, the first being the *monomer*, which is nothing more than a small molecule that undergoes a polymerization process to form a substance of several (poly) particles, commonly known as polymer. In its beginnings the great majority of polymeric materials came from animal or vegetable origin, natural plastics such as wool or wood were used in different daily activities in the old world. (Enrique Cisneros Zayas, 2020).

With the passing of the years and the appearance of modern scientific methods, accompanied by technological advances, more resistant polymeric structures began to be designed and used, which came from 100% synthetic elements, hence they were catalogued as synthetic polymers or modern polymers, of these the first synthetic known and presented in the market was the Bakelite (1907), since then the term synthetic polymer is catalogued with the definition of plastic, these are subcategorized by six major groups (thermoplastics, thermos rigid, rubbers, fibres, adhesives and paints). (Meira & Gugliotta, 2021).

At the beginning of the last century (1922), formal studies of polymers, their sources of obtaining and characterization of their chemical and physical properties began, these studies were initially carried out by the German scientist Hermann Staudinger, who, as he advanced with his explorations in the field of monomers, ruled by the end of 1926 that these particles, when interrelated in long molecular chains, could form particles with low molecular mass but efficient composition of elements compared to other metals, He ruled by the end of 1926 that these particles when interrelated in long molecular chains could form particles with low molecular mass but efficient composition of elements compared to other metals, since then until today the studies have advanced considerably, to such an extent that standards were created (IUPAC) in which the names of each element are established, the polymers are usually named using as suffix the name of the base monomer for its conformation, plus the prefix poly, for example: Polystyrene, polyethylene, etc. (Frontela, 2017)

3.3. Characteristics and types of polymers

Polymeric materials are classified and grouped according to the characteristics that these have to certain moments of stress to which they are subjected in controlled environments, the measurements performed check the physical, chemical and mechanical degree that the particles have before these episodes, as main chemical properties it is known that they usually have the reactivity of the molecules that constitute the monomers that are at the ends of the chains. Synthetic polymers are not very reactive, although the presence of acids and organic solvents tends to corrode them rapidly. (Gabriela, Rosario, Kashina, & David, 2018).

In the physical aspect it was established that polymeric materials are usually poor conductors of electricity, which favors their use for the development of electrical insulators, it is also known that these materials are crystalline, which ensures that at low temperatures these materials have greater hardness to the point that they can crystallize, although at commercial level the chemical and physical aspects are not the most demanded polymers, since the factor by which consumers choose a material over others are the mechanical characteristics (viscoelasticity, elasticity, plastic flow and fracture) which characterize the suitability of use or not in industrial operations. (Lomparte Cabanillas & Sánchez Neglia, 2019)..

Polymers are classified according to their origin, their chemical structure, the structure of their chains and the number of molecules they contain within their conformation. Table 1 summarizes the main aspects of this characterization.

Table 1. Characterization of polymers

Polymers by origin	
Type	Description
Organics	They are obtained from acids and proteins of natural origin.
Synthetics or modern	They are natural polymers which are transformed by chemical processes to obtain new elements.
Semi-synthetics	All those inputs that are obtained at scale through the use of organic monomers.
Polymers by chemical structure	
organic	The main chain of the element is mainly made up of carbon
vinyl organics	They are characterized by having only and exclusively carbon atoms in their main chain, which may be accompanied by halogens and styrenes in their structure.
non-vinyl organics	They lack carbon in their main chain, which is replaced by elements such as oxygen and nitrogen.
Inorganic polymers	They are based on free carbon elements, generally silica or sulfur.
Polymers by number of molecules	
Homopolymers	They consist of a single molecule that repeats throughout its molecular structure.
Copolymers	They are composed of two or more types of molecules that are reiterated successively in the molecular chain of the element.
	polymers according to their applications
Elastomers	They have the capacity to recover their initial shape after being subjected to some effort.
Adhesives	They are elements that allow joining two parts in their surface phase, due to their high adhesion and cohesion index.
Fibers	They are polymers with a high elasticity index, but with low extensibility, favorable for designing fabrics since their dimensions remain stable.
Plastics	Their main characteristic is that they are irreversibly deformed and cannot return to their original shape.
Coatings	They are polymers in liquid state with easy adhesion properties on surfaces where they are usually applied.
Thermostable	Better resistance to impact and temperature extremes
Thermoplastics	They have the facility to change state when the temperature of the surface that contains them increases.

Note. Table 1 contains the different classifications of polymers according to some aspects raised by Aizpurua et al, (2018), in their research article entitled "Study of high strength concrete with the use of organic material ash

and polymers" (Aizpurúa, Moreno, & Caballero, 2018). Polímeros biodegradables. Potenciales uso e importancia en el mercado actual.

3.4. Polímeros biodegradables. Potenciales uso e importancia en el mercado actual.

Polymers of organic origin are occupying an important line of world trade and industry. Due to the versatility that presents the processes of obtaining them, this has been one of the characteristics by which current consumers are declining when acquiring a polymer, is the way by which this input can be eliminated, biodegradation is perhaps the method in which the expectations of consumers and producers are falling, because this can break the molecular chains that make up the material from the use of mechanisms that are able to survive in the presence of oxygen (aerobic) or lack thereof (anaerobic). (Viteri, 2018).

Generally, biodegradable resources are obtained from starches or organic materials, which after 3 days with a constant thermal behavior (60º C) begin to decompose eliminating their structure almost completely, now it is worth mentioning that there are some types of starch which have thermoplastic characteristics, which are highly demanded in the current industrial sector, it is estimated that out of every 1000 kilograms of biodegradable polymers 500 kilograms of these correspond to thermoplastic elements or thermal agents. (Cornejo Reyes, Marinero Orantes, Funes Guadrón, & Toruño, 2021)..

Other methods of obtaining biopolymers are cellulose and vegetable oils, the former are obtained from a modification made in the chemical structure of cellulose through the inclusion of chains of certain polymeric groups, in the case of the latter their obtaining varies according to the resource by which they are obtained, some of the main polymers obtained by this means are epoxy resin, polyurethane, polyesters, etc. (Almonte & Rivera, 2020). (Almonte & Rivero, 2020).

The main advantage of an organic or biodegradable polymer is that it can be completely eliminated by the environment, thus limiting the increase of the environmental impact due to water or soil contamination, as an example we can take a common plastic container for liquids, this within its design contemplates a significant life cycle until the consumption of the final customer, in this phase the container is usually discarded with a low rate of reuse, in this case is where the advantage of a biodegradable input stands out since in the event that the final consumer does not want to dispose of the element for longer, this after a certain period in contact with the environment will disappear and will not alter the contamination of existing resources in the environment where it is usually discarded. (Arela, Masco, Churac, Rivera, & Calla, 2021).

However, despite their environmental advantages and low pollution rate, this type of materials have disadvantages compared to traditional polymers, one of these is that the cost of obtaining a biodegradable polymer is considerably higher than the cost of production of a petroleum-derived plastic, likewise the mechanical properties of biodegradable polymers are inferior to those of typical plastics, presenting lower physical strength (Maure, Candanedo, Madrid, Bolobosky, & Marín, 2018)..

At an industrial level, the use of biopolymers is becoming more frequent than one might think, its applications in the vast majority of cases are linked to textile companies in which fibers are contained for the manufacture of garments, which although they have a lower resistance in contrast to other elements, however its use is viable if one takes into account that other materials can be added that extend its duration and physical resistance to certain conditions. (Nieves & Zarazúa, 2020).

National figures regarding the use and inclusion of biopolymers in industrial activities have identified that approximately 28% of the bioplastics on the market are used in the production of consumer goods, while in the case of the construction sector the figure amounts to 21%, 2 percentage points higher than that shown in the automotive sector (19%), its use has also been extended to logistics packaging operations with 15%, while in the case of textiles they are only used with 11% participation of the total offered

4. Discussion

Pollution in ecosystems and biodiversity present in the universe, has been caused by various factors both individual and group, in the case of the second one we can identify those processes or actions executed by the vast majority of industries within their production systems, plastics are one of the inputs that have provided greater utility to the routine activities of human beings to such an extent, that most of everything around us has plastic, it is a reality that is very difficult to reject or deny.

The excessive use of these materials together with the negligent management in the activities after their disposal have caused one of the strongest environmental problems presented in the last 100 years, since almost 80% of these plastics are synthetic type obtained from fossil fuels that cannot degrade conveniently, therefore the end of a product instead of being the satisfaction of a consumer need on the contrary is the beginning of a greater evil in humanity and the biodiversity that surrounds it, This reason has allowed industries to look for new materials that do not pollute in the short and long term, biodegradable raw materials in principle are the solution to the problems of plastic pollution, however the financial investment that their extraction requires makes them not so attractive for the vast majority of entrepreneurs (Diaz Vela, 2022).

It is commonly thought that the processes or activities resulting from the inclusion of biodegradable materials are of poor quality, since it is believed that the chemical composition of most biodegradable materials does not meet the same considerations as products obtained from petroleum (López M. R., 2021), currently with scientific advances these statements have been forgotten, since the various scientific and practical assessments have demonstrated the excellent performance of organic polymeric materials when mixed or supplemented with other elements, thus providing a higher degree of durability and better feeling of guarantee in the product.

Now, the industrial phenomenon that has caused this pollution has not only been due to the use or not of some synthetic element, but on the contrary, it is the reflection of the obsolete methods or mechanisms of operation inside the companies, for this reason is that currently the fact of having management systems or environmental action plans in the medium and long term are an obligation on the part of the institutions of environmental care towards companies, for this reason it has been promoted what is well known as green production, green production is nothing more than the grouping of materials and renewable energies in industrial activities (Calderon, Santos, & Zaritzky, 2018).

Green industrial activities since 2016 have been increasing their participation within the economic sectors of each country, in fact the fact of integrating sustainable resources and support the care of the environment has been the added value that entrepreneurs have had for their consumers, from this that currently the main advertising actions beyond talking about discount policies, For example, when purchasing a flight by plane, each alternative begins to be evaluated by the percentage of CO2 that the flight generates, although this data was not so relevant a few years ago, it now seems essential in the consumer's decision when opting for the flight or not (Jimenez, 2021).

The above can be listed or grouped in the circular economy model, which beyond having environmentally friendly processes, seeks to consolidate actions after the final cycle of a product, since it is considered that these exist the largest environmental present, in this new model the production systems are considered as transformation tools in which there is a high degree of innovation when using data management technologies and likewise energy generation through renewable or alternative sources (Lorenzo-Santiago, Rendón-Villalobos, & Olvera-Guerra, 2020).

Circular economic systems have been created to establish themselves as an important economic scoop within the economic sectors of each nation, however the lack of knowledge of the stages of these and the ways in which they should be executed, has allowed entrepreneurs and major economic actors to obtain conventional production mechanisms in which the scientific limitations are very evident, for this reason there are no significant advances compared to market trends and the real needs that consumers are demanding both in general and collectively.

Another of the main limitations that the circular economy may have is the inclusion of research as a central axis in the decisions taken within the company, since the investment required to design laboratories, hire professionals and others exceeds in part the expectations of the industry and outsiders, which is why it is taken as an external activity in companies, which most of the time is usually hired when it is required.

Conclusions

The circular economy has a great environmental and social value within the economic sectors, however its use and appropriation is limited to the inclusion of various scientific methodologies that in some cases are often unattainable for small or medium industrialists, This situation has led producers to rely on third parties in the case of wanting to innovate their supply and production processes or, on the contrary, to continue with the same traditional methods and inputs in which contamination and low quality factors are not taken into account; the latter is one of the factors that are increasing the purchase rates on behalf of consumers.

The transition from synthetic to organic materials, in the first instance is often thought to be totally unrelated to each other, however within this there is a great possibility of reducing the large volume of pollution in the different current ecosystems, because by mixing these types of materials hybrids can be obtained with excellent behaviours that ultimately are the industrial future of plastics and products dependent on them.

The cost-benefit relation that is presented at the moment of including biodegradable materials in the industries is favorable as long as the businessmen contemplate or update the operation ideologies, since in this case activities such as recycling, research and professional development of their workers, due to the fact that these play a very important role within the management plans inside the organizations, likewise the different considerations that are trend in the market force in one way or another that the modern processes are green or friendly to the environment thus granting a significant added value at the moment of prevailing in competition.

Colombia has a great potential in terms of including and producing biodegradable elements since most of them are obtained from starches or fatty acids which are derived from many of the great products

cultivated in the country, and which are known for their excellent quality and low prices, For the nation, this strategy would be generating an income since what today are considered wastes of some sectors would be used to obtain new inputs with a wide market at present, as well as strengthening the Colombian industry with environmentally friendly public policies that in turn are attractive in foreign markets.

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Döngüsel ekonomi: Üretim süreçlerinde sentetik malzemelerden biyolojik olarak parçalanabilen malzemelere geçiş. Vaka incelemesi

Özet

Halihazırda mevcut olan iklimsel ve düzenleyici koşullar, şirketlerin değer zincirlerinde yüksek etkili stratejiler tasarlamalarını gerektirmiştir. Önceliğin şirketlerin ekonomik büyümesini garanti altına almak ve farklı piyasa oyuncularının beklentilerini karşılamak olduğu düşünüldüğünde, bu durum şirketleri mükemmel fiziksel özelliklere sahip düşük maliyetli hammaddeler kullanmaya yönlendiren bir faktör olarak mükemmel koşullara sahip bir nihai ürünü garanti altına almaktadır. Sentetik polimer günümüzde yaygın olarak kullanılan bir girdidir ve bir şekilde pazarın taleplerini karşılamasına rağmen, genel olarak çevre kirliliğinin odağı haline gelmektedir, oysa bu belge yeşil polimerlerin endüstride ticari ve üretken geçiş olasılığına ilişkin bir literatür taraması önermiştir. Bunun için, son beş yılda konuyla ilgili diğer yazarlar tarafından sağlanan referanslar ve araştırmalar dikkate alınarak, bu unsurların pazardaki kullanım ve maliyetlerinin nicel yönlerinin detaylandırıldığı tanımlayıcı bir metodoloji kullanılmıştır.

Anahtar sözcükler: Biyobozunur, Maliyet, Partikül, Sentez, Sistemler.