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The Current Scenario Over the Influence of Biodegradable Plastics

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ABSTRACT

Biodegradable plastics are a kind of plastic that may naturally decompose in the environment, cutting down on waste and pollution. Due to the damaging effects of conventional plastics on the environment, the manufacture and marketing of biodegradable plastics have gained importance in recent years. Renewable resources, including corn flour, are used as the main source in the production of biodegradable polymers. The demand from consumers for environmentally friendly products is driving a rapid expansion of the biodegradable plastics market. A wide range of products, including packaging, agricultural equipment, and medical supplies, use biodegradable plastics. A thorough grasp of the market, consumer preferences, and environmental restrictions is necessary for the development and marketing of biodegradable plastics. Since they can naturally decompose without harming the environment, biodegradable plastics are an environmentally friendly substitute for conventional plastics. Utilizing renewable resources, such as starch, cellulose, or vegetable oil, which are broken down by microorganisms into byproducts of nature, allows for the production of biodegradable plastics. Targeting consumers and businesses who are environmentally conscious, marketing biodegradable plastics involves highlighting the advantages of using sustainable materials and their positive effects on the environment. As consumers and businesses become more conscious of the negative environmental effects of conventional plastics and as there is a growing need for sustainable alternatives, biodegradable plastic has grown in popularity. Businesses have numerous options to stand out from rivals and contribute to a more sustainable future through the manufacturing and marketing of biodegradable plastics.

KEYWORDS: Biodegradable plastic; plastic recycling; composition; incineration; bioplastic, food packaging.

INTRODUCTION TO BIODEGRADABLE PLASTICS

In comparison to conventional plastics, biodegradable polymers offer a wider variety of waste management treatment options, and the Life Cycle Assessment supports this. Biodegradable polymers can therefore significantly aid in resource utilization, landfill reduction, and material recovery (Mostafa, 2018). We contend that the use of biodegradable plastics in packaging, single-use items, and agricultural plastic mulches has the greatest positive impact on the environment. Biodegradable plastics must be used and managed according to specific end-of-life scenarios if they are to be a significant part of strategies to reduce plastic pollution of the environment (Narayan, 2021).

Plastics that can be broken down by microorganisms into CO_2, CH_4, and microbial biomass are known as biodegradable plastics. For energy and carbon assimilation, microorganisms use the carbon substrate from plastic polymers. Both aerobic and anaerobic conditions can cause this process to take place, but the aerobic process is more effective in terms of energy gain. Plastic unquestionably has a significant impact on daily life because it is a practical and versatile material. However, since plastic is made up of more than 90% fossil fuels, it is not biodegradable and causes significant environmental issues (Banks, 2016). Global plastic production is estimated to be around 350 million tons per year (Statista, 2018); however, only 5% of the economic value of plastic packaging is kept in the country's economy, while 32% is lost to the ecosystem. A potential replacement for conventional plastics is bioplastics, which are defined as plastics that are partially or entirely made from renewable raw materials and also adhere to biodegradability standards. These wastes also contain organic municipal solid waste components (Moshood, 2018). But out of all the common goods like food, paper, leather, and aluminum, plastics are the hardest to break down. This is because it could last in nature for hundreds of years before decomposing (Chia, 2020).

OVERVIEW OF BIODEGRADABLE PLASTICS

Bio-based and biodegradable plastics are increasingly used in agricultural applications, food packaging, food service ware, retail bags, and fibers/nonwovens (E. Matsuura, 2008). Bio-based drop-in plastics, such as bio-PE and bio-PET, can be utilized in the same applications as fossil-based plastics (Iordanskii, 2020). As with fossil-based plastics, careful selection of bio-based and biodegradable packaging material is essential to ensure that a packaged product has the appropriate shelf life. Some plastic characteristics, such as low water vapor barrier in bio-based plastics, may be detrimental in some applications while advantageous in others (Z.S. Mazhandu, 2020). The PLA material has advantages for (breathable) vegetable and fruit packing but disadvantages in water bottles. Bio-based and biodegradable plastics must meet the same standards for food safety as fossil-based polymers. Numerous bio-based plastics have received certifications stating that they are suitable for contact with food (F. Razza, 2020).

Currently, it is necessary to lessen plastic waste's impact on natural resources and reduce CO_2 emissions due to the level of environmental awareness in society (J.Wang, 2016). A significant amount (10–30%) of home and industrial trash is made up of plastics, which have a slow decomposition rate and are resistant to natural processes (M. Kolybaba, 2003). They require more resources to produce and have chemicals in them that could endanger the atmosphere (Marsh, 2003). They require more resources to produce and have chemicals in them that could endanger the atmosphere (Marsh, 2003). The build-up of plastic garbage impedes the passage of oxygen and water, harming the environment and all living creatures. Plastic garbage was traditionally dumped in landfills as a means of disposal. The focus is now on recycling waste products due to environmental concerns and a lack of disposal capacity (Widiastuti, 2014). Even if recycling plastic materials is viable and environmentally friendly, more testing should be conducted to make sure the content meets the right consistency. Additionally, recycling has several problems, such as difficulties due to a complex polymer composition, a lack of specific beneficial properties, and the requirement for more resources or advanced technologies (Y. Zoungranan, 2020,2017).

When conventional plastic composites are recycled, dust and harmful gases (CO_2, NOx, and SOx) are discharged into the atmosphere. To solve these issues, businesses that deal with packaging must look for additional eco-friendly supplies and substantially cut the amount of plastic trash that pollutes the environment. A creative solution to the rising need for plastic packaging is the adoption of biodegradable plastics (Widiastuti, 2014).

Biodegradable polymers are quickly broken down by the actions of living things, usually called microorganisms in the water (D. Briassoulis, 2021). To lessen the strain caused by the depletion of landfill space and plastic pollution, this form of plastic can be used in place of non-degradable plastics. Additionally, the use of biodegradable plastics can reduce greenhouse gas emissions during use (Widiastuti, 2014). Biodegradable plastics naturally break down into harmless components in a production composting area after being discarded (Holden, 2011). Biodegradable plastics are a result of the rapid adoption of plastic materials in packaging. Polymer materials shouldn't be utilized to package goods that are intended to be used quickly (I.Blanco, 2020). As a result, biodegradable packaging was chosen since it degrades quickly in a composting facility used for manufacturing. It can be produced using either natural or synthetic resin (M. Kolybaba, L.G. Tabil, S. Panigrahi, W.J. Crerar, T. Powell, B. Wang, 2003). Synthetic biodegradable plastics are created using petroleum-based materials, which are a non-renewable resource. Natural biodegradable polymers, on the other hand, can be predominantly made from renewable materials or synthesized from them (S. Walker, 2020).

Renewable-based biodegradable polymers are made from plants, and because of the industry advantages, they have gained more attention. Additionally, using bio-based plastics can lessen your reliance on petroleum, which will reduce your emissions of carbon dioxide into the atmosphere (Widiastuti, 2014). PLA and polyhydroxyalkanoates (PHAs) are now the most highly regarded bio-based and environmentally acceptable plastic materials studied (Ipsos, 2019). Plant-based resources that are seasonally renewable are used as the raw material for the synthesis of PLA and PHA. This guarantees that, in theory, all aliphatic polyesters will be handled sustainably. Due to their biodegradability, these bio-based polymers could be converted back into CO_2 and used by plants to photosynthesize (K. Sudesh, 2008). Thus, the creation of PLA and PHA can be regarded as a pollution-free and carbon-neutral process.

The net amount of carbon in the atmosphere is consistent over the long term and across borders (M.I. Din, 2020). PLA and PHA are two examples of bio-based and biodegradable polymers that are frequently referred to as eco-friendly and renewable to reduce the use of fossil fuels. Additionally, it is predicted that these products will be used more widely and that new levels of global biodegradability will be produced for regulatory purposes (S. RameshKumar, 2020). The weight of the molecule, the order of the monomer distribution, and the crystallinity of the molecule can all be changed, and these changes can control how quickly PLA and PHA break down. The PLA and its copolymers have been successfully used by the biomedical and pharmaceutical industries to create recyclable sutures and matrices designed to coordinate the drug's administration (LAM Ho-Ching Dennis, 2013).

IMPORTANCE OF BIODEGRADABLE PLASTICS

Biodegradable plastics attract public attention as a promising substitute for non-degradable plastics that trigger serious plastic pollution, and they are claimed to be environmentally harmless and biodegradable by microorganisms. However, not all biodegradable plastics break down completely in the environment. Some of them might break down faster into microplastics than traditional plastics, posing a new danger to soil environments.

As a part of microplastics, biodegradable microplastics may pose stronger negative effects on several soil species than oil-based microplastics under some conditions. Currently, there is a fiercely increasing trend to replace non-degradable plastic commodities with biodegradable ones. Therefore, it is crucial to discuss the ecological safety of biodegradable plastics before advocating for their widespread use in commercial applications. Recycling, landfill disposal, and incineration are the main end-of-life options for plastic waste, but each has significant drawbacks and is still unregulated.

Researchers have been working hard to find suitable alternatives for traditional non-degradable plastic polymers to reduce the pollution status of both macro and micro-plastics. As a replacement for non-degradable plastic materials, the alluring concept of "biodegradable plastics (BPs)" gained widespread attention. According to this theory, BPs can be mineralized by naturally occurring microorganisms into CO_2 and H_2O as final products, opening up new treatment options for plastic waste at the end of its useful life, such as anaerobic digestion and composting. Unfortunately, it is impossible to achieve 100% degradation of biodegradable materials in natural environments (Qin, 2021).

With an annual global demand of over 400 million tonnes, plastics are the most advanced material in terms of application and range of properties, but they have recently encountered fierce public opposition. Bio-based and particularly biodegradable plastics have drawn attention as potential solutions to the issues of sustainable plastics, plastic waste, and plastic littering. The results of these strategies will be evident in the future. Plastic production can become entirely independent from fossil fuels in the long run, supporting the circular renewable carbon economy, if renewable carbon is obtained from biomass, direct CO_2 utilization, and recycling (Skoczinski, 2021).

The two most important commercial biodegradable and biobased polymers in 2012 were starch-based polymers and polylactic acid (PLA), which accounted for roughly 47% and 41% of all biodegradable polymer consumption, respectively (Petrova, 2014). Another illustration is microbial Poly-Hydroxy Alkanoates (PHA), which have been produced as biodegradable plastics for many years. According to (Chen, 2021), PHA has been promoted as a sustainable, eco-friendly alternative to petroleum-based plastics with low CO_2 emissions (Tsang, 2019).

Production of biodegradable plastic

PHB is a poly(hydroxy alkanoate), or PHA, which is a type of biodegradable plastic first discovered by Lemoigne in 1925. It was later discovered that numerous other bacterial strains were also capable of producing PHB. Chemical synthesis has also been found by Shelton et al.. The most widely used polymer of OHB, a linear polyester of d()-3-hydroxybutyric acid, is polyhydroxy butyrate (PHB). PHB is a semicrystalline, surface-eroding polymer that breaks down ester bonds through hydrolytic cleavage. It melts at a temperature between 160 and 180 °C.

The homopolymer PHB crystallizes quickly, is tough and brittle, and has a relatively high melting point. It makes drug entrapment technically challenging. PHBHV, a related copolymer of PHB and 3-hydroxy valerate (3-HV), is less rigid or brittle, has semicrystalline properties similar to those of PHB, but has lower melting points depending on the HV content. PHB and PHBHV can both be processed into different shapes, spheres, and fibers because they are both soluble in a variety of solvents. They could all be used as vehicles for controlled drug release.

Since electrical stimulation is known to promote bone healing, the piezoelectricity of PHBHV is very appealing for orthopedic applications. Additionally, it has been researched as a potential material for bone pins and plates. The FDA has designated the absorbable PHB surgical suture made using recombinant deoxyribonucleic acid (DNA) technology as class II (special controls) for future applications.

Beyond concentrating on the advantages of creating novel, environmentally friendly processes and products, businesses should also take equal care to consider the needs of consumers and consider how to effectively market products made of bioplastic (Xie, 2019).

APPLICATIONS

Application and advantages of biodegradable plastics We go over two specific uses for biodegradable plastics in this section: (1) packaging and single-use items, and (2) agricultural mulch films. We believe that biodegradable plastics have the greatest potential in these two areas.

Packaging and other single-use items

Packaging is the primary use of plastic in terms of total production by type, followed by consumer and home goods. The majority (40%) of plastics manufactured in Europe go towards packaging, followed by consumer and household goods (22%) and construction (20%). Because plastic packaging frequently has a brief and single-use life, packing generates a disproportionately large amount of garbage (61% of the plastic waste generated in Europe in 2018 was from packaging). Hence, reducing the amount of plastic trash produced by packaging will have a significant impact on global plastic pollution. A new plastic economy paradigm is required to reduce plastic waste from packaging. The Ellen MacArthur Foundation created and implemented a new paradigm based on the circular economy model.

The goal of this model is to ensure that plastic never ends up in the waste stream. To achieve this goal, the model is built around five key tenets:

(1) getting rid of unnecessary plastic packaging, (2) encouraging reuse, (3) making packaging completely reusable, recyclable, or compostable, (4) making plastics from renewable resources, and (5) ensuring that plastic packaging is free of dangerous additives. Plastics made from biobased and biodegradable materials are included in this circular economy paradigm. Although nonplastic alternatives like cellulose-based materials can be used in place of plastic packaging, they are not always necessary.

Due to the unique need for maintaining food quality and safety, replacing plastics in food packaging is particularly difficult. Recycling is just a limited end-of-life alternative for food packaging because it is frequently contaminated with food waste. An estimated 40% of food packaging is disposed of in landfills. There is a lot of potential for the use of biodegradable plastics because studies have shown that they frequently perform similarly to conventional plastics as food packaging.

The circular economy model is well-suited to the use of biodegradable plastics for single-use items without packaging. Since several jurisdictions recently passed legislation outlawing the use of single-use plastics, products like straws, toothpicks, cotton bud sticks, and retail bags are being phased out or replaced with nonplastic alternatives. However, some single-use plastic items (like cutlery and gloves) cannot be replaced by nonplastic alternatives, in which case biodegradable plastics can be useful.

Biodegradable device for women's urination

Dehydration, less frequent urination due to inconvenient restrooms, fewer available facilities for hygiene, an increase in sexual activity, and other changes in exercise, diet, and clothing are just a few of the factors that make women more susceptible to UTIs while traveling. Women travelers are advised to drink plenty of water and use the restroom whenever there is easy access, regardless of whether their bladders are full or not.

Several plastic and paper funnel devices have been created so that a woman can urinate while standing. A "portable john" is an additional option to consider for a chilly tent night or when there is no bathroom available. This unisex funnel turns the urine into a solid so it won't spill and empties into a biodegradable plastic bag with biodegradable filler. Use the individual urinal bags up to their capacity (800 ccs or 28 oz), then discard them.

Carrying pre-moistened towelettes and a supply of paper tissues or toilet paper in a fanny pack or backpack is essential for maintaining personal hygiene. Recent research indicates that estrogen vaginal creams, a vaginal ring, or even an oral contraceptive pill intravaginally once a week may reduce urogenital dryness and frequency symptoms in older women who have frequent or urgent urination without dysuria. Additionally, vaginal moisturizers like Replens can be used. Women who have increased frequency, urgency, or dysuria should be taught how to recognize a urinary tract infection (UTI) and treat it with an antibiotic and analgesic on their own.

An older woman should speak with a doctor who specializes in female urinary tract issues before the anticipated trip if she has a problem with stress incontinence or bladder control. A woman should carry extra pantyliners and learn how to perform Kegel exercises for minor issues.

Food packaging

The food industry's main concern in recent years has been plastic wrapping issues, which are a whole industry in and of themselves. This industry is always changing to meet the demands and standards of the food production industry. Its focus on creating inventive polymer-based packaging is crucial for the long-term sustainability and quality standards of the entire food industry, leading to, among other things, cleaner and more sustainable supply chains from production facilities and their internal storage systems to transportation facilities. Compostable or degradable biomaterials may satisfy the need for packaging that is reasonably priced, has a small environmental impact, is simple to customize, and has high-standard storage qualities in addition to those other requirements. The use of effective packaging in the food industry is still limited in comparison to other industries and needs to be expanded, but the biggest food distribution companies of today are aware of the problem and seem eager to use bioplastics as much as is practical.

This type of material required the development of numerous technologies, including multi-layer films, modified environment packaging, and intelligent and active packaging, due to the necessity of keeping in mind that different food items require various packaging features. Two of the most sought-after characteristics in food packaging are resistance to oxygen and water. Although it is not difficult to create bio-based multicomponent synthetic coatings to act as barriers, there is a drawback in terms of recycling because multicomponent coatings cannot be recycled while single-component materials can.

INSIGHT ON BIODEGRADABLE PACKAGING

Through their purchases of the product, customers play a very important part in the success of environmentally friendly food packaging. The choice is based on a variety of trade-off factors, including shape, color, and design. For instance, some products' flavors are influenced by color (Szolnoki, 2012). There are many reasons why consumers can decide against buying a sustainable product, including the longer production process, perceived lower quality, and limited availability (Ketelsen et al., 2020). Lack of recognition is one of the key drivers of non-development market growth sustainable packaging can be recognized by consumers thanks to logos, labels, etc. Many individuals are unaware of biobased packaging and believe it to be a marketing ploy (Sijtsema et al., 2016). Some studies found that factors like price and product quality were more significant than the use of green packaging. The only premium price that consumers are ready to pay is a little one.

Several ideas can be taken into consideration to increase the market for environmentally friendly packaging, such as the requirement that the packaging has a third-party label certification to foster consumer confidence. Food businesses that use ecologically friendly packaging must clearly explain any benefits and have an effective label on their product containers. Without effective communication, the packaging would not benefit the environment or businesses in the food industry (Ertz et al., 2017).

Agricultural applications

Nets, grow bags, and mulch films are just a few agricultural applications for bioplastics based on PHA. High-density polyethylene (HDPE), which has historically been used to improve crop quality and output while shielding it from birds, insects, and the weather, is increasingly being replaced by bioplastics-based nets. Low-density polyethylene, also referred to as planter or seedling bags, makes up the majority of grow bags. Polyhydroxyalkanoate (PHA) grow bags, on the other hand, would be biodegradable, friendly to roots, and non-toxic to nearby water sources.

To maintain excellent soil structure, moisture retention, weed control, and pollution avoidance, bioplastics must be used to replace fossil-based plastics in mulch films. In horticulture and agriculture, bioplastics are frequently employed. The buyer will save money by putting flowers or plants in a biodegradable container because they won't have to throw them away. It can be positioned next to the bloom and will eventually rot. Other applications in this area include the use of mulching film, flower bulb packaging, attaching technologies, fertilizer rods, and pheromone traps.

Medical applications

Bioplastics are used in a variety of medical applications, such as gloves, blood containers, and medical equipment. They are also used in implants due to their biodegradability. The plastic won't need to be taken out; it will 'disappear' on its own. Other applications include dental implants, medication delivery systems, burn and wound dressings, and cardiovascular applications. Biodegradable plastic material advancements in biomedical applications result in the creation of cutting-edge drug delivery systems and tissue engineering therapeutic devices like scaffolds and implants. Polymers are used in various medicinal and biological applications. As the main green bioplastic, cellulose can be advantageous in these areas. Due to its nontoxicity, lack of mutagenicity, and biocompatibility in pharmaceuticals, cellulose has been extensively researched in the fields of implants, tissue engineering, and neural engineering. The macroscopically organized arrangement of fibrils, which are the basic structural units with cell widths of 10 nm, results in the formation of cellulose fibers. Cellulosic membranes for tissue healing scopes are made using bacterial cellulose. The diameter of the holes in these membranes ranges from 60 to 300 m. Additionally, research has been done on modified cellulose matrix and bacterial nano-networks. Whether conducted in the dental, orthopedic, or biomedical fields, green plastic research on the production of medical implants heavily relies on nano cellulose and its composites. In more recent studies, magnetically sensitive nano cellulose-based materials and 3D printing have both been developed. Wound dressing nano-cellulosic membranes are another application that merits mentioning. They offer advantages like reepithelialization acceleration, wound pain reduction, infection reduction, and extruding retention.Bioprocess®, XCell®, and Biofll® are examples of patented goods of this type that are currently on the market. PHAs also have the advantage of being biocompatible, which makes them appropriate for a variety of medical uses, such as cancer detection and therapy, wound dressing, post-surgical ulcer care, and bone tissue engineering (Moshood, 2022).

ENVIRONMENTAL RISK OF BIODEGRADABLE PLASTIC

Another kind of plastic that, when utilized, has an inescapable effect on the environment is biodegradable plastic. Careless disposal of biodegradable plastics results in two environmental effects: build-up and dissolution. Biodegradable plastics can degrade into microplastics and nanoplastics, just as traditional plastics (PE and PP). Scientists have only lately started looking into the consequences of biodegradable microplastics (BMPs), thanks to advances in our understanding of biodegradable plastics (BPs). The environmental effects of biodegradable microplastics were thoroughly discussed by (Shruti, 2019). A small number of biodegradable microplastics have had their potential effects on aquatic life investigated. Biodegradable microplastics (PLA) have been proven (Green, 2016). to have detrimental effects on variety and benthic community growth richness. The high-dose response of PLA in sandy sediments and the high-concentration stress and elevation in respiratory rate induced by PLA in flat oysters have revealed similar findings in the respiratory rate of (Shen, 2019).

The adsorption and function of polymethylmethacrylate (PMMA) and biodegradable microplastics (PHB) were studied in the freshwater amphipod Gammarus fossarum, (Straub, 2017). The investigations revealed that both microplastic treatments with different particle sizes (32-250 m) significantly affected the amphipod Gammarus foss arum's ability to absorb nutrients and slowed its growth in wet weight. The results showed that secondary PHB nano-plastics altered relevant physiological parameters and statistically significantly reduced cell development in all three aquatic organisms (Shen, 2019). The'' researchers also noted that the aquatic animals put through the tests were harmed by the PHB nano-plastics produced as a result of the abiotic breakdown of PHB microplastics. The results of the aforementioned studies show that exposure to conventional microplastics and nanoplastics, as well as exposure to biodegradable microplastics and nanoplastics, has similar ecotoxicological effects on test organisms.

According to the results of induced modifications will probably indicate that biodegradable polymers are not fully safe for the environment (Shen, 2019). Additionally, biodegradable microplastics can act as carriers of microorganisms and chemical pollutants. Microplastics have been shown in numerous studies to be important vectors for the spread of microbes and chemical contaminants. The explored microplastics as vectors for environmental toxins, whereas looked at microplastic as a vector for chemicals in the aquatic environment. (Frère, 2018) investigated the microplastic bacterial communities in the Bay of Brest (Shen, 2019). Reviewed the most recent developments in toxicological research of nanoplastics in the environment, while (Ziccardi, 2019) investigated microplastics as vectors for bioaccumulation of hydrophobic organic chemicals in the marine environment (Pittura, 2019). investigated microplastics as vehicles of environmental PAHs to marine organisms (Ziccardi, 2016). Microplastics as vectors for bioaccumulation of hydrophobic organic compounds in the marine environment, while (Shen, 2019). The most recent developments in toxicological studies of nanoplastics in the environment. Due to their comparable particle size characteristics, great fluidity, and outstanding durability, biodegradable microplastics have a significant adsorption and enrichment potential for chemical pollutants and microorganisms. For the recent phenanthrene study (Zuo, 2019)investigated the adsorption and desorption of poly (-butylene adipate co-terephthalate) (PBAT, 2338 486 m), polystyrene (250 m), and polyethylene (2628 623 m) for conventional organic pollutants. The findings showed that PBAT BMPs had much higher adsorption and desorption capabilities than PS and PE microplastics.

The researchers discovered that microplastics were a more efficient phenanthrene vector when compared to typical microplastics. Unfortunately, it is still too early to say whether or not biodegradable microplastics pose a threat due to a lack of data in this area. Only a few research studies have so far revealed how biodegradable microplastics affect a select group of aquatic animals. There haven't been many studies done on the potential effects of biodegradable microplastics. Whether they will involve a variety of animals grown for human food is unknown. As a result, it is challenging to determine the precise threat that biodegradable microplastics may pose to the well-being of living things, ecosystems, and people. Therefore, the ecological effects of biodegradable microplastics on the ecosystem should worry future generations. By examining the potential effects of biodegradable microplastics on various species and ecosystems, it is essential to examine and take into account how they may affect human food safety and health.

MARKETING

Beyond concentrating on the advantages of creating novel, environmentally friendly processes and products, businesses should also take equal care to consider the needs of consumers and consider how to effectively market products made of bioplastic (Xie, 2019). By addressing environmental implementation and offering practical business applications, a circular economy has become more significant in literature as an extension of sustainability (Ghisellini, 2016), (Singh, 2019). Both academics and businesses are becoming more interested in a circular economy (Foundation, 2017), (Geissdoerfer, 2017).

Currently, PHAs are among the most promising biopolymers to replace fossil plastics thanks to several unique properties (Mumtaz, 2010). fully biodegradable under aerobic and anaerobic conditions; do not contain a single polymer, but a family of highly regulated copolymers; the possibility of microbiological synthesis under mild processing conditions; and the possibility of obtaining from a variety of wastes Thus, it would seem that the question of whether a new generation of bioplastics would be technically feasible has been resolved. However, since bioplastic products have not yet been marketed by businesses that are still concentrating on the production and technical aspects of these products, the question of consumer acceptance of such green innovation is still open.

The research discussion surrounding bioplastic products is found to be in a similar situation. Technical production-related issues have been the focus of the majority, if not the entirety, of studies on PHA-based bioplastics. To the best of the authors' knowledge, the consumer side has not received much attention (Russo, 2019), likely due to the topic and these plastics' complete novelty. Organic liquid and solid waste from homes and restaurants are used to make PHA-based biodegradable plastics and biopolymer products. The question of whether consumers recognize the value of those products and whether the impact on the environment outweighs any potential disgust with the raw materials is therefore crucial.

To successfully understand how consumers will react to products made from urban food waste, scholars and managers interested in this topic should read this paper. Policymakers should also consider the implications because bioplastics present a rare opportunity to start replacing fossil fuel raw materials and transition from a linear to a circular economy (Confente, 2020). The current study integrates consumers into the discussion of bioplastics on a marketing- and management-based theoretical foundation, making a first contribution and giving academics from the marketing and strategic management disciplines a chance to present their viewpoints. Because PHA-based bioplastics are novel and different from "traditional" green products, little is known about consumer perceptions of them. However, the prior literature advanced a set of potentially relevant variables. The new bioplastic products can technically replace actual plastics made from fossil fuels, which generate enormous amounts of waste and cause a variety of environmental issues.

There is an increase in demand for affordable, environmentally friendly materials to address waste management and pollution issues. This research aims to gain a thorough understanding of biodegradable plastics research, product prospects, sustainability, sourcing, and ecological impact. If proper waste management practices, like composting, are followed, biodegradable plastics can have properties similar to those of conventional plastics while also providing extra benefits due to their reduced carbon dioxide impact on the environment.

CONCLUSION

A multifaceted approach involving prevention, reuse, recycling, recovery, and disposal is necessary to address the world's plastic problem. Biodegradable plastics are a crucial and integral part of this strategy. Although protocols and standards have been created to test plastics' intrinsic biodegradability in standard laboratory conditions, their degradability under actual in-situ environmental conditions must also be tested to ensure actual biodegradability.

Utilizing biodegradable plastics to sterilize food and medical equipment has proven to be very effective. The primary issues that need to be successfully resolved are the high production costs and poor performance of some biodegradable plastics, which need more research to prevent them from competing with other environmental effects.

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