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Waste Vegetable Peals as Bioplastics: A Review

Suresh B[1], Poojitha[2]
[1, 2]*Department of Civil Engineering, M. Tech Programme in Environmental Engineering, Biotechnology, Bapuji Institute of Engineering and Technology, Davanagere - 577004, Karnataka, India*

Abstract: ***Bio-plastic is a significant role in our ecosystem as it is eco-friendly and compatible, when matched to plastic carry bags. Bio-plastic are produced by organic waste in environment and it degrading faster than plastic which was made of chain of polymers. Plastic made our environment poisonous, aquatic animals to die and many more. Environmental friendly plastic is made of many organic wastes like banana peel, sugarcane bagasse, newspaper, shrimps etc. Bio-plastic mostly utilised in food packaging so that they are edible to humans and doesn't cause any disease and disintegrates fast. Bio-plastic is helpful to mankind and useful to reduce environmental pollution. Bio-plastics are not affected to nature ecosystem because it can changes back into carbon dioxide. The plastics are substituted by number of varieties of bio-plastics. In this research paper chiefly discussed on utilization of substrates like vegetable waste, fruit and green leaves including water hyacinth as alternate substrate as bio- plastics. Market demand for bio-plastic is developing due to consumer-friendly products. It is less related with conventional plastics production than other bio-plastics.***
Keywords: bio-plastic, environmental friendly, organic substance.

I. INTRODUCTION

Plastics are long chain artificial polymeric molecules that are low-cost, lightweight and durable (Scott, 1999). The species in the ocean and the ecosystem get affected everyday due to the addition of plastic substance and the effects is called Trash islands also garbage patches (Jefferson, et al., 2009). The macro-plastics are renewed into micro-plastics, to convert into still small fragments takes nearly about 400 years (Ezeoha, et al., 2013). The plastics which contains chlorine releases the destructive chemical substance into the soil then enters into ground water through water cycle. This changes in the food chain and also harmful to species that intake through mixed water (Kathiresan, et al., 2003).

II. EXPERIMENTS OF BIO-PLASTICS

Literate survey summarises, collected, represented and analytical data by academic and industrial researchers from bio-plastcs and their effects on the ecosystem. The scholar's relevant work searched by placing the relevant studied to discuss in the present study. Bio plastics prepared using petroleum based, biomass based, biodegradability, disposal as waste, recycling and life cycle appraisal. Industrial research work done by the researchers like primary data accessible on company and agencies websites, was included from this review as such data gives information about the bio-plastic as economic, cutting-edge research and development activties. To specifically meet the objectives of the current review, discussed presenting a new categories of bio-plastics including its positive and negative impact on ecosystem were also discussed. The outcome of this literature review are represented in four parts. The first part is Plastics and Ecosystem, discusses currently using conventional plastics, their bio-degradability including impact on the natural and artificial systems. The second part consists about bio-plastics and replacement of currently using plastics including some of the significance of bio-plastics for commercial and industrial activities. The third part presents advantages and disadvantages of bio-plastics including effects on materials. The fourth part defines the life cycle assessment including the eco-friendliness of bio-plastics with reference to primary analysis reported by the various authors.

III. CURRENT TRENDS OF BIO-PLASTIC

Bio-plastics are one of the supreme innovative substances that are bio-degradable and bio-based, which is created from waste, renewable sources and bio-mass are used by many authors like as jackfruit (Lothfy, et al., 2018), banana peels (Mohapatra, et al., 2015), organic waste (Goswami, et al., 2015), agriculture waste (Zulkafli, 2014), paper waste (Joshi, et al., 2015), oil palm hollow fruit bunch (Isroi, et al., 2017), sugar cane (Khosravi-Darani and Bucci, 2015), corn starch (Keziah, et al., 2018), potato (Schon, et al., 2014), rice straw (Agustin, et al., 2014), rapeseed oil (Delgado, et al., 2018),vegetables oil, cellulose from floras, starch, cotton, bacteria (Shamsuddin, et al., 2017) and occasionally from several Nano-particles like polysaccharides (carbohydrate chains) (Jabeen, et al., 2015).

Bio-plastic degraded by the natural microorganisms such as bacteria (Ali, et al., 2017, Pradhan, S. 2014, Das, et al., 2018), algae and fungi (Momani, B. 2009). In this research paper chiefly discussed on utilization of substrates like vegetable waste, fruit and green leaves including water hyacinth as alternate substrate as bio- plastics. Describes the classification of bio-plastics then followed by merits and demerits of bio-plastics. The article also includes the processing, applications, experiments of bio-plastics and finally describe on future scenarios of bio-plastics.

A. Types of Bio-plastics-Material and Methods

Bio-plastics classified based on the type of manufactured using raw materials and its properties which are available in the market. Bio-plastics are also considered under biodegraded by microbes within a period of time in the environment. Generally, bio-plastics are classified into biodegradable (Polylactic acid, Polyhydroxy alkanoates, Cellulose, Starch) and non-biodegradable (Biopolypropylene, Biopolyethylene) plastics (Emadian et al., 2017, Mohapatra, et al., 2015, Ilyas, et al., 2016, Soykeakaew, et al., 2017, Lackner, 2015, Sun, 2015 and Rugenstein, and Angelova, 2013). Depends upon this bio-plastics are classified into four types like biomass based polymers, monomers from polymers, polymers from microbial biodegradable including fermentation, monomers and recyclable and compostable bio-plastics. Bio-plastics available in global market is assumed to be growing about 20% to 25% per year. Nearly out of total available plastics, about 10% to 15% bio-plastics will increase its market share to 26% to 34% by 2021. The bio-plastic market attained over 75 billion rupees in 2008 and it will be over 750 billion by 2021. More and more establishments are entering and investing in this market (Krzan, et al., 2006, Kaith, et al., 2010).

B. Merits and Demerits of Bio-plastics

Plastic is one of the chief pollutant which causes pollution in the ecosystem and also used in the daily life (Pradhan, 2014). Therefore, to reduce the pollution in the system, find out a substitute for alternate as plastics material to change the practice of conventional plastics. The progress was observed in the nature and world the contribution of bio-plastics. Many environmental issues can be renewed by using with polymers based on natural renewable resources like biopolymers starch based, cellulose based and other polylactides and polyhydroxyalkanoates (Kalia, et al., 2011). The properties of bio-plastics makes a good alternatives for conventional plastics. Along with this bio-plastics is having a unique properties like eco-friendly, energy efficient and biodegradable including compostable (Shamsuddin, et al., 2017). Conventional plastics affects the environment, difficulty to recycle and also creates pollutants into the ecosystem and creates pollution have various hazardous effects to the environment (Kalia, et al., 2011). Therefore, there is urgently require to rethink about the usage of kind of materials is difficult to protect air environment. Hence, bio-plastics is a replacement of conventional plastic also revolutionary way for sustainable development since both plastic are showing similar properties. Moreover, in certain condition bio-plastic shows better properties with some mechanical and thermal properties also water transmission rate (Pandey, et al., 2014). Some of the Bio-plastics having advantage like sustainable, reduced carbon foot print, reduce energy efficiency and partly prepared with natural feedstock. Like that some of the disadvantages costly, thermal instability, recycling problem and brittleness. Comparatively, bio-plastic and conventional plastics are showing similar properties observed by previous researchers (Shamsuddin, et al., 2017, Chen, Y. J. 2014, Jabeen, et al., 2015, Ilyas, et al., 2016, Lackner, M. 2015, Shivam, P. 2016, Reddy, et al., 2013, El-kadi, 2014, Andrady, et al., 2009, Arikan, et al., 2015, Pandey, et al., 2014).

C. Bio-plastic as Packaging Material

The bio-plastics introduced in 2018, as packaging material and market accounted for roughly 68% of the world-wide manufacturing of bio-plastic (European Bioplastics, 2019). Some presently created and applied bio-polymers using renewable resources contains cellulose and starch, which are biopolymers that are obtained directly from agricultural waste (de Moura, et al., 2017). However, bio-based does not considered as biodegradable and compostable (Dammer, et al., 2016, European Bioplastics, 2019, Van Den Oever, 2017). Bio-based goods products contains raw materials that are renewable and can be recycled through natural processes (Niaounakis, 2015). Biodegradable products consists polymers which consumed by microorganisms through degradation process.

IV. PROCESSING AND APPLICATION

Bio-plastics produced using PHAs as biomass source can be used for packaging material and disposable products on the other hand biofuels can also be generated using PHAs. PHAs find countless applications in industry, agriculture, pharmaceuticals and health. Soon a whole variety of day-to-day products will be produced with bio-plastics; along with the things you might expect like packaging and food-services products but also components in consumer electronics and automotive components. In relation to the manufacturing of packaging, conventional plastics are being substituted by bio-plastics at a rapid pace.

There's a big demand for bio-plastic packaging and it is the largest segment of the European bio-plastic market- estimated at around 44% of 2.05 million tonnes in 2017.

Bio-plastics provide an alternative approach to packaging and are a real solution to the need for a reduction in conventional plastic use and waste. Plant based polymers are able to fully compost at the end of their useful life. Biodegradable plastics are also being used for medical devices. Dentist are also getting on board and are using bio-plastics for dental implants that fill in the hole that remains after a tooth has been extracted. The cosmetics products are another big creator of packaging for its products. Many of these products have a short life span once disposed of they end up in landfills.

Biodegradable polymers have been at the forefront of research for biomedical applications in the last 50 years. The advancements have been seen in the areas of using biodegradable polymers as delivery vehicles for controlled drug release (Lyu, et al., 2016, Sung, et al., 2019 and Maya, et al., 2017). Bio-plastics have been the great of motivating exploration like in construction and building activities. However not only builder but home owners are also attracted to use bio-plastics for different products such as in fencing, decking and so on (Souza, et al., 2012).

V. FUTURE SCENARIO OF BIO-PLASTICS

To control the disposal of plastic waste released from the various sources, most environmentally innovative and eco-friendly solution is adopt biodegradable plastic in daily life and applications. Currently non-biodegradable petroleum products are source for plastic pollution and main treats to the ecosystem especially in the absence of waste management. (Temoor Ahmed, et al., 2018) Now a day's bio and fossil based plastics are adopted as alternate for petrochemical plastics. The demand of these type of plastics are increasing constantly in certain applications. These type of materials focused in future especially for manufacturing and packaging industries including disposable medical waste. Moreover, bio-degradable plastics should be used where diffusion into the ecosystem is imminent and challenging to segregate the garbage (Vijaya and Reddy 2008 and Chen and Patel 2011). On the other hand, proper management of waste and littering control is required to take benefits of such polymers in the community.

VI. CONCLUSION

Bio-plastics have significant potential as substitutes of fossil-based plastics in many applications especially in food packaging and carry bags. They have been used in several food packaging units. Molenveld et al. [1] reported that PLA and bio-PE are adopted as bottles to cover fruits, milk, and dairy foodstuffs. PLA, starch based, and cellophane are used as films, trays/dishes, and bowls to store food, like vegetables including meats and other food items. Bio-plastics can be used as single-use plastic substances and packaging material, which was produced by seaweed as raw material. Significantly, however, bio-plastics are related with some deficiencies. It should be understood that many degradable bio-plastics end up with the landfills, which degrades slowly and releases methane gas. Hence, public are starting to use bio-plastics.

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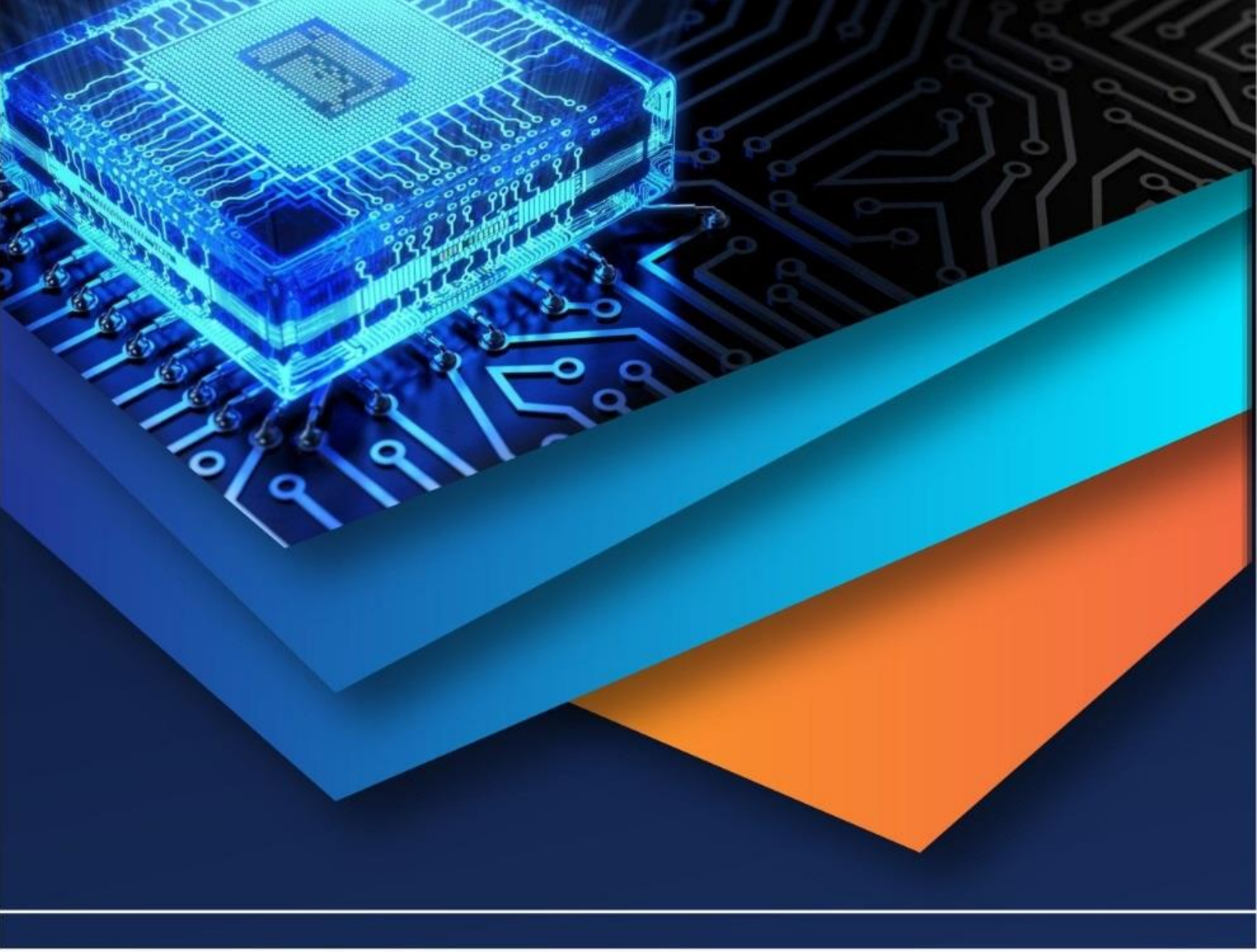

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