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Opinion

Seaweed Polymers, A Replacement of Single-Use Plastics- A Review

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ISSN: 2770-6613

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Submission: June 24, 2022

Published: July 01, 2022

Volume 3 - Issue 5

How to cite this article: Aswini Murugan, Thahira Banu A, Shanthana Lakshmi D. Seaweed Polymers, A Replacement of Single-Use Plastics- A Review. Polymer Sci peer Rev J. 3(5). PSPRJ. 000572. 2022. DOI: 10.31031/PSPRJ.2022.03.000572

Opinion

Petroleum-based plastics are increasing in multifold because of human demand and their versatility. The accumulation of microplastics in land, ocean and river leads to the accumulation of toxic chemical compounds in the organisms. At present, plastic industries are more responsible for huge plastic waste generation, primarily due to packaging. The time has arrived to explore environmentally friendly biomaterials for replacing single use plastics used for food packaging [1-3]. The term bioplastics refers to the plastic materials obtained from renewable and biodegradable biological sources. These types of plastic production require less cost and energy; are easy to recycle than fossil fuelbased plastics [4]. In general, bioplastics made from only one type of natural film-forming polymer possess a mixture of good and bad properties. An alternative approach is to blend biopolymers into a bio-composite material to improve biofilm properties [5].

Polymer (edible and biodegradable) materials are manufactured from edible and renewable ingredients, namely polysaccharides, protein, and lipids, which degrade more rapidly than non-renewable petroleum-based polymers. Due to their preservative capabilities and degradable properties, these polymers have been used in food packaging and biomaterial products in the form of film wrappings or food coatings. They greatly benefit to the economy, health and the environment ([6]; Khalil Abdul et al. 2017). Seaweed-derived biological components, such as alginate, ulvan, agar, fucoidan and carrageenan, have unique optical, thermal, mechanical, physical, antimicrobial and antioxidant properties. The seaweed-derived bioactive compounds have biodegradability properties. This property is ideal for producing bioplastic packaging for medicine and food [7]. In recent years, seaweed-based packaging received much interest and attention related to food, energy, biosensors, tissue engineering and drug delivery applications [8]. Seaweed-derived bioactive components have biological properties that can ensure the safety of the packed product [9], in addition to non-cytotoxicity, biocompatibility and antimicrobial properties [10]. Seaweed-derived bioplastics are biodegradable in the soil over a short period, which is helpful in foods or drugs packaging [11] whereas non-plastic residuals are dispersed into the environment [12], Bioplastics can be synthesized from seaweed because they are rich in polysaccharides and not widely used in the plastic industry [13]. Seaweed is a renewable biomass resource; its polymers are made from sugars, which contain carbon; they create high-quality biodegradable bioplastic and make a good environment-friendly, inexpensive and toxic-free bioplastic [14,15].

Biofilms made from seaweed are non-toxic, biodegradable, edible, and biocompatible; they demonstrate high rigidity and low deformability. Moreover, biofilms produced by seaweed have poor water vapor barrier properties due to their hydrophilic nature [16,17].

Biofilms (bioplastics) are manufactured from biopolymers isolated from seaweed with specific characteristics and are considered as potential new alternatives for plastic packaging materials. Packaging made from pure hydrocolloids does not meet the criteria of commercial bioplastic. The addition of plasticizers to the biopolymeric material will improve the performance of biofilm/bioplastics packaging. Seaweed-derived bioactive components were greatly interested in developing sustainable and eco-friendly bioplastic; this will be used to replace petroleum-based plastics and avoid the large production of plastic waste.

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