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BIOPLASTICS FROM FISH SCALES AND WATER HYACINTH

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ABSTRACT: Plastic is one product that is used in highly used in modern life for its durability and affordability. On the other hand, plastic poses a threat to the environment due to its non-renewable nature, making it difficult to decompose. Environmental pollution has increased due to the ease of transportation, single use in daily life and intensive use. Because of this, bioplastics have emerged as a solution and are thought to be more beneficial to the environment. Bioplastics are plastic materials produced from renewable biomass sources and are biodegradable. Recently, bioplastics production from fish wastes has been started. Cellulose from water hyacinth has been used to make polyhydroxybutyrate (PHB), a resource for bioplastics and also contributes to a more flexible. Also it reduces the usage of petroleum derived product by using bioplastics instead of plastic. For all of that reasons bioplastics usage has increased in our life.

KEYWORDS: **Bioplastics, Fish scales, Biodegradable, Environment, water hyacinth, polyhydroxybutyrate**.

INTRODUCTION: Plastic is a product that is highly used in our daily life for being cheap and useful. However, plastic expose a threat to the environment due to is non-renewable nature, making it difficult to decompose.

The world has produced over nine billion tons of plastic since the 1950s. 165 million tons of it has trashed our ocean, with almost 9 million more tons entering the oceans each year [7]. Since only about 9 percent of plastic gets recycled, much of the rest pollutes the environment or sits in landfills, where it can take up to 500 years to decompose while leaching toxic chemicals into the ground. In addition to this environmental problem, there is also the large amount of organic waste that is generated by the food industry, such as the fishing industry, which represents expenses for its treatment and recovery [22]. A seismic shift in economic objectives triggered by the growing and overwhelming evidence from industry suggests that the projected cumulative growth of primary plastic waste produced by 2050 will exceed 25 billion metric tons [11]. Combined with the shift towards sustainability using non-petroleum based plastics, the production of bio-based/non-biodegradable and biodegradable plastics projected from 2020 to 2023 [16], is expected to grow 13% per annum. Leading plastic packaging producers are moving towards a goal of 100% recycled, biodegradable or re-useable plastics in their products by 2025 [9].

For all of that disadvantages bioplastics appeared. It has faster decomposition, smaller carbon footprint and it is reducing the use of fossil fuel resources [16]. Biodegradable plastics usually suffer from limitations, such as poor mechanical properties, and the inability to blend them with many other polymers without losing their biodegradable functionality [3]. The market value of biodegradable plastics is in their biodegradable performance when disposed and still requires biodegradation testing to ensure that no chemical interactions hinder the overall biodegradation rate [10]. Biodegradation is the degradation process involving microorganisms, and is widely accepted as selective, and depends on several factors including the physical and chemical properties of biopolymers [2]. The biodegradation process is defined as polymer degradation by biological microorganisms into CO_2, H_2O, biomass and methane by composting, soil biodegradation, marine biodegradation, or other biodegradation processes [18]. It is also termed biotic degradation and can be enhanced or started after some initial abiotic degradation processes occur such as mechanical, oxidative or hydrolytic degradation which can increase the surface area of the organism–polymer interface [5]. Thermal or oxidative degradation is non-selective, occurring to all polymers, and introduces thermal or chemical stressors that scission the chains of polymers into smaller units of oligomers, acids, alcohols, esters, and radicals [4]. Thus bioplastics have been more important in our lives until last decade, to replace synthetic plastics derived from petroleum [1].

MATERIALS AND METHODS:

FISH SCALES: Fish scales have not been much used recently, only ending up in the bin. Actually, in the fish scales there are chitin and chitosan potential to be made into plastic [11]. Chitin is the second most abundant natural amino polysaccharide other than cellulose [4]. Chitin is nontoxic, odorless, biocompatible in animal tissues and enzymatically biodegradable. Crustacean and fish scale waste is ideal as raw material for chitin production. Chitin and chitosan include polyoxysalt formation, ability to form films, chelation- with metal ions and optical structural characteristics [12]. Chitin has become of great interest not only as an industrialized resource, but also as a new functional material of high potential in various fields. Chitin was successfully extracted from the scales of a common Carp fish (Cyprinus carpio L.) and characterized for it functional properties [22].

Chitosan is a biopolymer obtained by deacetylation of chitin, the main component of the exoskeleton of crustaceans, arthropods and cell walls of some fungi [13]. Their use associated with a plasticizer (glycerol and/or sorbitol) produces films with good properties, which have been applied to the fruits, vegetables and meats aiming at a longer shelf life [20]. The antimicrobial activity of chitosan against a range of food-borne filamentous fungi, yeasts, and bacteria has attracted attention as a potential food preservative of natural origin. The food preservation qualities of chitosan, along with its non-toxic nature, ability to chelate metals, and biodegradability are of interest for its incorporation into various food packaging strategies. Study of the moisture behavior of chitosan-based films (Leceta I.et al, 2015) showed that they have a high potential to be used as packaging films for food products with intermediate moisture sorption [17]. The knowledge of the moisture behavior of chitosan films will improve their design as sustainable packaging, facilitating their industrial development and application and offering numerous benefits [1]. The knowledge of the moisture behavior of chitosan films will improve their design as sustainable packaging, facilitating their industrial development and application and offering numerous benefits.

WATER HYACINTH: Water hyacinth (Eichhornia crassipes) is a pleustophytic hydatophyte, a cosmopolitan aquatic weed; it is widely recognized as the world's worst and invasive aquatic weed [9]. This weed forms dense impenetrable mats across water surface, limiting access by man, animals and machinery. Moreover, navigation and fishing are obstructed, and irrigation as well as drainage systems become blocked. These are the only plastics produced exclusively by microorganisms and hence are completely degraded to benign compounds (Anderson and Dawes, 1990).

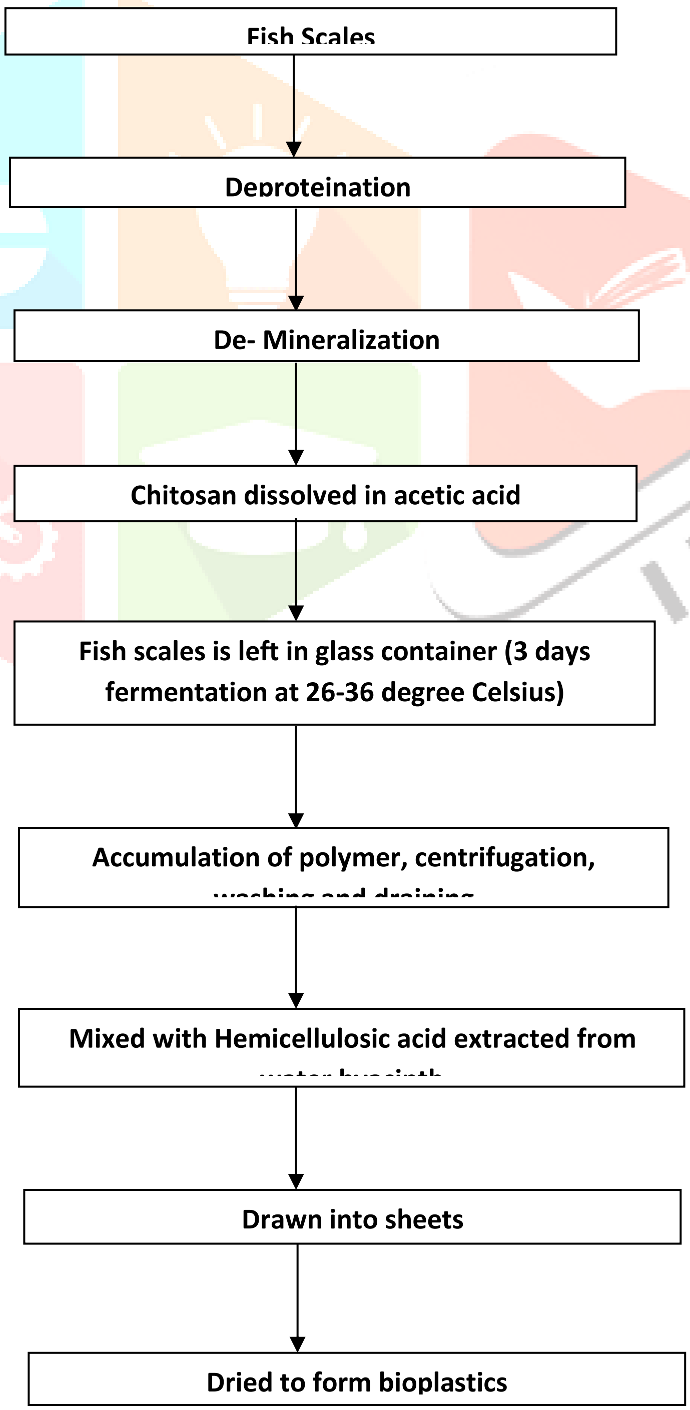
They can tolerate a wide range of environmental conditions such as temperature, illumination, pH, salinity, wind, current and drought. The plant is morphologically very plastic with a rapid mode of vegetative propagation which makes it well adapted to long distance dispersal and successful colonization of diverse ecological niches [8]. It is one of the most prolific aquatic plants which spread at an alarming rate having spikes of large blue flowers and roundish leaves with inflated bladder – like petioles. In spite of its environmental deteriorating effects the weed still offers potential to be used as substrate for production of commercially important products because of its promising carbohydrate content [10].

The use of synthetic materials from polyesters is currently criticized because they are not sustainable and create a lot of ecological harms; however, biopolymers, which are innately occurring resources, are highly compatible, environmentally friendly, readily available, and cost-effective [14]. They include polysaccharides, polypeptides, and polynucleotides. These biopolymers have been extensively used for various purposes such as food packaging, hydrogels, drug delivery, and pharmaceuticals [18]. Presently, studies are exploring numerous renewable materials for biopolymer production. Water hyacinth is the subject of attention because of its cellulosic content and proliferation rate. Cellulose from water hyacinth has been used to make polyhydroxybutyrate (PHB), a resource for bioplastics [25]. Nano materials fabricated from water hyacinth have been applied in wound dressings, biodegradable packaging film control release technology (hydrogel). However, there is a need for further investigation on the wound healing attributes of the aquatic weed. It is found to increase the flexibility of the bioplastics when used in combination with fish scales [26]

METHODOLOGY: Residual biomass, PHA accumulation and concentration of PHB (Zakaria *et al*., 2010) [14] was calculated by the following formulae:

Residual biomass (g/mL) =Wet Cell Weight (g/mL) – Dry weight of extracted PHA (g/mL)

$$\text{PHA Accumulation (\%)} = \frac{\text{Dry weight of PHA extracted (g/mL)}}{\text{WCW (g/mL)}} \times 100$$



RESULT AND DISCUSSION:

As a result, the product is strong, flexible and transculent. It gets biodegrades within four to six weeks and it does not require industrial composters to break down. The study demonstrates the correlation between the fish scales, water hyacinth were both are wealth out of waste. However, based on the findings of the similar studies, work with fish skin and scales, impressed a lot and bought an idea of making it yet stronger bio plastic with further more properties with water hyacinth. While previous research has focused on fish scales alone, these results demonstrated that with added water hyacinth the flexibility has been increased. The result met our expectations and supported our hypotheses.

CONCLUSION:

Thus the bioplastics using fish scales and water hyacinth was produced successfully with all desirable traits. The bioplastics produced from such resources was found to be highly acceptable. It had a smooth texture, well response as a physical barrier, low cost of production, and is biodegradable. The process of utilizing water hyacinth as a source of hemicellulosic acid to increase the flexibility of the bioplastics was also successful. Thus, massive waste generated during seafood processing can be properly managed in order to obtain renewable and biodegradable raw materials. This management implies the use of environmentally friendly and cost-effective processes for the extraction of materials to ensure that the innovative biorefinery practices designed to add value to by-products contributes to the sustainable development of materials. As the microorganisms are present ubiquitously, they have unique characteristics of forming an association with material surfaces.

REFERENCE:

1. BRZOSTOWICZ, P.C., ROUVIERE, P.E. (2002). Genes and enzymes for the production of adipic acid intermediates. U.S. Patent No 6,365,376.

2. CHİARATHANAKRİT, C., RİYAJAN, S. A., & KAEWTATİP, K. (2018). Transforming fish scale waste into an efficient filler for starch foam. Carbohydrate polymers, 188, 48-53.

3. DE LA CABA, K., GUERRERO, P., TRUNG, T. S., CRUZ, M., KERRY, J. P., FLUHR, J., & BURT, S. (2018). From seafood waste to active seafood packaging: An emerging opportunity of the circular economy. Journal of Cleaner Production.

4. ILES, A., & MARTİN, A. N. (2013). Expanding bioplastics production: sustainable business innovation in the chemical industry. Journal of Cleaner Production, 45, 38-49.

5. JENKİNS, D., & WANNER, J. (EDS.). (2014). Activated sludge-100 years and counting. IWA publishing.

6. LECETA, I., URANGA, J., ARANA, P., CABEZUDO, S., DE LA CABA, K., & GUERRERO, P. (2015). Valorisation of fishery industry wastes to manufacture sustainable packaging films: modelling moisture-sorption behaviour. Journal of Cleaner Production, 91, 36-42.

7. MİTTENDORF, V., ROBERTSON, E. J., LEECH, R. M., KRÜGER, N., STEİNBÜCHEL, A., & POİRİER, Y. (1998). Synthesis of medium-chain-length polyhydroxyalkanoates in Arabidopsis thaliana using intermediates of peroxisomal fatty acid �-oxidation. Proceedings of the National Academy of Sciences, 95(23), 13397-13402

8. MONTE, M. L., MORENO, M. L., SENNA, J., ARRİECHE, L. S., & PİNTO, L. A. (2018). Moisture sorption isotherms of chitosan-glycerol films: Thermodynamic properties and microstructure. Food bioscience, 22, 170-177.

9. SARANYA, N., & THAYUMANAVAN, T. (2014). Propertıes of purıfıed chıtınase produced by pseudomonas putıda. International Journal of Pharmacology and Biological Sciences, 8(2), 65.

10. SİNHA, R., & CHAUHAN, G. (2016). Generalized model for predicting methane Conversion to syngas in membrane reactor. International Journal of Engineering, Science and Technology, 8(4), 8-15.

11. SOAREZ A., BATARLO J.A.C. (2009). Bio-Plastics-From-Fish-Scales.

12. SUDESH, K., ABE, H., & DOİ, Y. (2000). Synthesis, structure and properties of polyhydroxyalkanoates: biological polyesters. Progress in polymer science, 25(10), 1503-1555.

13. ZAKU, S. G., AGUZUE, S. E. O., & THOMAS, S. A. (2011). Extraction and characterization of chitin; a functional biopolymer obtained from scales of common carp fish (Cyprinus carpio L.): A lesser known source. African Journal of Food Science, 5(8), 478-483.

14. Abdelhamid, A.M.; Gabr, A.A. Evaluation of water hyacinth as a feed for ruminants. Arch. Tierernaehr. 1991, 41, 745–756.

15. Akinwade, V.O.; Mako, A.A.; Babayemii, O. Biomass yield, chemical composition and the feed potential of water hyacinth (Eichhornia crassipes, Mart. Solms-Laubach) in Nigeria. Int. J. AgriSci. 2013, 3, 659–666.

16. Varanasi, J.L.; Kumari, S.; Das, D. Improvement of energy recovery from water hyacinth by using integrated system. Int. J. Hydrogen Energy 2017, 43, 1303–1318.

17. Rathod, V.P.; Bhale, P.; Mehta, R.; Harmani, K.; Bilimoria, S.; Mahida, A.; Champaneri, H. Biogas production from water hyacinth in the batch type anaerobic digester. Mater. Today Proc. 2018, 5, 23346–23350.

18. Poomsawat, W.; Tsalidis, G.; Tsekos, C.; de Jong, W. Experimental studies of furfural production from water hyacinth (Eichhornia Crassipes). Energy Sci. Eng. 2019, 7, 2155–2164.

19. Sukarni, S.; Zakaria, Y.; Sumarli, S.;Wulandari, R.; Permanasari, A.A.; Suhermanto, M. Physical and chemical properties of water hyacinth (Eichhornia crassipes) as a sustainable biofuel feedstock. IOP Conf. Ser. Mater. Sci. Eng. 2019, 515.

20. Pushpa, T.B.; Vijayaraghavan, J.; Vijayaraghavan, K.; Jegan, J. Utilization of eective Microorganisms based water hyacinth compost as biosorbent for the removal of basic dyes. Desalin. Water Treat. 2016, 57, 24368–24377.

21. Premalatha, R.P.; Parameswari, E.; Davamani, V.; Malarvizhi, P.; Avudainayagam, S. Biosorption of chromium (III) from aqueous solution by water hyacinth biomass. Madras Agric. J. 2019, 106, 12–21.

22. Rahman, A.K.M.L.; Al Mamun, R.; Ahmed, N.; Sarkar, A.; Sarkar, A.M. Removal of toxic Congo red dye using water hyacinth petiole, an ecient and selective adsorbent. J. Chem. Soc. Pakistan 2019, 41, 825–833. Sustainability 2020, 12, 9222 18 of 20

23. Canazart, D.A.; Nunes, A.R.; da, C.; Sanches, M.; Conte, H. Phytoremediation agro industrial wastewater of using macrophyte Eichhornia crassipes. Braz. J. Surg. Clin. Res. BJSCR 2017, 17, 87–91.

24. Gogoi, P.; Adhikari, P.; Maji, T.K. Bioremediation of arsenic from water with citric acid cross-linked water hyacinth (E. crassipes) root powder. Environ. Monit. Assess. 2017, 189.

25. Nash, D.A.H.; Abdullah, S.R.S.; Hassan, H.A.; Idris, M.; Muhammad, N.F.; Al-baldwi, I.A.; Ismail, N.I. Phytoremediation of nutrients and organic carbon from sago mill euent using water hyacinth (Eichhornia crassipes). J. Eng. Technol. Sci. 2019, 51, 573–584.

26. Sayago, U.F.C. Design of a sustainable development process between phytoremediation and production of bioethanol with Eichhornia crassipes. Environ. Monit. Assess. 2019, 191.

27. De Vasconcelos, G.A.; Véras, R.M.L.; Silva, J. de L.; Cardoso, D.B.; Soares, P. de C.; de Morais, N.N.G.; Souza, A.C. Eect of water hyacinth (Eichhornia crassipes) hay inclusion in the diets of sheep. Trop. Anim. Health Prod. 2016, 48, 539–544.

28. Mahmood, S.; Khan, N.; Iqbal, K.J.; Ashraf, M.; Khalique, A. Evaluation of water hyacinth (Eichhornia crassipes) supplemented diets on the growth, digestibility and histology of grass carp (Ctenopharyngodon idella) fingerlings. J. Appl. Anim. Res. 2018, 46, 24–28.