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Examining the Potentials of Fish Bone Bio-plastic in Sustaining Environmental and Biodegradable Effects

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Abstract:

The study aims to examine the potentials of fish bone bio-plastic in sustaining environmental and biodegradable effects. The descriptive quantitative research was utilized to answer the objectives of the study. Whereas, the respondents are the 15 experts in the field of science and bio-plastic production and they were chosen using purposive sampling method. Based on the finding found that the physical properties of bio-plastics made from milkfish fishbone are good in terms of texture, flexibility, durability, printability and transparency. Furthermore, the bio-plastic found a potentials in absorption of range amount of water, soluble in hot water, high tensile strength and thermal stability. Thus, this concludes that bio-degradable plastics made from milkfish fish bone have a potentials in sustaining environmental and biodegradable effects. Therefore, it is recommended to continuously develop biodegradable materials to help community and environment to sustain and healthy and green environment.

Keywords — **Biodegradable, Bio-plastics, Effects, Environmental, Fish Bone, Potentials, Sustaining**

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I. INTRODUCTION

Plastic is a commonly used product in our daily lives for being cheap and useful. The issue of plastic bags is really serious. Approximately 160,000 of them are utilized per second. That equates to five trillion bags annually. And just 3% of them are recycled. It is hardly shocking that used plastic bags appear to be everywhere. Plastic does not decompose naturally like other materials do. Because it takes up to a millennium to decompose, when it is disposed of, it accumulates in the environment until a crisis is reached. Plastic bags that end up in landfills or in the environment take more than 1,000 years to decompose.

During this time, animals come in contact with the material and are at risk. As the plastic breaks down, micro-plastics are leached into our soil and water. This pollution chokes marine wildlife, damages soil and poisons groundwater, and can cause serious health impacts. According to Partasarathy, Arumugam & Ajith (2022), synthetic plastics are becoming hazardous wastes, posing a threat to environmental sustainable health; hence, they must be replace with alternatives.

Bio-based polymers, such as vegetable oils, sugars, and other renewable resources, are combined with microorganisms to create bio-plastics. They are an alternate source of plastic that resembles synthetic plastics in terms of physical characteristics. Bio-plastics are biodegradable materials and can be used to reduce the problem of plastic waste that is suffocating the planet and contaminating the environment.

Although most commercial plastics are made from fossil resources, these materials can also be made from renewable resources and are commonly referred to as bio-plastics.

In this case, the monomers are extracted or synthesized from biomass compounds (such as sugars in plants) and then polymerized to either make a direct replacement for an existing plastic,

such as polyethylene (PE), or novel polymers, such as polyhydroxyalkanoates (PHAs). Biomass extraction can also yield non-synthetic natural polymers, such as starch, natural rubber and proteins.

Due to the increasing demand for fish products, the fish processing industry has produced substantial amounts of by-products such as guts, bones, skin, heads, and fins. Approximately 60% of the total weight is eliminated during the canning process, which typically results in these waste materials being discarded on land or in the sea. These discarded waste materials can pose health and environmental risks, including soil and water contamination. Instead of dumping these waste materials, they can be converted into fish meals for animal feed or fish silage. However, despite these alternative uses, a significant amount of waste still remains.

Fish bones are normally considered by-product wastes in the seafood industry, but they form a great resource for bio-plastic production since they contain a high content of collagen. Collagen is one of the proteins suitable for bio-plastic applications since it has good biocompatibility and can form films. Extraction of collagen from fish bones and its use as the main component in bio-plastics are focused on by the latest research. Not only does it valorise wastes, but this methodology contributes towards the pathways of sustainability (Wang, Li, lam et al., 2022). Additionally, fish bones in general have a high calcium and phosphorus content. In particular, they are rich in calcium carbonate making them a good alternative source of low-cost calcium carbonate, especially as they are generated in large amounts as solid waste from fish production activities, (Terzioglu, Ogut, & Kalemtas, 2018). A safer and more environmentally-friendly polyurethane-like polymer has been created using fishery and aquaculture waste such as fishbone, scale, guts and etc. because of oil content needed in making plastic (Trager, 2021). Moreover, one of the definite advantages of bio-plastics is their biodegradability. The degradation rate of such materials depends on their composition and environmental conditions. Biodegradability performance for bioplastics produced from fish bones is very encouraging. According to studies, they break down at faster rates than conventional plastics, especially in composting conditions, (Afshar et. al., 2024).

In this case, the researcher aims to examining the potentials of fish bone bio-plastic in helping sustaining environmental and biodegradable effects

A. *Objectives of the Study*

The main objectives of the study was to examine the potential of fish bone bio-plastic in sustaining environmental and biodegradable effects.

Generally, it sought to answer the following:

1. To identify the physical properties of bio-plastic made from fishbone.
2. To ascertain the potentials of bio-plastic in sustaining environmentally friendly plastics.
3. To determine the biodegradable effects of plastic made from fish bone.

B. *Research Problem*

The study answered the following:

1. How may the physical properties of bio-plastic made from milkfish fish bone be described in terms of:
    - 1.1. Texture;
    - 1.2. Flexibility;
    - 1.3. Durability;
    - 1.4. Printability; and
    - 1.5. Transparency?
2. How may the potential of bio-plastic made from fishbone be described in terms of:
    - 2.1. Water absorption range;
    - 2.2. Solubility in hot water;
    - 2.3. Tensile strength; and
    - 2.4. Thermal stability?
3. Is fishbone bio-plastics made have a potential as biodegradable and environmental plastics?

C. *Significance of the Study*

The study is beneficial and significant in many ways to the community, environmentalist and around

the world environment in water, land and air. Biodegradable plastics can save lives because the set of material s can be broken down by microbes, chewed up and turned into biomass, water and carbon dioxide and alongside food and other organic waste into compost. This biodegradable plastics are alternatives for green environment.

II. RESEARCH METHODS

The researcher utilized descriptive quantitative research through the use of survey questionnaire and observation tools in order to examine the potentials of fish bone bio-plastic in sustaining environmental and biodegradable effects. Whereas, the respondents are the 15 experts in the field of science and bio-plastics production and they were chosen using purposive sampling method. Thus, all the data gathered were encoded, tabulated and analysed using SPSS or statistical data analysis tools- weighted mean. Furthermore, the study were followed ethical guidelines and protocols to ensure that all respondents are safe and were not experience any harm during the conduct of study. Moreover, all data coming from them are used only for the purpose of this research.

III. RESULTS AND DISCUSSIONS

1. Physical Properties of Bio-plastic made from Fish Bone

TABLE I
PHYSICAL PROPERTIES OF BIO-PLASTIC FROM FISH BONE

Physical Properties	Weighted Mean	Verbal Interpretation
Texture	3.27	Strongly Agree
Flexibility	3.44	Strongly Agree
Durability	3.12	Agree
Printability	3.09	Agree
Transparency	3.31	Strongly Agree
Overall Weighted Mean	**3.25**	**Strongly Agree**

Table 1 presents the data on the assessment on the physical properties of biodegradable plastic made from milk fish bone. As shown, the overall weighted mean of 3.25 and verbally interpreted as “Strongly Agree”. The flexibility of bio-plastic got the highest weighted mean of 3.44 which interpreted as “Strongly Agree”; while the Printability got the lowest mean of 3.09 which interpreted as “Agree”.

The result meant that the physical properties of biodegradable plastic made from milk fish bone are good in all terms in texture, flexibility, durability, printability and transparency. Biodegradable plastics with fishbone are found flexible because the plastic can easily scrunch up into a ball. Since plastic is an indispensable part of everyday life. The durability becomes the curse of perishability.

This biodegradable plastic made from milkfish bone remains durable during usage but decomposes after disposal. Biodegradable plastic does exist though-these are polymers made up of microorganisms or polymers produced synthetically but which contain natural substance as components, such as polylactic acids, (Widdel, 2017).

2. Potential of Bio-plastic from Fishbone

TABLE 2
POTENTIAL BIO-PLASTIC FROM FISH BONE

Potential of Bio-Plastic	Weighted Mean	Verbal Interpretation
Water Absorption	2.97	Agree
Solubility in hot Water	2.59	Agree
Tensile Strength	3.10	Agree
Thermal Stability	2.20	Disagree
Overall Weighted Mean	**2.72**	**Agree**

Table 2 shows the data on the potentials of bio-plastic made from milkfish bone. As shown, the overall weighted mean got 2.72 and interpreted as “Agree”. Tensile strength got the highest weighted mean of 3.10 which was interpreted as “Agree”, whereas thermal stability got the lowest mean of 2.20 which was interpreted as “Disagree”.

The results meant that bio-plastics made from milk fish bone has a potential as alternative plastics in daily use. The fishbone bio-plastic will remain stable and submerge in a vat of water and no breakdown will occur.

One of the most critical aspects of biodegradable plastics is how fast and well they degrade in the environment that may help in reducing waste and replacing the trickier substances, (Montanari, 2021).

3. Fishbone Bio-plastic from Milk Fish

Based on the results and thorough examination on fishbone biodegradable plastic made, the researcher found that it has potentials as biodegradable and environment plastics

IV. CONCLUSIONS

The biodegradable plastic made from milk fish bone has a potential in sustaining the environmental and biodegradable effects. It was decomposed immediately and turned as fertilizer, petrochemicals, renewable raw materials, and micro-organism which can be part of waste management system and or biodegradable effects to environment.

Based on the findings of the study, the researcher recommended to continuously produce and develop biodegradable materials that really helps to conserve environment in all aspects for the benefits of the community. It is also recommended to replace traditional plastics into biodegradable plastics to lessen plastic waste that causes heavy pollution and harmful effects to the community.

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