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Fabrication of Bioplastics from Sea Weeds

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Abstract: ***This research deals with the production of bio-plastics from sea weeds. The main objectives is to produce bio-plastics from sea weeds (marine algae). The research has got two specific objectives which are to produce plastics that are environmental friendly whereby the plastic produced can be at least decomposed to smaller substance by the living organism and also to check the stability of the bio-plastics produced via mechanical and physical testing. In this study, marine algae specifically brown algae such as sargasum are the raw materials.***
Other materials required are glycerol, starch, gelatin, and colors. Methods used were observation to identify what type of algae has high content of agar and green algae were most the most efficient type. Experimentation involved the chemical processes to extract agar content from the from the algae by addition of sodium hydroxide to a powder form of algae which was dried and grinded, thereafter the mixture was heated 100 degree centigrade and allowed to cool agar powder was extracted and mixed with starch (as strengthening materials) and glycerol (plasticizer) and heated at 100 degree centigrade to get the tough semi-solid that helps to mould the plastics on a modal vessel.
The bio-plastics obtained was able to survive for 10days and thereafter decomposers they started decomposing it. The samples obtained could be useful in carrying cold drinks and foods further steps are done to make sure samples that will be stronger are produced to let hot materials be carried for domestic uses. Bio-plastics have got lot of advantage; they reduce the carbon dioxide emission and are cheaper as compared to synthetic plastics. However the main disadvantages of bio-plastics is that they are often produced from genetically modified food crops such as corn, potatoes, and soybeans. Challenges of bio-plastics include cost and misconceptions.
From our research we recommend the government and varies institutions to initiate work concerning bio-plastic production in order to bring industrialization in bio-plastics to reduce the use of synthetic plastics which are non-degradable and have many negative effects to our daily life
Keywords; Bioplastics, seaweeds, sargassum

I. INTRODUCTION

Plastics are carbon based polymers and we make them mostly from petroleum. With the discovery of plastics, life become much more convenient because it is used to make a wide array of useful materials, but these plastics are so durable that it will take many countries for these plastics to completely degrade while other plastics will last forever. Discarded plastics are also a big cause of pollution and because of that.

Plastics makes our environment a much less attractive place, getting rid of plastics is extremely difficult, burning these plastics gives off harmful chemicals such as dioxine that could contribute to Global warming , recycling these plastics is also difficult because there are many different kind of plastics and each has to be recycled by a different process (bird et al.,1987). Though these plastics are considered to be one of the greatest innovation ever.

They are also imposing a great havoc to the environment. The wildlife and the general public (DiGregorio, 2009). For this reason, this study aims to develop a bio-mass based plastics from the natural polysaccharides of seaweeds. Biomass resource like sea weeds or corn starch rather than the conventional [plastics which are made from petroleum. Their advantages are innumerable and one is their capability to biodegradable naturally within a short period of time only. Some of these polysaccharides are Floridian starch, agar and alginate.

Since they are renewable biomass resources and are polymer made from sugars which contain carbon, they could be used to create a bio-plastics

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II. MATERIALS AND METHODS

A. *Materials*

1) *Agar:* Is the main component of the sea weeds that is extracted from sea weed, Extraction involving collecting the species , drying which can be done through sun dry for maximum of 2 to 3 days or by the use of hot air oven at 80degree centigrade for 5hrs followed by grinding the dried sea weeds to obtain the agar powder, 100ml of 10% sodium hydroxide is added to 50g of agar powder and the mixture is heated between 100-300 degree centigrade for three hours to remove the unwanted materials and obtain the pure agar powder
2) *Starch:* Starch is being added in order to improve the gluing strength.
3) *Clay:* Clay can also be used for strengthening of bio-plastics instead of starch powder silica gel may also be used.
4) *Glycerol:* Glycerol is a simple poly-ol compound. It has three hydrophilic hydroxyl group that are responsible for its solubility in water and its hygroscopic nature. In addition, the glycerol backbone is central to all lipids known as triglycerides, glycerides forms cross links with protein.

B. *Methods Used*

There are two methodology used which are;

1) *Observation*

Involves identifying and selecting the species with high agar content. And also collection of the species with high agar content

2) *Experimentation*

a) *Methods foe Extraction of Agar Content from Seaweeds*

Bio-plastics from seaweeds are reported to be more resistant to microwaves radiation, less brittle and durable. The components of seaweeds used in making of bio-plastics is polysaccharides. The seaweed is systematically gathered, quickly dried and then baled to maintain its quality and fressness

b) *Removal Of Impurities*

The dried seaweeds is mechanically ground and sieved to eliminate impurities such as sand and salt which is followed by extensive washing to ensure additional quality

c) *Hot Extraction Process*

Seaweeds undergo a hot extraction process to separate the polysaccharides which is two step clarification process

- *Centrifugation*

First the dissolved polysaccharides mixture is centrifuged to eliminate the dense cellulose particles, filtered to remove the smaller particles and then, the solution is concentrated by evaporation for the removal of water.

- *Recovery of Polysaccharides*

The polysaccharides are then recovered by one of the two processing methods

- Potassium chloride is added to the concentrated solution of polysaccharides to increase the gelling temperature so that the filtrate will gel immediately, the gel is then frozen and compressed to remove excess water.
- In another method, the concentrated solution is precipitated in isopropyl alcohol and as the polysaccharides are insoluble in alcohol, the filtrate turn into a coagulum of polysaccharides, alcohol and water. The coagulum is compressed to remove excess of liquids and vacuum dried to completely remove the alcohol. Drying is completed on a belt drier and is blended to meet the finished product of exact specification.

III. PROCEDURE FOR PREPARATION OF BIO-PLASTICS

The preparation involves the following procedure

1) Measuring the ingredient

- 24g of agar
- 5g of starch
- 6mls of glycerol
- 120mls of water

2) Mixing the ingredients
3) Boiling while stirring the mixture to 100degree centigrade to obtain semi- solid porridge.
4) Moulding the bioplastics according to desired shape

IV. PRESENTATION AND INTERPRETATION OF RESULTS

The first objectives was to produce plastics that is environmental friendly whereby the plastic produced would be at least slightly decomposed to smaller substance by the living organism from marine algae , Basing on this objective bio-plastics which are environmental friendly were produced by using seaweeds , starch and glycerol
The second objectives was to check the stability of the bio-plastic that have been produced from the marine algae
The bio-plastics produced had moderate stability and lasted for about 11days and woulb be used for packaging various materials like foods and soft cold drinks

A. Samples Of Bio-Plastics

The above figure shows the samples of bio-plastics produced from our work, the samples are biodegradable hence are environmental friendly. the sample produced are strong enough to carry different materials such as solids and liquids however they are strong to last for 10to 11 days from the produced date though there are ongoing findings done to improve their strength and durability.

B. Interpretation Of Results

Bio-plastics=bio-polymer+plasticizer+additives
A considerable amount of research shows difference in strength, flexibility and color of biopolymers due to difference in amount and type of ingredient used.

1) Bio-ploymers.

These are substances that increase the strength of bio-polymers these are ;-

- Starch
- Agar,
- Casein, and
- Gelatin

a) Starch

This is needed as the backbone of the bio-plastic. It does not produce strong plastics and is not good for making hard plastics but its strength can be increased by adding other bio-polymers.

b) Gelatin

This produce harder plastic than starch

c) Agar

Similar to gelatin but is extracted from seaweeds.

d) Casein

Is found in milk and is very hard and brittle as compared to starch, gelatin, and agar.

A Table Showing Strength Of Bioplastic According To Nature Of Strengthening Materials Used

S NO	BIO-POLYMERS/STRENGTHENING MATERIALS	STRENGTH
1	Starch	Low strength
2	Gelatin	Medium strength
3	Agar	High strength

The above table indicates the strength of bio-plastics depending on the kind of bio-plastics used. Starch seems to result into low strength of bio-plastics produced while when gelatin is used as strengthening material tend to result into medium strength bio-plastic and Agar contents results into high strength of the bio-plastics when used

2) Plasticizer

These interacts with bio-polymer to make the bio-plastics strong and flexible.They include gelatin and sorbitol.

3) Glycerol

This is widely used since its cheap and abundant .it makes the plastics tough and bendable.

A Table Showing Effect Of Glycerine On Plasticity Of Bio-Plastics

S NO	Amount of glycerine	Nature of bio-plastic
1	Less glycerine	Hard, rigid and brittle
2	More glycerine	Soft and flexible
3	Too much glycerine	Sticky and slimy

The above table shows effect of glycerine as a plasticizer of the bio-plastics. The amount of glycerine used determine the nature of bio-plastics obtained where less glycerine gives hard, rigid and brittle bio=plastic. Moderate amounts gives soft and flexible bio-plastics while too much glycerine produces sticky and slimy bio-plastic samples.

A Table Showing Ingredients According To Desired Bio-Plastics

Ingredients	Gelatin/glycerine hard	Gelatin/glycerine flexible
Agar	24g	5g
Glycerine	6ml	100ml
Water	120ml	50ml

The above table represents the ratio of ingredients required to produce the types of bio-plastics whether hard or flexible depending on mixed ratio. To obtain a hard bio-plastic the amount of agar contents should be high with less amount of glycerine and more water while inorder to obtain a flexible bio-plastic less amount of agar should be used with more glycerine and less water

V. CONCLUSION AND RECOMMENDATION

Bio-plastics from see weeds may also be expensive but they have gained utmost important in the recent times because of their advantages over other biological sources which have already mentioned above. Seaweeds based bio-plastics play a vital role as an environmental friendly and biodegradable alternative compared to conventional plastics. The technology routes for the production of seaweeds based bio-plastics are still under research and the use of biotechnological and genetic engineering techniques play a key role in conducting the feasibility and sustainability studies in seaweeds based bio-plastics. It is hoped that significant advances made in the bio-plastics industry in general will benefit seaweeds based bio-plastics industry as well and will make seaweeds based bio-plastics a reality in the distant future. The most recent of the development being the possible production of plastic chitosan extracted from shrimp shells, a resilient from of chitin , which researcher at Harvard wyss institute of biologically inspired engineering say is the ‘’the second- most abundant organic materials on earth’’ Capturing atmospheric methane and carbon presents on exciting climate mitigation strategy for the bio-plastics industry. New light technology are creating PHA from the air carbon. These are the highlights that helped us to come up with the idea and shaped the study with practicality and social applicability. Eventhough bio-degradable plastics are anticipated to be good for environment, they can damage the nature in certain ways, Emanation of Greenhouse gases like methane and carbondioxide, while they are degrading, is huge at landfill sites. This can be controlled by designing plastics so that they can disintegrate and breakdown slowly or by accumulating the methane released and use it elsewhere as fuel.

Because petrochemicals based plastics have been developed and used extensively for over seventy years they are relatively cheap compared to bio-plastics. While there are a number of bio-plastics with great potential, and unique features , to compete in a wide range of applications currently dominated by petrochemical based plastics, certain barriers still exist that prevent this from happening, ideally , to compete a bio-plastics should be environmentally sustainable, inexpensive and functionally equivalent to conventional plastics. Usually bio-plastics are environmentally friendly and sustainable, but they are still relatively expensive and they can’t replace plastics.

VI. RECOMMENDATIONS

Bio-plastics can be used all over the world and create a better environment especially in Africa. This technology has been used mostly in developed countries and for Africa to be able to use this technology we recommend the following

1) The government and various institutions should kept to initiate research concerning bio-plastics production in order to bring industrialization in bio-plastics to reduce the use of synthetic plastics which are non-degradable and have many negative effects to our daily life
2) Connecting feedstock and users with algae producers if the production of bio plastics will be at large
3) The government should initial focus on Academic and product development so as to develop knowledge needed for production
4) Provide detailed feed stock characteristics and compositional analysis making it easier for algae producers
5) Help commoditize the feed stock and grow industry throughout the continent

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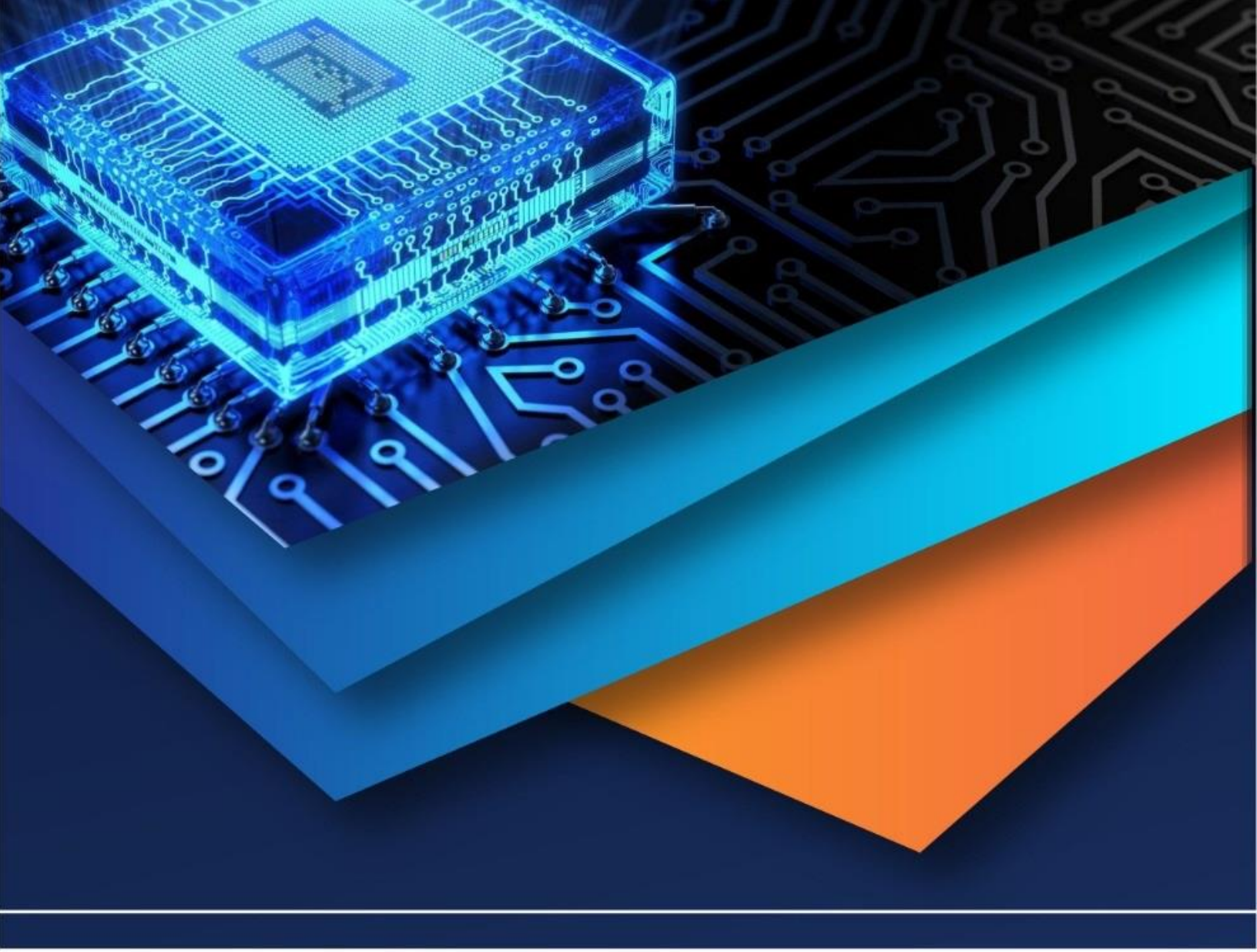

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