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Bioplastics Made from Kitchen Waste

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Abstract - *As everyone is aware of the wide usage of plastics around the world, which is the ultimate reason of destruction of environment, which also includes ocean pollution. All marine debris contain almost 80% of plastic. This problem comes from land and marine sources, often collecting in large areas where currents come together. Due to this we find waste on beaches, on land, and in freshwater sources also. The littered waste most often are plastic straws, bags, bottlecaps and food wrappers. So, we decided to develop a solution on this problem to replace plastic with – Bioplastic. Bioplastic offers a greener and cleaner solution to cope up with plastic waste. Our entire focus was on preparing bioplastic from waste products (mainly from Kitchen waste) like potato peels, orange peels, corn starch etc. Our main aim is to create plastic pollution free environment and reduce carbon emission in air. Bioplastic don't generate as much toxic run off as normal plastic and therefore, reduces the amount of waste. It can reduce greenhouse gas emission produced by the industries. Bioplastic will not only help to save environment but also gives you better world to live in.*

Key Words: **Bioplastic, Kitchen Waste, Pollution, Plastic, Environment**

1.INTRODUCTION

Plastic is one of the materials, we all cannot live without. Everyone is surrounded with plastics. From the toothbrush to the toothbrush holder, from the storage container to the refrigerator, from the packaging to the cutlery, plastic is everywhere. Once one material is found to have so many uses, humans don't leave a chance to not use it. Such practices are very essential for the development of our country, but we should never outlook its disadvantages. We all are aware of the fact that plastics are manufactured from natural materials like petroleum, cellulose, natural gas, crude oil, etc. And continuous manufacturing of plastics from these non-renewable resources is exhausting these resources. We nearly produce and consume 300 million tons of plastic every year. With its such broad usage, its environmental and health hazards cannot be neglected. After the usage, these plastics are either dumped in the landfills or in the ocean, none of them being the appropriate option. Plastics take about 20 to 500 years just to decompose. Again, plastic has become such an important part of our day-to-day life that eliminating it at once would be burdensome. Bioplastics can be an alternative. Bioplastics are plastics made from renewable biomass such as vegetable fats, oils, corn starch, recycled food wastes, etc. The reason why bioplastics can be an alternative is that it does not have many disadvantages. It degrades very quickly compared to the petroleum-based plastics. This being the main reason for replacement. Here we have focused on making bioplastic from kitchen wastes such las potato peels, banana peels and orange peels. Starch is the main ingredient in these peels and the main raw material for Bioplastic. Let's look into the science behind using starch for making bioplastic. The dried starch powder is a bundle of polymers. When water is added to this, the bundle loosens up. Some of the starch polymers have branches on them which makes it difficult to form a good plastic. So, we add vinegar to it to cut off the branching and thus making it a linear polymer. If plastic is made from this linear polymer, we would get very rigid plastic. Hence glycerin is added to make the plastic more flexible. This is the reason why starch, vinegar and glycerin are used to make the bioplastic at home.

2. METHODOLOGY

Bioplastics are a good alternative to the regular petroleum-based plastics. These bioplastics can be made at home, on a very small scale. The procedures are very simple and the ingredients are readily available too. The bioplastics made here were from kitchen wastes, such as:

2.1 By Potato Peels

2.2 By Orange Peels

2.3 By Banana Peels

2.1 From Potato Peels (Starch)

To prepare bioplastic from potato peel starch we require some basic things which are easily available in our kitchen they are as follows:

a) Potato starch

b) Water

c) Vinegar

d) Glycerin

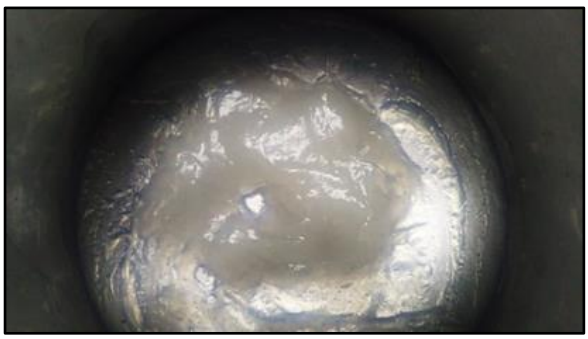
e) Food Colour (if required)

Making of Starch:

Collect peels of about 4 to 5 potatoes. And grind it, collect the potato peel in any vessel then add some water and crush them with hands/mix it properly so the starch content gets dissolved in water. Allow it to settle for some time then with the help of a strainer strain the mixture. After straining the water from the mixture add some water to the paste again and strain it, making sure that the potato peels are properly used. Collecting the water in a vessel allows it to settle for some hours. The starch gets settled at the bottom of the vessel then slowly drains the water. Let the starch dry for about 2 days and it is ready to use.

Making of Bioplastic:

Take 20 g of Starch made from potato peels, add 20 ml of Vinegar, then add 5 g of glycerin and 50 ml of water. Stir it until everything gets mixed. Now place the container on the stove and heat it on a low flame. While heating, stir it continuously, the mixture becomes thick within a few seconds. And the paste is ready.



Moulding:

The thick paste can be moulded into any shape as required. Apply the paste gently on moulds. Keep the moulds to dry for 2 to 3 days. Once the bioplastic is completely dried, demould it.

2.2 From Banana Peels

Gathering raw materials:

To make bioplastic from the banana peel, we need banana peels, water, vinegar, honey, cinnamon powder, stove, and a pan. These ingredients are easily available at the grocery store. The quantity of ingredients to make bio-plastic is given below :

1. Banana peels – 3 to 4
2. Water – 500 ml
3. Vinegar – 20 ml
4. Honey – 1 teaspoon
5. Cinnamon powder – 1 teaspoon.

Preparation of the pulp :

Take about 3 to 4 banana peels. Cut them into small pieces and add them to the bowl. Crush the pieces present in the bowl and make a paste of it. Then add 250ml of water and mix it thoroughly. Heat the mixture for 5 minutes on medium flame. Turn off the heat after the mixture thickens, again add 250ml of water to the mixture. Filter the mixture using a strainer and remove the excess water from the mixture. The pulp is ready.

Making of bioplastic:

Take 40g of the pulp made and add 20ml of vinegar to it. Then add 1 teaspoon of honey and 1 teaspoon of cinnamon powder. Heat this mixture on medium flame till it thickens. Pour this mixture on parchment paper before the mixture cools and press it to make a thin sheet of bio-plastic.

Let the bioplastic cool:

It will take a minimum of about 2 to 3 days to dry depending on the thickness of the bio-plastic. Keep the bioplastic to dry at a normal room temperature. The more the thickness, the more time it will take to dry. Even after 2 to 3 days if the bioplastic is not dry, keep the bioplastic for a few more days and make sure that the bioplastic is completely dried and hardened.

2.3 From Orange Peels

Bioplastic from Orange peels sounds like a good alternative since the ingredients needed are all readily available and the bioplastic itself will have an orange scent to it. In order to make bioplastic from Orange Peels, which is a kitchen waste, the following ingredients are needed:

i.Orange peels (25 gm)

ii.Water (15 ml)

iii.Corn-starch (50 gm)

iv.Sodium bicarbonate (2 gm)

v.Lemon Juice (5 ml)

vi.Sage oil (5 ml)

vii.Vinegar (5 ml)

Blanching the orange peels:

The collected orange peels are placed into a pot of water and are boiled in high flame. The mixture needs to be boiled constantly for about 10 minutes. Once boiled, the pot is taken off the heat and is cooled down, after straining the water. The peels must be cooled down completely for the next step.

Making it into a paste and adding other ingredients:

Once cooled, the peels are transferred into a mixer jar for grinding into a smooth, lump-free paste. The peels must be completely cooled down before grinding them. Measure about 25 grams of this orange paste and transfer it into a bowl. Later add Water, Corn-starch, Sodium bicarbonate, Lemon juice, Sage Oil, and Vinegar in the quantities mentioned above and stir it.

Heating the mixture:

After stirring the mixture, which is in more of a liquid consistency, place the pot onto the stove. Stir the mixture continuously on a low flame till the consistency of the mixture thickens. Ensure continuous stirring.

Molding the plastic:

Once the thickened mixture cools down, scoop it and mold it according to your convenience. If you want a flat piece of bioplastic, then spread the mixture into a smooth, flat surface. And, if you want to mold it in the shape of a bowl, then grease the bowl with oil and spread the mixture evenly.

Drying the Bioplastic:

You can either let these air dry or can place them into the oven for the drying to take place quickly. The air-dry method usually takes about 3 to 4 days, depending upon the surrounding moisture and temperature. Once dried, peel it off the mold slowly and steadily.

3. OBSERVATIONS

3.1 Potato Peels:

The Bioplastic made out of potato peels was better than the other two. Bioplastic was closely monitored for the following factors:

1. Odour: The bioplastic made from potato peel starch has a slight odour of vinegar.
2. Elasticity: On count of elasticity the bioplastic made from potato peels is more elastic than bioplastics made from orange and banana peels.
3. Degradability: When we keep the bio-plastic in water it gets dissolved in a few weeks. And the rate of degradation totally depends on the content of the bio-plastic. Bio-plastic made from potato peel took about a month to degrade.
4. Shelf Life: The bioplastic has a good shelf life.
5. Transparency: We came to know that bioplastic made from potato starch is more transparent than bioplastic made from orange and banana peels.

3.2 Banana Peels:

The bioplastic made from banana peels is a bit hard and sticky. The bioplastic was observed carefully upon the following factors:

1. Odor: The bioplastic made from banana peels has the odor vinegar in starting and decreases as the materials become dry.

2. Elasticity: The bioplastic is brittle and breaks easily. The elasticity of bioplastic made from banana peel is stretchy and hard.

3. Degradability: A thin sheet of bioplastic when kept in a bowl of water degrades in about a week. If the bioplastic is thick, then it takes about 2 weeks to degrade.

4. Shelf Life: The bioplastic has a good shelf life.

5. Transparency: It has a brownish black color to the plastic. It is opaque and not transparent at all.

3.3 Orange Peels:

The bioplastic made from Orange Peels held its shape a bit. The bioplastic was observed carefully upon the following factors:

1. Odour: The bioplastic has an orange scent to it which does last. In the start, it gives off a strong scent but later the scent diminishes. It doesn't totally disappear, the scent lingers.

2. Elasticity: The bioplastic is not elastic at all. It is brittle in nature and can break off easily. If you try to tear, it will stretch for a bit and then tear off.

3. Degradability: A small piece of this bioplastic when placed into a bowl of water at room temperature, takes about 1 and a half weeks to degrade completely. You must ensure to maintain the water level in the bowl or else the bioplastic will dry out. But when this bioplastic is kept in a bowl of hot water, it degrades quickly, within a week.

4. Shelf Life: The shelf life is great for this bioplastic. It retains all the conditions.

4. CONCLUSIONS

We did research on how bioplastics should be made and during that we found out that Plastic is harmful for environment, but it is engineered in such way that it will last long. So, we tried making bioplastic at home using potato peels, banana peels and orange peels. The Conclusion of our results is that potato starch-based plastic performed better in our tests. Bioplastic made from banana and orange peels turned out to be brittle. It was not elastic as we expected. We believe that some moderations in the procedure will lead to a more elasticity.

Some Experimental error…

1. Heat of a room
2. Temperature of the materials when heated
3. Sunlight
4. Moisture in the atmosphere

Since these experimental errors are a major part of our results. We have tried to minimize our experimental errors as much as possible. Sunlight is unfortunately not possible to control easily.

First of all, we believe that Potato plastic will perform the best. According to the research, the potato plastic contains the best polymer chains, also because it contains a low quantity of Amylopectin-Unwanted type of polymer. This reason, as well as many others, like the fact that we added vinegar to break some of the amylopectin bonds, helps to make an educated guess that our longest surviving biodegradable plastic will be potatoes. Also another reason why we believed that potato plastic would take more time to biodegrade is because of the higher starch content. Another best thing about this bioplastic is that they are compostable and can break down in matter of weeks.

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