

# ***ECO-STARCHY***

## ***Science Fair Project Report***

*Level* : *Middle Level*

*Category* : Environmental Science

### ***Submitted by***

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*(Grade 8)*



**ARRAHMAAN**  
INTERNATIONAL SCHOOL

*(Creating the community of Excellence)*

# ***ECO-STARCHY***

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# ***ECO-STARCHY***

## ***ABSTRACT***

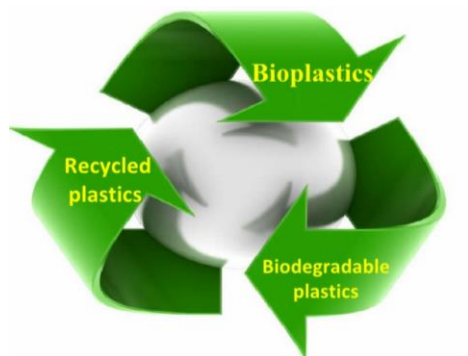
A bioplastic is a substance made from organic biomass sources, unlike conventional plastics which are made from petroleum. Bioplastics are made through a number of different processes. Some use a microorganism to process base materials, such as vegetable oils, cellulose, starches, acids and alcohols.

Starch is one of the most common and easily obtained natural polymers, making it attractive as a potential bio-based alternative to synthetic polymers. The plasticisation of starch is complex due to the extensive hydrogen bonding between chains. This project studied the use of starch as the basis for a bio-degradable plastic.

I selected the different samples like Porridge, Cooked Rice, Oats, Saga, Rice water which has starch content. To derive the bio-plastic from the materials, I grind, then mixed glycerin, agar-agar and vinegar to the paste and treated under heat to obtain the consistency. Then I moulded and allowed to dry. I kept under observation for 3 days. To check the quality of the moulded bio-plastic of different substances, I treated all of them with various test like;

- ❖ Solubility Test
- ❖ Flammability Test
- ❖ Rigidity Test
- ❖ Bio-degradable Test

After all the process and tests, I concluded that Bioplastic made from porridge is best in quality among all the bioplastics I prepared.



## **INTRODUCTION**

While almost all bioplastics produce less carbon dioxide in production than conventional plastics, they are not necessarily completely green. The methods by which their base materials are grown and the processing involved both impact their product footprint. Many bioplastics also release carbon dioxide or monoxide when biodegrading. Nevertheless, their overall environmental impact is typically lower than that of conventional plastics, and as oil costs rise, their cost becomes more and more competitive.

Some biodegradable bioplastics can break down in 180 days, given the right conditions. Others are not biodegradable at all. This capacity is desirable, for example, for outdoors applications where longevity and a reduced carbon footprint in production may be the goals.

Bioplastics, like petroleum-based ones, differ in make up to address different needs. The bioplastics used to make disposable cutlery, food containers, grocery bags, electronics casings and conductive bioplastics for electronics are all very different from one another.

Bioplastics were mainly developed in an effort to find a replacement for conventional plastics whose problems include:

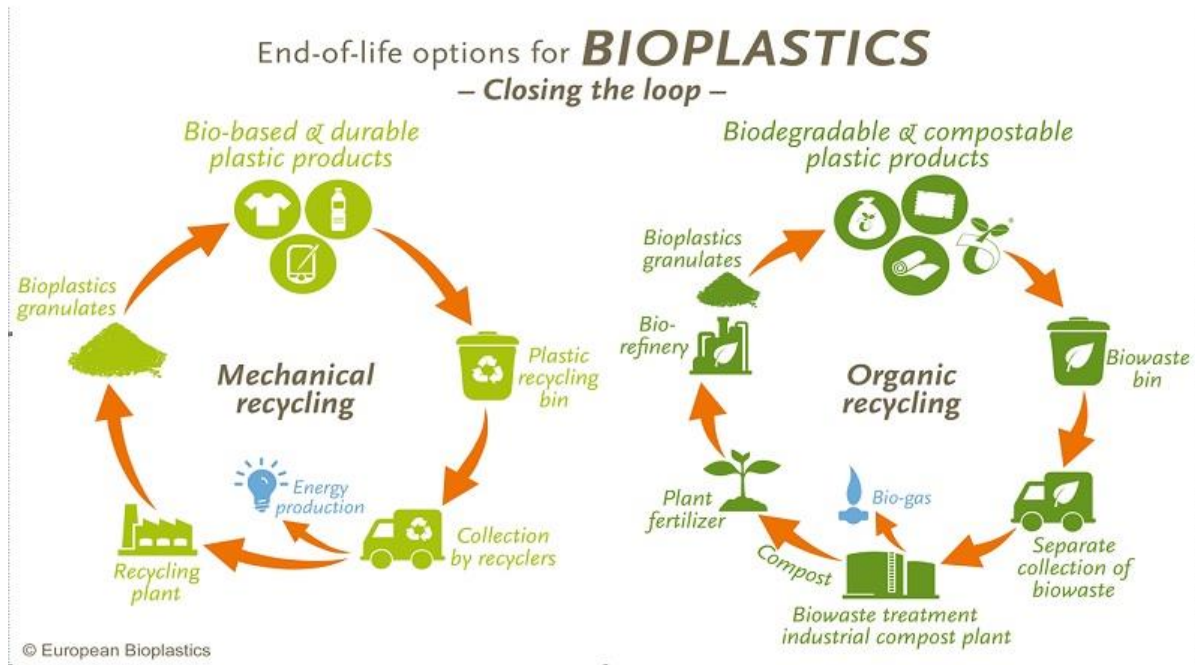
- They can take thousands of years to decompose.
- Plastics are a major contributor to landfills and pollution, and especially problematic to sea life.
- Conventional plastics are made from a non-renewable resource, petroleum, which is increasing in cost as it becomes more scarce.
- Toxic and carcinogenic chemicals are used in their production, such as BPA and many other plasticizers.

- Plastics have a large carbon footprint in both production and recycling.

As an alternative, the use of bioplastics is being promoted, consisting in obtaining natural polymers from agricultural, cellulose or potato and corn starch waste. These are 100% degradable, equally resistant and versatile, already used in agriculture, textile industry, medicine and over all, in the container and packaging market,

***Advantages of bioplastics:***

- They reduce carbon footprint.
- They provide energy savings in production.
- They do not involve the consumption of non-renewable raw materials.
- Their production reduces non-biodegradable waste that contaminates the environment.
- They do not contain additives that are harmful to health, such as phthalates or bisphenol.
- They do not change the flavor or scent of the food contained.



### **STATEMENT OF THE PROBLEM**

Plastic is the one which affect our Environment. We cannot eradicate the plastic completely from our day -to -day life. So I planned to invent an alternative to plastic in such a way that it should not harm our environment. The bio-plastic which I planned to prepare is an eco- starchy product. Eco means environment friendly and starchy means large amount starch.

Bio-plastic might bring the changeover in the environment. Instead of using normal plastic this will be eco-friendly to our earth and reduce the ecological hazards. Using the bio plastic from the cheapest materials, we can create an eco–friendly environment. At the same, our routine plastic necessity also gets satisfied with bio plastic.

### **HYPOTHESIS**

*Porridge can give a qualitative bio-plastic when compared to other samples.*

## DESIGN OF STUDY

### *INDEPENDENT VARIABLE:*

- Starch Contained Items (Oats, Porridge, Rice water, Cooked Rice, Saga)

### *DEPENDENT VARIABLE:*

- Bio- plastic

### *CONTROLLED VARIABLES:*

- Agar
- Glycerin
- Water
- Vinegar

### *MATERIALS:*

- Oats
- Porridge
- Rice Water
- Saga
- Cooked Rice
- Vinegar
- Glycerin
- Agar
- Water
- Bunsen Burner
- Wire Gauge
- Baker
- Glass Rod
- Knife
- Labels
- Mud pots
- Soil

**PROCEDURE:**

- **Preparation of base for Starchy content;**
  - Soak Saga overnight and grind until it gets pasted well.
  - Grind porridge, cooked rice, oats and rice water separately by adding 100 ml of water each.
- **Preparation of bio plastic from the starch base;**
  1. First add 200g of starch extract that derived from the Saga.
  2. Add 100ml of water.
  3. Add 1 tbsp of glycerin.
  4. Add 1 tbsp of vinegar.
  5. Add 2 tbsp of agar.
  6. Stir the mixture.
  7. Until a sticky precipitate formed.
  8. After heating, find a flat surface for us to spread the product. Lastly roll the product to make it flat.
  9. Let the product dry.
  10. Repeat the steps 1-9 for Oats, Porridge, Cooked rice and Rice water.
- **Quality Test:**
  - Take samples from each dried product and undergo the following test for knowing the quality.
    - a. **Solubility test:** Take same size of different samples and immerse it in 100ml water in a separate beaker. Let the set up and observe the solubility level regularly up to 1 week.
    - b. **Flammability test:** Take same size of different samples and show the samples one by one to the flame to check their flammability.
    - c. **Rigidity test:** Take same size of different samples and check their rigidity using hammer.
    - d. **Bio- degradable test:** Take same size of different samples and burry half of the plastic under the soil and check their degradable level for frequent intervals (Days).
- **Analyze the result:** After undergoing all the quality tests, analyze which starch material results in quality bio-plastic.



**COLLECTION OF DATA- PHOTOGRAPHS**



weighing samples



Preparation of plastics



Transferring the content in plates



Different sample



spreading the prepared porridge content in the plate



s are spreaded in plates fo



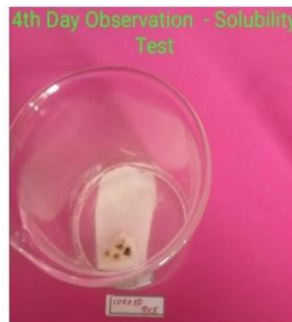
reading the porridge



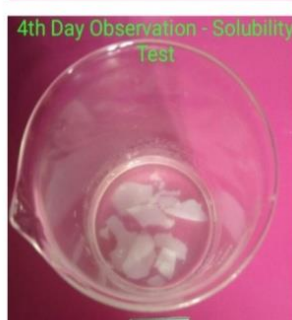
Blending the sample



Solubility Test



Checking the level of water





**Tabulation:**

**A. Solubility test**

<i>No. of days</i>	<i>Saga</i>	<i>Cooked rice</i>	<i>Rice water</i>	<i>Porridge</i>
1	No Change	No change	No Change	No Change
2	No Change	No Change	No Change	No Change
3	No Change	No Change	Slightly Soluble	No Change
4	Slightly Soluble	Slightly Soluble and fungal growth appeared	Slightly Soluble	No Change
5	Slightly Soluble	Slightly Soluble and fungal growth developed	Slightly Soluble	No Change
6	Slightly Soluble	Slightly Soluble and fungal growth developed	More Soluble	No Change
7	Slightly Soluble than 6 <sup>th</sup> day	Slightly Soluble than 6 <sup>th</sup> day and showed increase in fungal growth	More Soluble	No Change
8	Appearance of Slightly Colloid	Appearance of Slightly Colloid and fully shown fungal growth	More Soluble	Slightly Soluble

**B. Rigidity Test**

<b>S. No</b>	<b>Samples</b>	<b>Levels of Rigidity</b>
1	Saga	Slightly hard
2	Cooked Rice	Slightly hard
3	Rice Water	Soft
4	Porridge	Very Hard

**C. Flammability test**

S. No	Samples	Level of Flammability
1	Saga	Slightly Hard
2	Cooked Rice	Easy
3	Rice Water	Very Easy
4	Porridge	Hard



**D. Bio-degradable test**

No of days	Saga	Cooked rice	Rice water	Porridge
After 2 <sup>nd</sup> Day	No change	No Change	No Change	No Change
After 5 <sup>th</sup> Day	Slightly Degraded	No Change	Slightly Degraded	No Change
After 7 <sup>th</sup> Day	Slightly Degraded	Slightly Degraded	Slightly Degraded	Slightly Degraded

## **RESULTS AND DISCUSSION**

- In the solubility test, the bio-plastic which derived from the starchy materials shows solubility in the order of rice water, cooked rice, saga and porridge.
- Comparing all the samples, the porridge has less solubility in nature rather than other samples.
- I observed the formation of fungal growth in cooked rice from the fourth day itself but, the rice water has more soluble when compared to all other samples.
- In oats, I observed there is no plastic formation from the starchy materials. Due to this reason, oats is not taken into accountability of quality tests.
- Every sample has the flammable capacity in the order of rice water, cooked rice, saga and porridge. Rice water bio- plastic seems very thin and so it is easy flammable when compared to all other samples.
- The porridge bio-plastic is very hard and rigid when compared to all other samples. So porridge acts as a best bio-plastic in rigidity test too.
- Finally, the porridge bio-plastics gave better result under all the conditions tested.
- After getting my first experiment results, I thought in preparing an eco-starchy from 100g of different samples (Rice Water, Cooked Rice and Porridge) but it seems so thin and it didn't worked out well as in previous composition.
- Simultaneously, I prepared a bio-plastic mould from the same samples.

*From this research, every sample I had taken has shown plastic content to some extent. But porridge has proven as the best source of bio-plastic.*

### APPLICATION

- Plastics are typically made from petrochemicals. This depletes a non-renewable resource and we are now trying to develop systems to recycle plastics.
- Plastic made from plant materials use a renewable resource. One benefit of this is an impact on climate change
- Bio-plastics are plastics derived from renewable biomass sources such as food waste. This plastic can be made from agricultural by-products and also used plastic bottles and other containers using micro-organisms.
- Plastic from starchy product will probably be bio-degradable because, all the starting materials are bio-degradable. As the plastic is soluble, it cannot be used for packing anything that is wet, contains water (or) is likely to get wet because the packing will just fall apart. Possibility include not used for packing liquid products, could be used for packing dry goods and catering products (disposable crockery, cutlery, bowls, etc).

## **CONCLUSION**

- My hypothesis, “Porridge acts as a best source of bio-plastic” has been proved.
- Starch is a type of carbohydrate found mostly in certain types of vegetables, such as potatoes and corn, and in grains, including wheat, rice and oats. As a carbohydrate, the starch in porridge supplies your body with energy. When you eat a bowl of the whole-grain cereal, your body breaks those starches down into glucose, which then supplies your cells with energy to work. Because starch is a complex carbohydrate – as opposed to a simple carbohydrate like sugar – it takes your body a little longer to break it down.
- Porridge is not only a healthy food but also an Eco-Starchy Product.
- Porridge bio-plastics could be alternative to petrochemical plastics in the near future.

## **FUTURE ENHANCEMENT**

- I wish to research my further experiment in preparing different moulds with different composition that can sustain for both wet as well as dry products with high durability and sustainability.
- Its useable should include lot of multi-useable way in preparing bio-plastic bags, bio-plastic cups, bio-plastic bowls, storage boxes etc.

## **ACKNOWLEDGEMENT**

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