

Homemade Bioplastic

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ABSTRACT

The aim of the project was to prepare a homemade plastic and study its properties in order to find the feasible substitution for the petroleum based plastic. For this, we decided to make our own plastic using the material and chemicals available at home. The starch content was found moderate in case of potatoes and hence we decided to extract starch from it. The methodology basically unfolds in two stages. The first stage includes the extraction of maximum amount of starch from the potatoes using various simple processes such as grating, grinding and blending. The extracted starch needs to be dried first to measure the exact amount of starch. The second stage includes the actual preparation of the plastic from the extracted starch by heating the solution, made by the addition of vinegar, glycerin and water in the starch in the correct proportions. The dense viscous liquid obtained is then used to cover the mold and kept under the sun for a day or two. The plastic thus obtained can be used for many purposes and has many applications.

Keywords: Distilled water, Glycerol, Potatoes, Tea strainer, Vinegar

I. INTRODUCTION

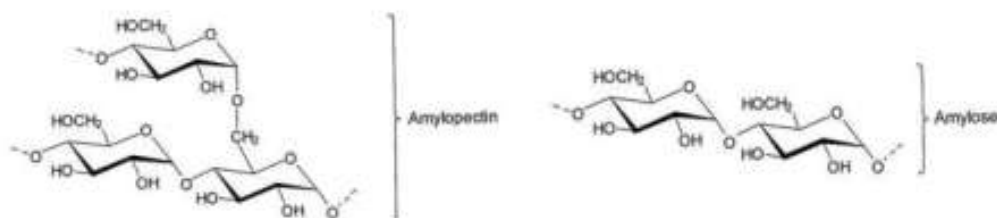
Basically, plastic can be classified on the basis of the raw material used to produce it. The petroleum plastic happens to have the best properties when it comes to strength, malleability and other physical properties. Also, the cost required for the preparation is too low. Hence, in today's world, this plastic plays an important role. But, with these many advantages, comes a dangerous and hazardous side effect that it cannot be degraded and is insoluble in almost every liquid. This danger is now being identified by the researchers and many researchers work on its management right now. Thus, there is a need for a better alternative which will substitute this plastic. And one of these feasible solutions is bioplastic.

Therefore, our aim was to prepare the bioplastic from potato starch at home without using any chemicals available only at the laboratory.

II. CHEMISTRY BEHIND

The starch is a long chain molecule, made up of amylose and amylopectin. When it is heated in presence of an acid (vinegar) the amylopectin present is broken down into the straight chained amylose. After heating for a while, the starch starts dissolving into the water and loses its semi crystalline structure. This produces a highly viscous paste and the process is known as gelatinization. As the liquid dries, the amylose molecules form get bonded with hydrogen bonding to form a semi liquid crystal once again. ^[1]

The addition of glycerol makes the plastic more flexible and less brittle. This is because the addition of glycerol increases the intermolecular hydrogen bonding and traps the water molecules which increases the strength of the plastic.^[4]



The plastic obtained in this way is commonly known as thermoplastic starch (also known as plasticized starch).^[3]

III. PROCEDURE

1. Extraction of starch from potato^[2]

- Weigh 200 gm of potato on the weighing machine.
- Wash it carefully and remove the mud on it if any.
- Grate it into a dish and add about 200 ml of water.
- Blend the mixture obtained in the previous step through the mixer.
- Separate the water containing the starch from the potato remains using tea strainer.
- Repeat the procedure at least twice to maximize the extraction of starch.
- Keep the 600 ml solution obtained steady for some time and filter the solution to get starch.
- Dry the starch obtained and weigh it carefully.

2. Preparation of plastic from starch.

- Take 8 gm of starch into the beaker
- Add around 50ml of water, a tea spoon of glycerol and a tea spoon of vinegar to form a solution.
- Heat the solution gently for a minute of two. While heating, make sure to stir the solution continuously.
- After heating for a minute, you will find a viscous jelly like liquid formed. Keep stirring till the gelatinous substance turns transparent.
- Stop the heating, keep the viscous liquid into a mold and dry it for a day under the sun.

IV. OBSERVATIONS

1. The amount of starch extracted from the potatoes weighs around 10 gm (after drying).
2. Without the use of glycerol, the plastic obtained turns out to be brittle and nearly useless.
3. When glycerol is used, the viscous liquid obtained after heating is very gluey and can be used as an adhesive substance when used fresh.

4. At the room temperature, it takes about 2 days for the viscous liquid to turn into a mold completely.
5. The plastic turns out to be thermoplastic, as when it heated it dissolves directly into the water and can be molded using the same procedure.
6. The Glycerol and water used acts as a plasticizer and the acid added initializes the reaction.^[3]
7. The Plastic obtained dissolves in water at high temperature.

V. DIAGRAM



VI. PROPERTIES OF PLASTIC OBTAINED

- a. The plastic obtained is thermoplastic in nature, i.e. it can be moulded back into other shape by heating and cooling again and again.
- b. The plastic obtained is transparent in nature.
- c. The plastic has poor elastic properties and the only factor contributing to the elasticity is the amount of glycerol.
- d. The plastic dissolves in water at high temperature and hence is biodegradable in nature.

VII.CONCLUSION

- The plastic obtained is thermoplastic in nature.
- The Product obtained is very thin yet very plastic like material.

- The plastic is easily degradable in nature and is soluble in water which is its advantage and the disadvantage at the same time.
- The preparation of plastic from starch is a viable option for substituting a petroleum plastic.

VIII. ACKNOWLEDGMENT

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