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DEVELOPMENT OF AN ECO-FRIENDLY SEED CUP USING *CENCHRUS PURPUREUS, COCOS NUCIFERA*

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Abstract: One of the major issues facing by human is plastic pollution, which results by plastic's impact on every part of our environment. Research on the rate of plastic in land use has just currently began, in comparison with freshwater and aquatic areas, just it is contributing a lot to global plastic pollution (14%). Due to its difficulty of biodegrade, plastic waste has turned into an important environmental issue in recent years. The growth of plastic garbage in land might harm ecosystem function, soil health, and wildlife. In agricultural area, plastic waste might pollute the soil, stopping plants from proper absorption of nutrients and slowing their growth. Also, the presence of plastic materials might block irrigation systems, that may result in water stagnation and yield reduction. In addition to the effects, microplastic growth in soils from plastic materials in agriculture may result in a harmful impact on the fertility of the soil and structure. Sustainability aims to reduce a product's impact on the environment at each phase of its life cycle, from production to disposal Using biodegradable materials might reduce the quantity of plastic waste produced and the harmful effects it has on ecosystems. In order to cut down plastic waste in agriculture, various methods are being tested in addition to sustainable product.

keywords: Eco-friendly, Decompose, Sustainable, Micro-plastic reduction, Soil Health

I.INTRODUCTION

As discusses over plastic pollution have increased, many industries including agriculture are seeking sustainable alternatives. Along with lack of it's ability to biodegrade, ordinary plastic seedling trays heavily contribute to environmental harm. A practical way to address this issue is to develop biodegradable seed cups using natural materials. The usage of several biodegradable materials for seed cup has been reviewed in recent studies. For example, a study assessed the effectiveness of creating biodegradable seed cup by combining textile and paper waste. Creating biodegradable seed cup using *cocos nucifera*, *cenchrus purpureus, corn starch* for improving the strength, durability and properties compared to other biodegradable seed cup.

By using these biodegradable seed cups, agriculture can reduce the use of plastic products, which will help to reduce pollution in the environment. In addition, when they decompose, these seed cups may provide the soil with organic matter that encourage plant growth. Plant growth and agricultural yields might be affected by these microplastic's ability to affect the physicochemical properties of soil, affect with nutrient cycling, and disturb soil microbial populations. Further, thermoplastics could make it easier for the movement of pathogens in soil, which could risk the quality of both food and groundwater.Also, crops may take in the microplastics, which may result in human intake along the food chain.

II.OBJECTIVES

- To Explore Sustainable Alternatives to Plastic in Agriculture.
- To Explore the Effectiveness of Biodegradable Seed Cups.
- To Analyze the Manufacturing Process of Biodegradable Seed Cups.
- To Assess the Environmental Impact of Biodegradable Seed Cup.

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III.METHODS/METHODOLOGY

FLOW CHART

Select Materials

(*Cocos nucifera, Cenchrus purpures*)

↓

Combine Materials

(in specific proportion)

↓

Mold Seed Cups

(Hydraulic hot press molding machinery)

↓

Testing and Analysis

(Tensil strength, Decomposition)

↓

Evaluate Result

(impact on plant growth)

Four crucial processes are involved in the creation of biodegradable seed cups: raw material preparation, raw material blending, molding, and drying/processing. Every step is intended to minimize plastic waste in agriculture while guaranteeing that the finished product is robust, biodegradable, and beneficial to plant growth.

4.1. PREPARATION OF RAW MATERIALS

The development of biodegradable seed cups includes three essential processes: raw material preparation, mixing, molding, and drying/processing . Every action aims to reduce the usage of plastic in agriculture while ensuring that the end product is durable, biodegradable, and supportive to plant growth.Three primary raw materials were selected to make the seed cup durable, biodegradable, and beneficial for seedling growth. The high lignin and cellulose content of coir fiber makes the seed cups durable, flexible, and water retentive.Finely chopped Napier grass (30%) to adds essential organic matter to the soil as it decompose. As a natural binder, corn starch adhesive (20%) keeps the fibers together and ensures that the cup decompose without spreading any harmful substances after.

Fig 1

Fig 2

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4.2. COMBINING RAW MATERIALS

The prepared the raw materials were mixed together in a 5:3:2 ratio (Coir Fiber: Napier Grass: Corn Starch Adhesive) to maintain a balanced structure. The coir fiber and Napier grass are mixed first to make sure equal fiber dispersion.Then, with a combination of corn starch adhesive, the fibers are slowly mixed to get a uniform mixture. After blending, the mixture is divided into 50-gram portions, ensuring that each seed cup has a uniform shape, weight, and thickness. This step is crucial for consistency in production and product performance.

Fig 3

4.3. MOLDING PROCESS

The seed cups developed through the molding process at controlled pressures and temperatures by using hydraulic hot press molding machines. Before the 50-gram mixture is placed in, t he mold is heated to a maximum temperature between 150°C to 200°C. The seed cup is formed approximately in 15 to 20 minutes by pressing the material between two mold surfaces after it is heated. Moisture evaporates during this process, which reducing the seed cup's weight approximately from 50 grams to 30 grams and improving its durability. Also, the heat activates the corn starch adhesive, which provides a strong attachment between the fibers. This step is essential i n order to make a seed cup that is durable, properly formed, and biodegradable.

Fig 4

4.4.DRYING AND PROCESSING

To enhance their structure and improve their life span, the seed cups are dried after molding. T he cups are dried in the air for 1 to 2 hours in order to ensure any left over moisture to totally evaporate. The seed cups are cleaned and polished after drying to level out the edges and improve their overall look. It ensures that the final product is useful, smooth, and visually appealing. Proper drying and finishing enhance the seed cup's durability and maintain their sustainable benefits and biodegradable qualities.

Fig 5

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IV.RESULT AND DICUSSION

The biodegradable seed cups made from *Cocos nucifera*, *Cenchrus purpureus*, and corn starch have been successfully produced using the specified molding process. The formed seed cups exhibit a uniform structure with a smooth surface, adequate thickness, and notable durability. During the preliminary observations, the cups retained their shape and provided sufficient structural support for seedlings. The molding method mentioned was successfully used for making the biodegradable seed cups developed from corn starch, *Cocos nucifera*, and *Cenchrus purpureus*. The seed cups which develop are of uniform structure, a smooth surface, suitable thickness, and excellent strength. During those first observations, the cups maintained shape and gave sufficient structural support to the seedlings. Even though they are already being studied, more study is required to identify whether the seed cups improve growth of plants, durability, and overall decomposition speed. According to the current research, the fiber based material enhances moisture retention while maintaining the roots circulating. For examining long lasting performance, such as biodegradability and soil impact, controlled studies are still needed. The aim of the study is to find out the way these seed cups perform as an environmental friendly alternative to plastic containers.

5.1. BIODEGRADABLE TEST

5.1.1. OBJECTIVE

To test an environmentally friendly biodegradable seed cup made from corn starch, Cocos nucifera, and Cenchrus purpureus regarding biodegradability under natural environments. Its suit as a sustainable, biodegradable alternative for plastic seed cups is to be proved.

5.1.2. MATERIALS

MATERIALS USED:

- *Cenchrus purpureus* (stem fibers)
- *Cocos nucifera* (coconut shell powder)
- *Corn starch* (natural adhesive)

5.1.3. TEST ENVIRONMENT

- **Medium:** Garden soil
- **Temperature Range:** 28–35°C
- **Moisture Level:** Naturally maintained through regular watering
- **Sunlight Exposure:** Partial sunlight (4–5 hours/day)
- **Microbial Activity:** Active (soil containing natural microorganisms)
- **Test Duration:** 15 days

5.1.4. OBSERVATIONS

DAY	OBSERVATION
1	Buried in soil
5	Slight surface softening and edge discoloration
10	Visible surface breakdown, fibrous texture emerging
15	Cup started decomposing; about 20% disintegration

5.1.5. FINAL RESULTS

- **Total Decomposition Time:** Began decomposing within 15 days, significant breakdown by Day 30 to 40 days.
- **Soil Impact:** Neutral; no negative effect on environment.
- **Conclusion:** The seed cup is **highly biodegradable** under natural outdoor conditions, breaking down within 15 days and posing **no harm to the environment**.

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Fig 6
(Day 15 - Decomposition of seed cup

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