



## TALAHIB (*SACCHARUM SPONTANEUM LINN.*) AS A BIODEGRADABLE CUP

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### Abstract

Disposable cups produce a substantial quantity of refuse, presenting environmental difficulties. This study explores the capacity of talahib (*Saccharum spontaneum Linn.*), a rapidly growing grass found in the Philippines, to be used as a material for biodegradable cups. The study will investigate the physical and chemical characteristics of talahib (*Saccharum spontaneum Linn.*) to determine its suitability for use in cups. Subsequently, it will devise a methodology to fabricate utilitarian and long-lasting cups using talahib. The rate at which the designed cups break down naturally will be evaluated, and a comprehensive analysis of their whole life cycle will be performed to compare their impact on the environment with that of traditional throwaway cups. The objective of this study is to assess the viability of utilizing talahib as a sustainable and environmentally beneficial substitute for disposable cups, to encourage waste reduction and foster environmental stewardship.

**Keywords:** *saccharum spontaneum linn.*, *biodegradable cup*, *waste reduction*

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### Introduction

*Saccharum spontaneum*, also referred to as Talahib or wild sugarcane, is a highly adaptable plant that has promise for many applications across multiple industries. It can serve as a substitute for synthetic fibers in textile manufacturing, demonstrating greater tensile strength than pure cotton yarn (Santos & Torres, 2019). The fibers of the plant can strengthen green composites, hence improving their mechanical characteristics (Kaith et al., 2010). The lignin component of Talahib can be isolated and utilized as an adsorbent for heavy metals in solutions that contain water (Datiles & Marquez, 2021). In addition, *S. spontaneum* has demonstrated potential in the manufacture of bioethanol using several pretreatment techniques and fermentation processes (Scordia et al., 2010; Chandel et al., 2009; Chandel et al., 2011). The plant's capacity to inhabit and thrive in challenging environments, along with its potential for restoring ecosystems and producing large amounts of biomass, renders it a valuable asset for the management of the environment and the development of rural economies (Pandey & Singh, 2020).

Furthermore, Talahib (*Saccharum spontaneum Linn.*) exhibits potential as both a sustainable substitute in the textile sector (Santos & Torres, 2019) and for manufacturing biodegradable cups. Research demonstrates the antioxidant properties of Talahib leaf extract. Additionally, studies emphasize the significance of using materials such as biodegradable plastic-coated paper and degradable compound plastic cups to tackle the issue of plastic waste in the Philippines (Dela Peña & Camara, 2019). By utilizing the biodegradable characteristics of Talahib and integrating them into cup manufacturing, it is feasible to diminish the ecological consequences of conventional plastic cups and support sustainability initiatives in the Philippines.

### Research Objectives

The study aims to develop a biodegradable cup using Talahib (*Saccharum spontaneum Linn.*) Additionally, the research seeks to evaluate the physical and mechanical characteristics in order to maximize the efficiency of the product. The following objectives will help the researchers investigate biodegradable cups using Talahib (*Saccharum spontaneum Linn.*):

- Assessing the physical and chemical characteristics of talahib (*Saccharum spontaneum Linn.*) to ascertain its appropriateness for manufacturing cups.

- b. Designing a method to produce robust and long-lasting cups using talahib (*Saccharum spontaneum* Linn.). This may entail investigating various processing methodologies and additives.
- c. Conducting tests to determine the rate at which the newly created talahib (*Saccharum spontaneum* Linn.) cups break down naturally, under carefully regulated conditions, in order to guarantee that they decompose within a suitable amount of time.
- d. Evaluating the environmental effects of talahib (*Saccharum spontaneum* Linn.) cups in comparison to typical disposable cups, taking into account variables such as resource utilization, energy usage, and trash production.

## Methodology

### Materials and Equipment

The primary material that will be utilized is the talahib (*Saccharum spontaneum* Linn.) fibers in order to develop a biodegradable cup. Moreover, cornhusk, cornstarch, and soybean wax will also be used as an ingredient in binding and forming the cup. Additionally, the properties of these materials can increase their biodegradability, durability, and water absorption. The research methodology aligns with specific time frames, acknowledging potential limitations in capturing long-term implications. The structured approach ensures a targeted investigation, addressing the study's specific objectives and adhering to defined scope and limitations.

### Treatment/ General Procedure

#### Initial Preparation

To create the pulp, utilize scissors or another cutting tool to trim 850 grams of talahib (*Saccharum spontaneum* Linn.) grass and cornhusk into lengths measuring between 3 and 5 cm. Subsequently, the talahib (*Saccharum spontaneum* Linn.) grass and cornhusk were boiled separately in distinct casseroles for a duration of 30 to 60 minutes, with the boiling time being modified according to the thickness and maturity of the grass fibers. In order to prevent possible chemical reactions, a quantity of 90 grams of washing soda was introduced into each casserole before reaching the boiling point. Subsequently, filter the water and allow it to rest for a duration of 7 minutes in order to cool down. The talahib (*Saccharum spontaneum* Linn.) fiber and cornhusk were thereafter combined individually until they reached a fine consistency. Simultaneously, the researchers prepared an additional vessel to heat water for the 90 grams of starch powder. The starch powder was liquefied and subsequently added to boiling water.

Moreover, the researchers combined the talahib (*Saccharum spontaneum* Linn.) fiber and cornhusk in the bucket and added the boiling starch powder to the mixture. Subsequently, water was introduced into the receptacle, and the amalgamation was shaped utilizing the shifting technique in a mold and deckle. A sponge was employed to control the moisture level during the molding procedure. After the mixing process was finished, the fiber was manually shaped into the correct thickness using a molder and then left to dry in the sunlight.

#### Final Preparation

The hydrophobic soy wax can be prepared by heating a mixture of 50g of soybean wax and 100 mL of ethanol solution at a low temperature for 5 minutes. The heated wax mixture will be administered onto a paper cup using a 25mm brush and thereafter allowed to dry at the ambient temperature.

## Results and Discussion

### Product Analysis

Table 1. Results of Product Development Trials

	Trial 1	Trial 2	Trial 3
Talahib ( <i>Saccharum spontaneum</i> Linn.)	56g	40g	24g
Cornhusk ( <i>Zea mays</i> L.)	24g	40g	56g
Cornstarch	20g	20 g	20 g

Table 1 indicates the different development trials in order to find the best composition. The first trial used 54 grams of talahib, 24 grams of cornhusk, and 20 grams of cornstarch (constant throughout). Talahib (*Saccharum spontaneum* Linn.) fiber is fine but weak, this ratio smoothed a cup. The second study used 40 grams of cornhusk and talahib (*Saccharum spontaneum* Linn.). The balance and structural integrity of this ratio suggest durability. The third trial used 24 g talahib (*Saccharum spontaneum* Linn.) and 56 g corn husk. The cup ratio was more durable than the second trial. Because corn husk strands are coarse, it increases the incidence of flaws, notably holes.

According to the experiments, the second trial, which had 40 grams of talahib (*Saccharum spontaneum* Linn.) and 40 grams of cornhusk, is the most promising for creating the biodegradable cup. This ratio showed a balanced material mix, improving durability and structural integrity compared to other studies. The third attempt, with 24 grams of talahib (*Saccharum spontaneum* Linn.) and 56 grams of corn husk, was more durable but had more defects, particularly holes, due to the coarser corn husk fibers. Thus, the second trial composition is advised for the production of biodegradable cups for maximum performance and quality.

## Biodegradability Test

Table 2. Results of Biodegradability Test

	Initial weight	After 10 days	Percent of weight loss
Trial 1	31g	25g	19.35%
Trial 2	28g	25g	10.71%
Trial 3	38g	34g	10.52%

Table 2 shows the biodegradability results. The researcher tested the cup's biodegradability three times. The biodegradable cup with cellulose degrades 23.33 after 10 days of burial, according to ASTM D5511. Thus, the researcher examined the talahib (*Saccharum spontaneum* Linn.) cup's biodegradability. The first attempt buried the cup for 10 days, and after 10 days, it weighed 25g and biodegraded 19.35%. In the second trial, the cup's starting weight was 28g, became 25g after ten days of burial, and had a 10.71% biodegradability rate. The cup changed from 38g to 34g after ten days of burial in the third trial, with a biodegradability rate of 10.52%. The average weight loss is 13.53%, indicating a low deterioration rate.

The researcher used soybean wax to cover the cup, which explains this. It impacts cup degradation since organic waxes entirely dissolve within 30 days, according to Dorger (2022). Thus, it the degradation via affecting cup degradation.

## Durability Test

Table 3. Results of the Durability Test

Stress Test			Average
First Trial	Second Trial	Third Trial	
5 Kilograms	5.5 kilograms	6.5 Kilograms	6 Kilograms

Table 3 shows the result of the durability test. The cup originally tested at 5.5 kg and was durable. In the second test, the cup can hold 6 kg without tearing. In the third test, the biodegradable cup can sustain 6.5 kg without tearing. According to Candelier et al. (2017), the average weight is 6 kilograms, although the cup is strong enough to endure up to six kilograms without tearing.

## Conclusion

Based on the results of this study, we can ascertain the potential of talahib (*Saccharum spontaneum* Linn.) as a material for biodegradable cups. The findings indicate that talahib cups exhibit favorable physical and mechanical characteristics, can be made efficiently, and biodegrade within an acceptable period, thereby strongly suggesting their potential as a sustainable alternative. Moreover, if a life cycle study demonstrates a positive outcome in comparison to traditional throwaway cups, it would strengthen the environmental advantages of talahib cups. On the other hand, additional investigation is required to arrive at a conclusive determination. This may entail optimizing the cup development process to improve both the durability and user experience. Additionally, carrying out extensive biodegradation research on a broad scale under different environmental conditions might yield more reliable data.

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