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Verdant Sanctuaries: Cultivating Flora through Biodegradable Pet Interment Pod Capsules

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Abstract

This study explores the development and evaluation of biodegradable burial pods for pets made from starch-based materials and plant fibers, primarily coconut coir. The aim is to create a product that respects the memories of cherished pets while promoting environmental sustainability. The research focuses on two experimental products with varying coconut coir concentrations—50% (Product A) and 75% (Product B)—to assess their tensile strength and biodegradability in different environmental conditions. Product A demonstrated higher biodegradability, breaking down rapidly within 10 days, but lacked sufficient tensile strength for long-term burial stability. In contrast, Product B exhibited superior strength, enduring significantly higher loads before failure, but decomposed more slowly. The study also considers the environmental implications of using coconut coir, a renewable material that repurposes agricultural waste, compared to traditional synthetic polymers. The findings highlight the trade-off between biodegradability and strength, suggesting that a balanced approach, such as the use of 75% coconut coir, optimizes both structural integrity and ecological impact. This research contributes to the development of sustainable pet burial alternatives, offering insights into material selection for applications requiring both durability and environmental compatibility.

Keywords: Verdant Sanctuaries, Biodegradable, Pod Capsules

Introduction

As environmental sustainability gains influence in shaping cultural norms, traditional pet burial practices are evolving to address ecological concerns. Biodegradable pet burial capsules have emerged as an innovative solution that blends remembrance with environmental care. These capsules, crafted from decomposable materials, not only provide a respectful resting place for pets but also support plant growth, transforming burial into a regenerative process (Lu *et al*., 2022). This method addresses the growing issues of plastic waste and aligns with the rising demand for green, eco-friendly practices.

By incorporating these sustainable capsules, the approach bridges the gap between traditional customs and modern ecological needs. The natural decomposition facilitated by these capsules allows for the nurturing of flora, turning the end of a pet's life into the beginning of new growth (koHan, 2023). This aligns with the broader movement toward environmentally responsible living, offering a compassionate and sustainable way to honor beloved pets while contributing positively to the environment.

The use of starch-based biodegradable materials presents unique opportunities and challenges. While these materials offer an environmentally-friendly alternative, they often exhibit weaknesses such as poor mechanical properties and sensitivity to moisture. However, by incorporating natural fillers like plant fibers and using advanced processing methods, these limitations can be effectively addressed. Such innovations can enhance the functionality and sustainability of biodegradable interment capsules, making them suitable for the purpose of nurturing plant life as they decompose alongside pet remains.This study is prompted by the need to bridge the gap between environmentally-conscious end-of-life practices and the existing methods of pet burial (Jiang *et al*., 2020).

In addition, according to Jiang *et al*. (2020) By focusing on biodegradable materials, the project not only respects the bond between pet owners and their companions but also contributes to ecological restoration. This approach aligns with the

increasing global shift towards green practices, where every action is designed to benefit the planet.To captivate attention and demonstrate the project's significance, striking statistics on pet ownership and environmental waste can highlight the scale of impact. Furthermore, emphasizing the rationale behind using plant-nurturing capsules serves as both a scientific and emotional appeal, convincing readers of the project's value and necessity.

According to studies the mango tree (Mangifera indica) is a highly suitable choice for this project due to its numerous advantages. Its adaptability to a range of soil types, including less fertile ones, allows it to thrive in diverse burial environments. The deep root system of the mango tree contributes significantly to soil stability and erosion prevention, which is crucial for maintaining a healthy landscape. Furthermore, mango trees provide essential ecological benefits by offering shade and attracting pollinators, which supports local biodiversity and enhances the surrounding environment.Culturally, mango trees hold significant symbolism. They are often associated with abundance, life, and prosperity, making them a meaningful symbol for a project focused on honoring pets through sustainable practices. This symbolism resonates with the project's aim to transform the end of a pet's life into new growth and renewal. Additionally, the mango tree's ability to produce nutritious fruit ensures that it continues to benefit both the environment and the community long after the burial. This ongoing contribution aligns perfectly with the project's vision of integrating ecological sustainability and cultural respect into end-of-life practices (Vasanthaiah *et al*., 2020). If the study succeeds, users will have the freedom to select the type of plant they prefer, rather than being restricted to *Mangifera indica* (mango trees). This flexibility enhances the personal nature of the biodegradable interment capsules, allowing pet owners to choose flora that resonate with their unique memories and feelings about their pets. The ability to select from a wider range of plants,such as native trees, ornamental shrubs, or vibrant flowering plants which enables users to create a tribute that is both meaningful and symbolic. This choice allows the memorial to reflect the personality or spirit of the pet, whether it's through a hardy tree symbolizing strength, a delicate flowering plant symbolizing beauty, or a fast-growing species symbolizing energy and vitality.

Moreover, this flexibility also aligns with environmental considerations, as users can choose plants that are best suited to their local climate and ecosystem, promoting ecological balance and sustainability. This aspect of the study empowers users to not only honor their pets but also contribute positively to their environment by selecting flora that supports local biodiversity. By offering a wide array of plant options, the biodegradable capsule becomes more than just a burial option—it becomes a personalized, living legacy that fosters an enduring connection between the pet, the owner, and the natural world.

This study explores various factors affecting the effectiveness of these capsules. One critical variable is the placement of the capsules in different environmental conditions, such as variations in soil type, moisture levels, and temperature. The research also tests additional variables, including the color of the capsules and the inclusion of specific additives, to determine their impact on the rate of capsule decomposition and nutrient release.

Outcomes measured include the decomposition rate of the capsules in soil, the timing and extent of nutrient release, the availability of space for root expansion, and the overall environmental conditions conducive to tree growth. By systematically manipulating these variables, the study aims to develop an optimal capsule design and placement strategy that supports the healthy growth and development of trees. The ultimate goal is to create a capsule system that enhances tree health and contributes to ecological sustainability by supporting robust root systems and efficient nutrient utilization.

Additionally, the study assesses broader factors such as ecosystem health, environmental sustainability, and community engagement. This includes support for biodiversity, creation of wildlife habitats, and the growth and survival of trees over time. Soil quality improvements, community involvement in environmental initiatives, reduction of carbon footprints, and prevention of soil erosion are also considered. By examining these aspects, the research seeks to understand how different practices and interventions can positively influence the environment, enhance sustainability, and foster greater community involvement.

Background of The Study

The loss of a beloved pet is a significant emotional event, prompting many pet owners to seek meaningful and respectful ways to honor their companion's memory. Traditional methods of pet burial, including conventional coffins and cremation, often involve materials and processes that are not environmentally friendly, contributing to pollution and the depletion of natural resources. The increasing environmental impact of conventional pet burial practices has driven interest in more sustainable alternatives, such as biodegradable pet interment capsules. (Cirigliano, 2024). In cultivating biodegradable pet interment capsules, explores how these capsules can merge pet remains with plant life, promoting eco-friendly practices. The study will compare various contemporary final disposition methods, including both rapid and prolonged techniques, to evaluate their effectiveness and sustainability (Gould *et al*., 2024).

In the context of pet interment, biodegradable burial capsules offer a unique opportunity to not only provide a respectful resting place for pets but also contribute positively to the ecosystem by supporting plant growth. These symbolic and practical considerations, this study explores how environmentalist values extend to end-of-life choices. Environmentalists often incorporate eco-friendly practices into their daily lives, such as recycling and sustainable transportation. This research investigates whether these values influence their decisions about death care. Through interviews with older adult environmentalists, the study examines whether their environmentalism persists after death and how they wish to be disposed of or dispersed. By analyzing the death care preferences of these individuals, the study aims to bridge the gap between one's identity as an environmentalist and their anticipated choices for death care. It explores the discourse around disposal versus dispersal and concludes that while environmental activists maintain their identity through their death care decisions, both the ecological understanding of burial options and knowledge about green burial practices are continuously evolving (Stock & Dennis, 2021).

In addition, the ecological science traditional techniques frequently consume a lot of energy, emit pollutants, and use chemicals and non-biodegradable materials. Green burials, on the other hand, assist land conservation and natural decomposition by utilizing biodegradable materials and avoiding hazardous ingredients. It emphasizes how cultural values have influenced the development of green burials and how, to promote greater acceptance, practices must be in line with various cultural beliefs.

According to (Westendorp & Gould, 2021). As the Anthropocene era highlights the profound impact of human activities on the environment, the consequences extend beyond our daily lives to how we approach death and the disposal of bodies. Traditional death care practices often reflect a disconnect from ecological principles, with modern systems being criticized for their environmental impact and detachment from natural processes.

Primary issues might address the environmental impact of traditional burial practices and the potential for biodegradable interment solutions to offer a more sustainable alternative. Traditional burial methods often involve the use of non-biodegradable materials such as metal caskets and synthetic liners, which can contribute to soil and groundwater contamination. This study explores how biodegradable pet interment capsules, designed to decompose naturally and support plant growth, could mitigate these environmental concerns. The key issue lies in evaluating whether these biodegradable solutions effectively integrate with the soil and promote healthy flora growth, as well as the broader implications for ecological sustainability and community acceptance. This background underscores the need for innovative burial methods that align with ecological principles while addressing practical challenges and regulatory considerations (Khangura, *et al*., 2023).

This study looks at the psychological and environmental effects of pet burial, with an emphasis on the possible advantages of employing biodegradable pet interment capsules. Conventional coffins and cremation are two examples of traditional pet burial techniques that frequently use non-green materials and methods, which add to pollution and the depletion of natural resources. Traditional pet burial and burial practices frequently harm the environment by causing pollution and depleting natural resources.

To sum up everything that's been stated so far the examination of biodegradable pet interment capsules reveals a significant shift in addressing the environmental and emotional issues linked to traditional pet burial practices. Conventional methods, which often involve non-biodegradable materials and energy-consuming processes, contribute notably to pollution and the depletion of resources. In contrast, biodegradable burial capsules present a sustainable option that honors the memory of cherished pets while promoting ecological health through enhanced plant growth and soil enrichment. This research emphasizes the necessity for innovative burial solutions that resonate with environmental values and rectify the limitations of traditional practices. Additionally, the study investigates how principles of environmentalism shape end-of-life decisions, indicating that individuals dedicated to sustainability frequently aim to incorporate these values into their death care choices. Ultimately, biodegradable interment capsules signify a progressive advancement towards embedding ecological principles in end-of-life considerations, nurturing both environmental responsibility and personal significance in pet memorialization. This method not only lessens environmental repercussions but also signifies a broader transition towards aligning human activities with natural processes, providing a more respectful and sustainable means to commemorate our departed companions.

The goal of this study is to develop options that respect the memories of cherished pets while also being in line with the increasing environmental consciousness. Furthermore, studying the ways in which these eco-friendly actions are representative of larger patterns in eco-aware living contributes to closing the distance between environmental theory and real-world end-of-life decisions.

Conceptual Framework

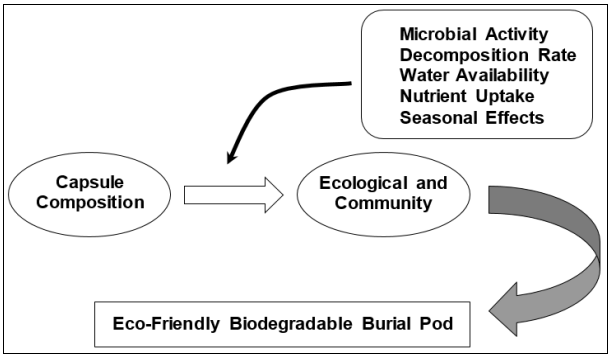

Fig 1:

Fig 1 investigates the interactions between various variables involved in the design of biodegradable pet burial capsules intended for cultivating flora while also contributing to ecological and community well-being. The research focuses on how these variables influence the effectiveness of the capsules in supporting plant growth, enhancing soil quality, and promoting biodiversity, ultimately providing a sustainable alternative to traditional burial methods. The study identifies several independent variables critical to the capsule design, with capsule composition being the most significant. The composition focuses on starch-based materials, chosen for their biodegradability, low cost, and availability. Starch-based materials are particularly favored due to their ability to break down naturally in the environment, leaving behind minimal ecological footprint. These materials are often sourced from agricultural byproducts, aligning with the study's goals of sustainability and environmental stewardship. Other independent variables include the size and shape of the capsules, their placement in the soil, color, and the inclusion of specific additives designed to enhance soil quality or plant growth.The dependent variables in this study represent the anticipated positive outcomes from using these biodegradable capsules. These outcomes include the support of biodiversity, such as increased plant variety and the attraction of beneficial insects and wildlife; improvements in soil quality, including better nutrient cycling and soil structure; the creation of wildlife habitats; enhanced plant longevity and survival rates; greater community engagement and awareness of eco-friendly practices; and a reduction in carbon footprint through the use of sustainable materials. These variables are critical as they measure the success of the capsules in fulfilling their intended ecological and community

functions.

To ensure that the results of the study accurately reflect the impact of the capsule design, several controlled variables are maintained. These include the type of pet remains used, the soil type in which the capsules are placed, the watering schedule, sunlight exposure, and ambient temperature. By controlling these variables, the study aims to minimize external influences and isolate the effects of the capsule design on the dependent variables.

The study also accounts for intervening variables that could influence the decomposition process and subsequent plant growth. These include microbial activity in the soil, which plays a crucial role in breaking down the starch-based materials; the rate of decomposition of the capsules; the availability of water, which is essential for both decomposition and plant growth; nutrient uptake by the plants; and seasonal effects, which could impact both the decomposition rate and plant growth.

Although not the primary focus of the research, extraneous variables are acknowledged for their potential impact on the study's outcomes. These include pollution levels, which could affect soil and plant health; wildlife interference, such as animals digging up or disturbing the capsules; human activities, including accidental disturbances or intentional removal of the capsules; natural disasters, which could alter the study environment; and soil erosion, which could affect the stability and placement of the capsules.

The research involves designing and testing various starch-based capsule compositions. These capsules will be produced in different sizes and shapes, each embedded with pet remains and specific additives aimed at improving soil quality and supporting plant growth. The capsules will be placed in controlled environments, such as designated test plots, and monitored over time. The effectiveness of the capsules will be evaluated by comparing the test plots containing the biodegradable capsules to control plots without capsules. Key metrics will include plant growth rates, soil health indicators, and biodiversity levels. This comparative analysis will help determine the efficacy of the capsules in achieving the desired environmental and community benefits.

The economic impact of introducing biodegradable burial pods is a key consideration in this research. Starch-based materials, chosen for their affordability and rapid degradation in soil, also have the potential to boost local agriculture by utilizing crops like cassava, corn, and potatoes. This can open up new opportunities for small-scale farmers and local producers, creating an economic ripple effect in rural communities. Furthermore, the production of these biodegradable capsules could generate jobs, contributing to the growth of the eco-friendly burial industry. By offering a low-cost and environmentally responsible alternative to traditional burial methods, these pods could attract consumers and communities seeking sustainable solutions.

Starch-based materials were selected due to their multiple advantages. They degrade quickly in soil, releasing nutrients that can be easily absorbed by plants, thereby enriching the soil and promoting plant growth. Additionally, starch is a renewable resource, making it both economically and environmentally sustainable. These characteristics align perfectly with the goals of the research, which seeks to develop a biodegradable burial pod that supports ecological balance while being economically viable.

The conceptual framework of this research explores the feasibility and effectiveness of biodegradable pet interment pods as a sustainable alternative to conventional burial methods. It examines various independent variables, such as capsule composition (including materials, size and shape, placement, color, and additives), which directly impact the success of the capsules. The study also focuses on dependent variables, which include biodiversity support, soil quality improvement, wildlife habitat creation, plant longevity and survival, community engagement, and carbon footprint reduction, as the desired outcomes of using these capsules.

To ensure accurate results, controlled variables are maintained, including the type of pet remains, soil type, watering schedule, sunlight exposure, and temperature. These controls help isolate the effects of the capsule design from other environmental factors. Intervening variables, such as microbial activity, decomposition rate, water availability, nutrient uptake, and seasonal effects, are also considered, as they play a crucial role in the effectiveness of the capsules. Additionally, extraneous variables like pollution levels, wildlife interference, human activities, natural disasters, and soil erosion are acknowledged, even though they are outside the direct focus of the research.

By conducting thorough and rigorous research while addressing potential ethical concerns, this project aims to contribute to the development of a more sustainable and environmentally responsible approach to pet interment.

Theoretical Framework

The theoretical framework for this study, titled "Verdant Sanctuaries: Cultivating Flora Through Biodegradable Pet Internment Pod Capsules" is founded on three important theoretical stances. This approach aims to investigate how plant-based remedies might be used in pet burial procedures, aligning with Human-Plant Interaction Theory, Attachment Theory, and Biodegradation Theory. Creating environmentally friendly pet internment solutions is ultimately supported by these theories.

The Human-Plant Interaction Theory was proposed by Patricia Hasbach, this theory supports the notion that incorporating plants into pet interment practices can enhance emotional comfort for pet owners and promote a positive, sustainable relationship with the environment (Colino & Foglia, 2023). The theory postulates that touching plants can help in obtaining a mental and emotional break, which is critical when fighting grief compared to the loss of a pet. Using pods which can support plant growth and using plants to give memories of the lost pets, it can also support the mental health of pet parents by the presence of plants. Moreover, Hasbach's concept also emphasizes how such interactions might contribute to the improvement of human's relationship with the environment and might inspire people to adopt more environmentally friendly actions. This approach is also consistent with the tenets of the theory and the encouragement of care towards the environment and the inclusion of nature within people's lives as well as applicable to both healing and environmentalism. According to John Bowlby, the Attachment theory investigates how biodegradable internment pods affect the grieving process by offering a way to maintain attachment to a deceased pet. The relationships developed throughout the pet's life have a big impact on the grief and coping processes that follow.

Through the use of biodegradable plant-growing pods, this provides pet owners with a way to respect and retain their emotional bond with their departed companions. The biodegradable pods capsule provides a living memorial that changes with time, acting as a tangible representation of this eternal relationship. This assists the grieving process by allowing for a continuous connection, which is consistent with attachment theory. When a growing plant is there, it helps people find solace and purpose in their loss and represents the ongoing relationship. due to the study addresses the necessity for maintaining emotional bonds through creative, meaningful means, it thus has a close relationship with attachment theory. Additionally, Alexander Fleming proposed the Biodegradation Theory. Although Fleming is more famously known for his work on antibiotics, his contributions to understanding the natural processes of decomposition and biodegradation are relevant here. According to the biodegradation theory, nutrients are recycled back into the environment as a result of microorganisms breaking down organic waste. It emphasizes the advantages of employing natural materials that break down naturally for the environment in order to advocate the adoption of biodegradable pet internment pods. As a living monument, a plant can grow out of the pods because they are made to decompose and blend in with the soil. Assuring that the internment process is both ecologically sustainable and in harmony with natural cycles is in line with Biodegradation Theory (Brown, 2024).

These theories are essential to the study's objectives because they highlight the many advantages and difficulties associated with employing biodegradable materials while incarcerating pets. According to Human Plant Interaction Theory, biodegradable pods can provide bereaved pet owners with continuous consolation and a deep sense of connection, underscoring the emotional significance of integrating plants into memorial activities. This is corroborated by attachment theory, which shows how these rituals preserve emotional ties to departed pets and offer a living memorial through flora. The practical issues of employing biodegradable materials are also covered by Biodegradation Theory, ensuring that the pods break down organically and in harmony with the surroundings. Combining these theories emphasizes how crucial it is to address the psychological and environmental aspects of biodegradable internment pods in order to make sure they are not only efficiency.

Statement of the Problem

This section outlines the research problem, aiming to quantitatively evaluate perspectives on the use of biodegradable pet interment pod capsules in Noveleta, Cavite. The study seeks to understand how these capsules might impact environmental conservation and contribute to the development of sustainable interment practices. The research addresses the following questions:

1. How effective are the starch-based materials (e.g., potato and corn starch) and plant fibers (e.g., coconut coir) selected for the biodegradable pet interment pod capsules in cultivating flora, what are the specific steps involved in the development and creation of these biodegradable pet interment capsules?
2. How effective are the biodegradable pet interment capsules in achieving the desired ecological benefits in terms of:
    a. Tensile strength.
    b. Biodegradability.
3. How does the incorporation of starch-based materials (e.g., potato and corn starch) and plant fibers (e.g., coconut coir) into biodegradable pet interment capsules impact the environment, particularly in reducing agricultural waste and mitigating carbon emissions, when compared to traditional polymer-based materials?

Scope and Delimitation

This study aims to assess the effectiveness of biodegradable pet interment pod capsules in fostering ecological growth and sustainability. It concentrates specifically on using these environmentally beneficial pods, which break down and add nutrients to the soil to stimulate the growth of flora. The materials utilized to build these pods, how quickly they decompose, and how they affect plant growth and soil quality will all be examined in this study. The study is committed to evaluating how these interment pods can contribute to a greener environment by transforming pet remains into a source of nourishment for plants. It will examine the capsules' biodegradable characteristics, such as how quickly they break down and release nutrients, and evaluate the advantages these pods have over conventional burial techniques, which frequently use non-biodegradable materials and possibly dangerous chemicals. By examining the effects of the pods on soil health and plant growth, the study aims to determine their viability as a sustainable alternative in pet interment practices. In addition, it will examine the wider implications for urban green spaces and environmental protection, offering important new perspectives on how biodegradable solutions might improve ecological sustainability.

The results of this experiment focus on investigating the biodegradable pet burial capsules, made of starch-based materials, and how they influence the development of mango trees in controlled soil environments. To a large extent, it is concerned only with these kinds of capsules' degradation rates, nutrient liberation, and their effects on the soil properties and trees, where certain test locations are in Noveleta, Cavite. The study focuses solely on capsule ability on stimulating plant growth without considering other biodegradable materials that may also be effective, different species of plants or changes in conditions of the environment.

Significance of the Study

This section underscores the significance of the research by highlighting the potential impact and benefits of the study. This investigation is designed to gather valuable and reliable information regarding the cultivation of flora using biodegradable pet interment pod capsules. By exploring this innovative approach, the study seeks to advance our understanding of how biodegradable interment solutions can promote environmental sustainability and support plant growth. The key beneficiaries of this research include:

The consumers/users: This study benefits consumers and users by offering them an eco-friendly alternative to traditional pet burial methods, allowing them to memorialize their pets in a way that contributes to environmental sustainability. Consumers can choose a plant or tree they prefer to grow from the biodegradable pod, creating a personalized and meaningful living tribute. This choice not only allows them to honor their pets but also actively

supports the environment by fostering new plant life. The research empowers users to make informed, environmentally responsible decisions, reinforcing their role in promoting sustainability through their everyday choices. By selecting a plant that resonates with them, consumers can turn a moment of loss into a life-affirming act that aligns with their values and contributes to broader ecological goals.

The Environmentalist and Sustainability Advocates: This study benefits environmentalists and sustainability advocates by offering a tangible, research-backed solution that directly aligns with their core values of conservation and eco-friendly living. By exploring how biodegradable pet interment pods can reduce environmental impact and foster plant growth, the study provides a model for integrating sustainability into practices that are often overlooked in discussions of environmental responsibility. It not only highlights the potential for reducing waste and promoting ecological balance through circular processes but also offers a pathway for advocates to influence and inspire broader adoption of sustainable end-of-life practices. This empowers them to champion environmentally conscious choices in both personal and community settings, contributing to a larger movement towards sustainability and ecological stewardship.

The Students: This research study impacts students by deepening their understanding of sustainability and environmental responsibility. It provides them with valuable interdisciplinary learning experiences, combining biology, environmental science, and materials engineering. Students also gain practical research skills and experience in experimental design, which are crucial for their academic and professional growth. Moreover, the study encourages ethical reflection on environmental and cultural values, helping students develop a sense of moral responsibility in their scientific and personal lives.

The Community: This research study positively impacts the community by promoting sustainable burial practices, raising environmental awareness, and encouraging the adoption of eco-friendly alternatives. It can also foster stronger community engagement in environmental conservation efforts and create opportunities for local economic growth, particularly in agriculture and eco-friendly industries. By addressing both ecological and cultural values, the study helps build a more environmentally responsible and conscious community.

The Government: This research study can influence the government by highlighting the importance of sustainable practices in death care and environmental conservation. It may encourage the development of policies and regulations supporting eco-friendly burial methods, such as biodegradable pet interment capsules. Additionally, the study can provide data that informs government initiatives focused on reducing environmental impact and promoting biodiversity. By demonstrating the benefits of these innovative solutions, the research could also lead to government support for funding and implementing similar projects on a broader scale, contributing to national sustainability goals.

The Future Researchers: This research study provides a strong foundation for future researchers by offering insights into sustainable burial practices and the use of biodegradable materials. It encourages further exploration in environmental science, materials engineering, and ecological conservation. Future researchers can build on this work by investigating advanced biodegradable materials, optimizing capsule design for enhanced plant growth and environmental benefits, and conducting long-term studies on the ecological impact of these capsules. Additionally, the study promotes interdisciplinary collaboration, integrating knowledge from various fields to address both ecological and societal needs. This research also has the potential to influence policy and regulatory frameworks, encouraging future researchers to advocate for sustainable practices and contribute to the development of eco-friendly innovations.

Definition of Terms

Advantages: Refers to the use of biodegradable pet interment pod capsules offers several key benefits. These include promoting environmental sustainability by reducing waste and enabling natural decomposition. Additionally, the capsules support plant growth by recycling nutrients back into the soil, creating an eco-friendly way to honor pets.

Biodegradability: Indicates the capacity of the pet internment pod capsules to naturally decompose through the action of microorganisms, such as bacteria and fungi, over time. This process results in the breakdown of organic materials into natural elements like carbon dioxide, water, and biomass, which are non-toxic to the environment. Biodegradability ensures that the capsules do not contribute to long-term pollution or waste accumulation, as they are designed to seamlessly integrate into the ecosystem.

Conventional Method: Refers to the traditional practices of pet burial, where materials like plastic, metal, or treated wood coffins are used to contain the remains. These non-biodegradable materials slow or completely hinder natural decomposition, resulting in long-term environmental impacts, such as pollution, waste accumulation, and the disruption of natural processes. Conventional methods are often associated with resource-intensive production and disposal, contributing to larger ecological footprints.

Cultivation of Flora: Demonstrate the process of promoting and nurturing the growth of plants, trees, or other vegetation, often through deliberate human intervention. In the context of biodegradable pet interment pod capsules, this refers to the integration of a pet's remains into a nutrient-rich environment that fosters plant development. As the pod decomposes, it releases essential nutrients into the soil, creating a fertile foundation for flora to thrive.

Decomposable: Indicate about the characteristic of a material that allows it to break down into simpler organic or inorganic components through natural processes, typically involving microorganisms, bacteria, and environmental factors like moisture and temperature. In the case of biodegradable pet interment pod capsules, being decomposable means that the materials used can naturally disintegrate without harming the environment.

Encouragement: In the context of this study, encouragement refers to the active promotion and fostering of eco-conscious behavior among individuals and communities. It involves efforts to inspire pet owners to consider environmentally sustainable practices, such as choosing biodegradable interment capsules, which support the preservation of nature. This term also extends to the emotional motivation provided to individuals in adopting such practices as a way to memorialize their pets while contributing positively to the environment.

Environmentalism: Is defined as the philosophy and social movement that advocates for the protection, conservation,

and responsible management of the environment. In this research, environmentalism is embodied through the use of biodegradable materials in pet burial pods, a practice that minimizes ecological impact and contributes to reducing the carbon footprint.

Flora: Within this study, flora refers specifically to the plant species that are cultivated and nurtured through the decomposition of biodegradable pet interment capsules. These plants or trees, chosen by the pet owners, symbolize the ongoing cycle of life and death, where the remains of pets contribute to the growth and sustainability of new plant life. The term emphasizes the project's goal of transforming pet remains into life-giving resources for nature, enhancing the local environment by fostering the growth of native or chosen plant species.

Nurturing: Nurturing in this study pertains to the process of supporting, caring for, and promoting the growth of the flora cultivated from biodegradable pet interment pods. It reflects both the physical and emotional investment in fostering life after death, where the care of the plant serves as an extension of the care provided to the deceased pet. Nurturing also refers to the environmental stewardship associated with ensuring the successful growth of the flora, representing the human connection to the natural world and the desire to sustain life in a way that honors both the environment and the memory of the pet.

Regenerative: Regenerative refers to the ability of the biodegradable interment pods to support the natural cycles of growth and renewal within ecosystems. In this research, the term highlights how the organic decomposition of the pods and remains enriches the soil with nutrients, thereby facilitating the growth of new plant life. The concept of regeneration is central to the study's focus on sustainability, as it embodies the principle of giving back to the earth and renewing life through natural processes. It reflects the broader environmental goal of creating systems that restore and enhance ecological health rather than deplete it, making regenerative practices a core aspect of the biodegradable burial method.

Review of Related Literature and Studies

This review of related literature and studies explores the innovative concept of biodegradable pet interment pod capsules, focusing on their role in promoting sustainable and eco-friendly practices in pet memorialization. By examining existing research and advancements in the development of these biodegradable pods, this review aims to highlight their potential to provide a more environmentally friendly option to conventional pet burial techniques while also helping in preserving the environment.

Biodegradable Materials for Internment Pod

Biodegradable pet interment pods are made from naturally decomposing materials to provide a more environmentally friendly option for interment than previous methods. According to Onyeaka *et al.* (2022) [9], the environmental impact of conventional petrochemical-based polymers has driven the search for more sustainable alternatives. As it identifies, the use of biodegradable packaging materials especially films based on starch may serve as a viable alternative. Through the analyses of the properties of starch-based biopolymers such as their availability, affordability and better environmental qualities than the traditional plastics the benefits of the starch based biopolymers are underscored. Further, because of the sources of raw material for PLA production, the material is viewed as more sustainable relative to fossil-based plastics (Fonseca *et al*., 2023) [2]. However, since PLA is produced chiefly for use in agriculture, the assessment also identifies some notable environmental impacts associated with it and these are relatively negative impacts in freshwater eutrophication, marine eutrophication, and human toxicity impacts. It also underlines the importance of proper selection of materials with sound environmental credentials, and considering their life cycle in entirety that is relevant to the development of biodegradable pet burial pods. Some of the aspects that could be guided while selecting raw materials for burial pods that minimize on negative impact on the environment while at the same time undergoing natural decomposition are; This goes to support the work and effort towards looking for suitable materials which have suitable environmental influences for the production of biodegradable pet pods.

Nevertheless, plastics, with their strength, flexibility, and durability, have been a cornerstone of modern life. However, their non-biodegradable nature has created a significant environmental problem. The ever-increasing demand for plastics has led to the depletion of natural resources like petroleum and the accumulation of plastic waste. This has spurred research into biodegradable plastics, known as bioplastics, which are made from renewable sources like starch, proteins, and lipids. Bioplastics offer a promising alternative to traditional plastics, as they are environmentally friendly and can be broken down naturally. Starch-based bioplastics are particularly attractive due to the abundance, renewability, and biodegradability of starch (Shafqat *et al*., 2020).

In addition, the increasing concern with regard to using biodegradable materials instead of conventional plastics, due to its natural properties, material such as Coarse Wool, which is derived from the meat and dairy industries and has been explored in the following uses of garden utensils and acoustic panels (Berg *et al*., 2023) [10]. This is in line with the goals of creating biodegradable pet burial pods, which use new substances that naturally break down and promote plant growth in order to address environmental issues.

Environmental problems resulting from the extensive use of plastics in packaging have prompted research into bioplastics as a sustainable substitute. Even though they are biodegradable, starch-based bioplastics frequently lack the mechanical strength and water resistance of traditional plastics. This study looked into how different treatments affected the elongation and tensile strength of bioplastics made from starch (Gabriel *et al*., 2021) [24]. The findings demonstrated that the common plasticizer glycerol greatly enhanced the way starch interacted with other constituents, resulting in improved bioplastic characteristics.

According to Gercke *et al*. (2021) [11], The exploration of PET degradation through biological processes, such as those involving PETase enzymes, illustrates the potential for innovative material solutions that decompose naturally. It encourages the creation of biodegradable internment pods by emphasizing the value of using materials that have a low environmental effect and naturally degrade. Understanding the breakdown and recycling cycles of PET is important for creating sustainable internment pods that are environmentally friendly.

Decomposition and Soil Interaction of Biodegradable Pods

Environmental costs of unused residual mineral fertilizers that are not taken up by plants are known to have serious effects on soils, atmosphere and water bodies (Synelnikov *et al*., 2020) [6]. They suggest that these Speciality fertilizers can be packaged within a material called modified polyethylene terephthalate (PETF). Literature on watercress salad had given evidence that the PETF encapsulation technology works effectively in managing the time and rate of nutrients release as well as enhancing the growth of plants. The creation of pet interment pods that decompose naturally can benefit directly from these discoveries. Through the use of similar encapsulating technologies, the biodegradable pods may provide regulated release of nutrients, thus augmenting their efficacy in bolstering plant growth.

Furthermore, Yang *et al*. (2023) [16] added that the interaction of these materials with soil biota can also influence the availability of nutrients, as shown by, who found that the application of biochar in microplastic-contaminated soils improved nutrient metabolism and plant growth. This implies that biodegradable pods interact with soil microbes and the dynamics of organic matter to not only break down but also potentially improve soil quality. Similarly, emphasized the necessity of ongoing studies to evaluate the effects of biodegradable plastic films on soil characteristics, warning that evaluations conducted over a shorter period of time might not fully capture their effects on soil health (Zhang *et al*., 2022) [8]. The results indicate that although biodegradable materials can break down efficiently, environmental conditions like moisture and the composition of the microbial community can affect how quickly they degrade and how they affect the quality of the soil (Fernandes *et al*., 2020) [18].

Plant Growth and Ecological Restoration

According to (Gatica-Saavedra *et al*., 2022) [19] Forest restoration is considered among the most affordable and effective practices to address ecosystem and biodiversity loss and mitigate the impacts of human-induced global change. Soils are intrinsically complex systems that mediate and regulate multiple processes and functions vital for forest ecosystem restoration. Although monitoring soil attributes are critical for evaluating the success of forest restoration projects, research, and development of soil function indicators are still limited. Here, we have reviewed the most commonly reported soil indicators in forest restoration research and their recovery trajectory on a global scale. We also identified and discussed less frequently used indicators that have the potential for monitoring ecosystem recovery. We found that soil indicators have considerably increased in the literature. However, research is regionally concentrated, and a significant proportion of publications neither considered reference ecosystems (41%) nor provided basic information about soil types (<21%). The most reported indicator types were chemical (76%) (e.g., soil carbon, nitrogen, and pH). A significant proportion of the studies (46%) performed long-term evaluations (>15 years) of indicators. The majority of the indicators tended to resemble the levels of the reference ecosystem in the long term, with a few exceptions (e.g., water content and bulk density). We identified several less used but more integrative indicators with great potential for monitoring forest ecosystem recovery (e.g., aggregate stability, oxidizable carbon, soil respiration, and enzyme activity). Our results emphasize the need to effectively develop standardized soil health indicators to monitor ecosystem recovery under different conditions and expand their use in underrepresented regions.

Using plant species, phytoremediation is an environmentally friendly and economically viable method of eliminating toxins from soils and waterways. Plants can, in fact, break down organic molecules and absorb metals by nature. On the other hand, pollution can sometimes result in plant distress and stunted growth. In these circumstances, plants can attract the best bacteria to assist their growth based on the specific environmental stress by producing certain root exudates. Plant growth-promoting rhizobacteria (PGPR) have the potential to promote plant growth and development in several ways. These benefits may be particularly noticeable in situations when plants are cultivated in environments that provide challenges, such as those containing harmful pollutants. For example, by changing the metal bioavailability in soil and promoting metal translocation inside the plant, PGPR may reduce metal phytotoxicity. The hydrocarbon oxidizing properties of several PGPR enable them to promote and intensify plant biodegradation activity. Furthermore, by substituting costly chemical fertilizers that harm the environment, PGPR in agriculture can be a great way to combat the damaging impacts of abiotic stressors like drought and excessive salinity. More potential for phytoremediation may arise from a deeper comprehension of the roles played by plants and related microbes in the matrix of interest, particularly when there is ongoing contamination (Vocciante *et al*., 2022) [20].

Environmental Benefits of Biodegradable Pods

According to Yabor *et al*., (2020), The life cycle assessment of pet-related products, including food and packaging, reveals significant environmental burdens associated with traditional practices, the consequences extend beyond our daily lives to how we approach death and the disposal of bodies. In the study, the quantification of energy use, CO2 emissions, resource utilization and generation of waste will help to establish the environmental cost incurred by such activities. In addition, it will focus on identifying the variables that influence consumers' decisions regarding their feelings towards sustainable pet products and disposal methods used and this study will seek to make recommendations on how to influence consumers to take up sustainable pet products. To draw public attention to the environmental impact made by the pet industry using the normal commercial practices in the production of pet foods as well as the disposal of the shredded products and to search for broad solutions to reduce the impact of the pet industry on the environment.

The environmental benefits of utilizing the biodegradable interment pods may be quite vast. Organic matter added to the soil helps replenish its nutrients and stimulates microbiological activities and this is good for plant growth. For instance, the use of wood ash has been described as improving the physical and chemical properties of soil as well as promoting tree growth of some species, thus suggesting that comparable biodegradable material could supply nutrients necessary for plants grown in interment pods Similarly, By now, the use of biodegradable pods is becoming popular in a shift towards environmentally

friendly practices in various sectors of economy especially horticulture and food production. Organic products such as coffee pods and agricultural films have surpassed traditional plastics by their way of easing disposal and encouraging emergence of ecosystem practices (Jansone *et al*., 2020).

Natural Fibers for Enhancing Biodegradable Pods

It supports the use of coconut husk specially in utilizing renewable and biodegradable resources for the said purpose. Both are concerned with the concept of sustainability, the bioplastics research would offer information about how to make the material long-lasting and environmentally-friendly while the idea of interment capsules will be directly affected by the concept of creating a sustainable product. Technological processes such as partial removal of lignin, which increases the mechanical strength of the pod, is useful in the creation of the burial pod. Moreover, the findings on water stability and biodegradability of bioplastics drawn in this study provide important comparative points for assessing the behaviors of the capsules in natural burial conditions (Leow *et al*., 2022) [12].

According to (Ezra *et al*., 2023), coir fiber from coconut husks is a promising source for producing nanocellulose, a material with various applications. Furthermore, Abd El-Sayed *et al*., (2020) explores the organic materials including rice straws, corn stalks, cotton stalks and bagasse used in replacement of wood in the pulp and paper making. It also explains the advantages and disadvantages of non-wood fibers, noting their capacity to meet the prospects of the ecological problems and the provision of the raw material. This study relates to our project since it gives some information concerning the utilization of plant material for application in sustainable development. Referring to the discussion on non-wood fibers as a raw material for pulp and paper production you can extend it to your work on the biodegradable pet interment pods.

Primary concerns may involve the effects of the conventional burial practices and the possibility of biodegradable burial solutions to resolve those problems This research investigating implements biodegradable pet interment capsules, with the capability of degrading naturally and sprout plant life, as a solution to the named environmental concerns. The question is what these biodegradable systems do to the soil, whether they support healthy plant growth and how these factors tie in with the overall question of environmental and social acceptability (Alexander *et al*.,2020) [1].

The use of biodegradable materials in pet burial practices also solves another trending problem associated with the usage of plastics in general and in particular – microplastics problem. According to Hink *et al*., (2023) [3], biodegradable polymers like PLA are known to produce different effects on the environment as compared to non biodegradable polymers like plastics. Introducing the biodegradable material in pet interment pods can assist in limiting chances of the microplastics to build up in the environment consistent with the current global fight against plastic pollution. Two major factors that are of high importance while designing biodegradable interment pods are the environmental advantages and the emotional and psychological factors of pet loss. People can get comfort through the use of burial of trees or flowers for a dead pampered animal to heal the bereaved. The therapeutic aspect of the nature-based memorials is well captured in research that shows the psychological value of green spaces and the ability of nature to enhance the psychological well-being of people (Zhang *et al*., 2020) [8].

Research Methodology

This chapter contains the method used in the study. These include the research design, data gathering procedure, population and sampling, and data analysis.

Research Design

A quasi-experimental design was used in this study to examine the efficacy of a specific intervention. Rather than allocating participants to groups at random, the study made use of naturally existing groups that decided to use or not employ the intervention. Although quasi-experiments and randomized controlled trials are comparable in many ways, creating and carrying out a quasi-experiment can be difficult when internal validity concerns arise due to the lack of randomization (Pamungkas, 2022) [23]. This method made it possible to compare the intervention's effects between those who used it and those who did not.

Because of ethical and practical limitations, the researchers were unable to generate artificial groups for the experiment; hence, the quasi-experimental design was selected. With a particular focus on the Noveleta, Cavite. This research used a quasi-experimental methodology to thoroughly evaluate the efficacy of biodegradable pet interment pod capsules. With this method, it is possible to gain a more nuanced understanding of how these capsules work in the particular setting of the research region, which offers important insights into both their potential advantages and disadvantages. Nevertheless, by carefully choosing individuals and gathering data at predetermined intervals, the researchers were able to incorporate features of experimental design. This method gave insightful information about the intervention's possible effects. The biodegradable pet burial pod capsules can be thoroughly evaluated thanks to this quasi-experimental design, which also gives student researchers a framework for creating their research approach. They can choose the best tools, procedures, and techniques for gathering and evaluating data thanks to the design. By using a systematic strategy, it is ensured that the data collected is accurate, dependable, and suitable for analysis to support the study's conclusions and make significant conclusions.

Data Gathering Procedure

The data collection process is a structured and systematic process aimed at gathering and analyzing critical information to evaluate the environmental sustainability, feasibility, and user acceptance of biodegradable pet interment pods. It begins with the selection and preparation of sustainable raw materials, such as coconut coir, plant-based fibers, and bioplastics, which are processed to ensure they are biodegradable and capable of supporting plant growth once decomposed. The next phase focuses on the production of the pods, with data gathered on their design, material composition, and manufacturing processes to ensure quality and consistency, while testing various shapes and sizes for different pet burial needs. The pods are then tested for decomposition and soil interaction, with data collected on how quickly they break down in different soil types and environmental conditions, helping to assess their sustainability and impact on plant growth. In parallel, plants are seeded into burial sites enriched by decomposed pod

material, and data on their growth and health is collected to evaluate the pods' effectiveness in supporting vegetation. The objective of this research is to provide valuable insights into the potential of biodegradable pet interment pods, particularly those incorporating coconut coir, as an eco-friendly and viable alternative to traditional pet burial methods, promoting sustainability and compassionate pet care.

Population and Sampling

In this study, the population consists of various sustainable materials, such as coconut coir, plant-based fibers, and bioplastics, that are considered for use in the production of biodegradable pet interment pod capsules. These materials are sourced from regions and suppliers known for their environmentally responsible practices, ensuring that the data gathered will be pertinent to the goal of promoting eco-friendly pet memorialization practices. The focus is on materials that are biodegradable and capable of supporting plant growth once the pod has decomposed, contributing to environmental sustainability.

To ensure that the study focuses on the most relevant and high-quality materials, purposive sampling, also known as judgmental sampling, is employed. Purposive sampling allows for the selection of materials and sources based on specific characteristics that align with the objectives of the study. In this case, the research prioritizes sustainable materials, such as coconut coir, known for its biodegradability and ability to enrich soil. Only materials that meet certain quality criteria such as being harvested in an environmentally sustainable manner are selected for inclusion in the study. Additionally, the materials chosen are those that have been proven to break down effectively in soil and support plant growth, ensuring that the data collected is both valid and applicable to the study's goals.

The study also applies purposive sampling to select burial sites for testing the decomposition and soil interaction of the biodegradable pods. These sites are chosen based on specific criteria, including soil composition, moisture levels, and environmental conditions, which are essential for observing the breakdown of the pods and their impact on plant growth. The goal is to ensure that the pods decompose in a variety of environmental settings, providing a comprehensive understanding of their effectiveness across different soil types and climates.

Once the materials and sites are identified, biodegradable pet interment pods are produced and tested under the specified conditions. This allows for the collection of data that will assess the decomposition rate, the environmental sustainability of the pods, and their ability to promote plant growth after burial. By using purposive sampling, this study aims to provide meaningful insights into the potential of biodegradable pet interment pods as an eco-friendly alternative to traditional pet burial methods, ultimately supporting broader sustainability efforts and environmentally responsible pet care practices.

Data Analysis

The approach used in this study can be classified as Quasi-experimental, which, according to Maciejewski *et al*. (2020), can be similar to randomized controlled trials, though they have their differences, most notably in internal validity since participants have not been randomized. This approach enables the researchers to determine the benefits of the biodegradable pet interment pod capsules where randomisation is not possible. Through the consideration of actual users and their experiences, this paper seeks to contribute to understanding the extent of use and success of these environmentally sensitive forms of burials.

The objective within implementation science among the pet care community is to enhance the scalability and integration of the effective practice. Implementing new practices, as implementation science focuses, means not only using them but also doing it in the right way and continuously achieving good outcomes. This study will also consider qualitative data should this form of pet interment gain favor among pet owners in terms of satisfaction, success of plant growth, and cost implication in relation to traditional burial.

Thus, valuable for the theoretical development of the field of psychology and, in particular, for investigations related to pet memorialization, the current research will also be useful for practical development and can contribute to the generation of practices-oriented data, as it employs a quasi-experimental approach. The outcomes will be useful in understanding how the biodegradable solutions may be incorporated into pet care in a way to be environmentally friendly, while at the same time increasing pet owners' happiness.

Data Analysis

This chapter introduces the data analysis phase of the study, which evaluates coconut coir as a sustainable material for pet interment pods. This section examines the tensile strength and biodegradability of coconut coir, assessing its decomposition rates, impact on soil health, and ability to support plant growth, comparing these properties to traditional burial methods to determine its potential for eco-friendly pet memorialization.

Table 1: Tensile Strength Test Table

Product	Percentage of Coconut Coir Used	Initial Length (cm)	Sectional Area (cm2)	Initial Force Applied (N)	Maximum Force (N)	Calculated Tensile Strength (N/cm2)	Final Observation	Rank
A	50%	12.7 cm	161.29	49.05 N	172.91 N	172.91N/161.29 = 1.07 N	The pod's sectional areas were compromised as a of the weight applied to it, in addition it gradually stretches as you continue to add weight to it.	2
B	75%	12.7 cm	161.29	98.1 N	278.87 N	278.87N/161.29 = 1.72 N	The pod's sectional areas were also compromised as a of the weight applied to it but instead of "stretching out" it cracked and broke.	1

Product A, characterized by a 10% thickness and a composition of 50% coconut coir, demonstrates promising potential in terms of load capacity and structural integrity as a biodegradable pod. The product has a length of 12.7 cm (5 inches) and a sectional area of 161.29 cm². In the experimental trials conducted on Product A, it was subjected to an applied weight of 17.555 kg (17,555.0 g), equivalent to a force of 172.91 Newtons. This value represents the lowest load endured among all the products tested by the researcher. Notably, the observations made during the testing process revealed that only the side and bottom of Product A sustained damage or puncturing due to the weight of the wet soil loaded onto the pod. Furthermore, the product was able to withstand the applied load for approximately one minute before it ultimately failed and shattered completely. Despite the favourable load-bearing characteristics initially observed, Product A, with its 10% thickness and 50% coconut coir composition, exhibited a deficiency in tensile strength. This deficiency resulted in the pod's inability to support heavier loads, thereby culminating in the lowest tensile strength among the two products tested in the study. These findings suggest that the current formulation of Product A may require further modifications to meet the necessary strength requirements for optimal performance under heavier loads.

Product B was recorded at 28.367 kg (28,367 grams), equivalent to 278.61 Newtons. Throughout the test, Product B was able to withstand the increasing weight for approximately 2-3 minutes before it eventually failed. During this time, it was observed that only the body and bottom portions of the pod suffered significant damage, with the product almost losing its original shape. Despite this damage, Product B still maintained the highest tensile strength compared to the other products tested, demonstrating superior load-bearing capacity and structural resilience. Product B, which was made up of 75% coconut coir and had a thickness of 10%, displayed the strongest and most flexible characteristics when subjected to heavy loads. The data collected from the experiment clearly indicate that Product B performed significantly better than the other products tested, highlighting its exceptional durability and ability to withstand substantial weight before failure. This emphasizes the promising potential of Product B for applications that require high tensile strength and the capacity to endure considerable stress without compromising structural integrity.

To sum up everything that's been stated so far, the testing of Product A and Product B reveals significant differences in their performance, particularly in terms of tensile strength and load-bearing capacity. Product A, with its 50% coconut coir composition and 10% thickness, demonstrated promising potential but ultimately failed to support heavier loads. Despite initially bearing 17.555 kg (172.91 Newtons), it succumbed to the weight after a brief period, highlighting its insufficient tensile strength for applications requiring substantial load-bearing capacity. This indicates that further adjustments to Product A's formulation may be needed to enhance its strength and durability. In contrast, Product B, with a higher composition of 75% coconut coir, exhibited superior tensile strength and resilience. Tested under a progressively increasing load, Product B successfully endured up to 28.367 kg (278.61 Newtons) before failure, maintaining structural integrity for a significantly longer duration. Despite experiencing some damage to its body and bottom, Product B retained its position as the highest performing product in terms of strength and flexibility. These findings demonstrate that Product B, with its enhanced coconut coir content, is more suitable for heavy-load applications, offering better durability and greater promise for practical use. While both products have potential as biodegradable pods, Product B clearly outperforms Product A, showing that a higher percentage of coconut coir contributes to better overall strength and longevity under stress.

Table 2: Biodegradability Test Table

Product	Percentage of Peanuts Used	Initial Weight (g)	Initial Dimensions (cm)	Days in Soil/Compost	Weight After (g)	Dimension Change (cm)	Visual Change	Breakdown Level (Low/Medium/High)	Final Observation	Rank
A	50%	250 grams	12.7 cm	10 days	200 grams	13 cm	heavy coating of soil	High	losing strength and structural integrity	2
B	75%	320 grams	12.7 cm	10 days	300 grams	2 cm	Dirtier	Low	maintaining better structural integrity	1

The researchers conduct a biodegradability test, Biodegradation product testing, when intended for product claims related to biodegradability, should incorporate several factors of the product's actual performance and review examines the current state, challenges, and potential of biodegradable, highlighting their environmental, market opportunities, and the need for further research and commercialization to address issues (Filiciotto & Rothenberg, 2020) [17]. This is relevant to the project as the biodegradability test determines the pod's ability to decompose effectively after burial. The researchers developed two distinct and visually identical products, using the same amount of "ingredients" while varying only the percentage of coconut fiber (coir) based on the hypothetical decomposition rate of the pods, with coconut fiber serving as the primary material. Both products have a uniform thickness of 1 cm, which, when converted using the "Ratio to Percentage" formula, equals 10%.

Product A, containing 50% coconut fiber (coir), demonstrated significant expansion during the biodegradability test. Initially, it weighed 250 grams and had a length of 12.7 cm. After being buried in moist soil for 10 days under a partially humid environment, its weight decreased to 200 grams, and its length increased by exactly 13 cm. This expansion was likely due to the absorption of moisture, but it also led to the product being heavily covered in soil. The increased moisture and environmental conditions contributed to a high level of degradation, and

the product showed substantial breakdown. Based on these results, Product A earned the top ranking for biodegradability, highlighting that products with a lower percentage of coconut fiber (coir) and starch content tend to decompose more rapidly. However, this increased biodegradability came at the expense of durability, as the product lost its structural integrity and did not retain much strength. This finding suggests that while a quicker breakdown is beneficial for environmental concerns, it compromises the long-term strength of the bioplastic, which may limit its practical application for uses requiring durability.

In comparison, Product B, which had a higher content of 75% coconut fiber (coir), exhibited a different behavior during the biodegradability test. Initially, it weighed 320 grams and had a length of 12.7 cm. After the same 10-day period in moist soil, its weight decreased to 300 grams, and its length shrank by 2 cm. This slower rate of weight reduction and shrinkage was likely due to the higher concentration of coconut fiber (coir), which is more resistant to decomposition due to its higher lignin and cellulose content. Although Product B became somewhat dirty and was partially damaged, it showed only a moderate level of degradation, maintaining a higher degree of structural integrity than Product A. This led to Product B being ranked second in biodegradability, supporting the hypothesis that the higher the concentration of coconut fiber, the slower the decomposition process. This is because lignin and cellulose, which are abundant in coconut coir, are more resistant to microbial breakdown, thus extending the material's durability in the soil.

When comparing the two products, it is clear that Product A, with its 50% coconut coir content, was the best performer in terms of biodegradability due to its rapid decomposition. However, it did not maintain durability, as the material broke down quickly and lacked the strength to withstand longer periods of burial. In contrast, Product B, with 75% coconut coir, expanded and degraded at a slower rate, allowing it to retain more of its structure and strength over the 10-day test period. These findings suggest that a balance must be struck between the biodegradability of the material and its ability to maintain strength and durability. The optimal formulation may lie in a combination that incorporates a higher percentage of coconut coir, but not to the extent where the material becomes too resistant to decomposition. Therefore, the ideal balance for a bioplastic would likely lie around a 75% coconut coir content, where biodegradability is still significant but the product maintains a reasonable level of structural integrity, making it a more practical option for use in real-world applications where both degradation and strength are important.

The findings from the tensile strength and biodegradability tests highlight the trade-offs between durability and biodegradability in the development of starch-based biodegradable burial pods. Product A, with 50% coconut coir, demonstrated superior biodegradability, rapidly decomposing in soil conditions within 10 days. However, its lower tensile strength and reduced durability make it less suitable for applications requiring structural integrity. Conversely, Product B, with 75% coconut coir, exhibited exceptional tensile strength and durability, withstanding significantly higher loads for a longer duration. Its slower decomposition rate, attributed to the higher lignin and cellulose content of coconut coir, suggests that it is more resistant to microbial breakdown, maintaining its structure better than Product A.

The comparative analysis of the two products indicates that increasing the percentage of coconut coir enhances durability at the expense of biodegradability. While Product A may be ideal for applications prioritizing rapid environmental decomposition, Product B is better suited for scenarios requiring higher strength and prolonged functionality. Striking an optimal balance between these factors is crucial. A formulation closer to 75% coconut coir content appears to provide a reasonable compromise, maintaining sufficient biodegradability while ensuring the structural resilience needed for practical applications.

These findings underline the importance of tailoring material composition based on the intended use of the product, balancing environmental sustainability with performance requirements. Further research into modifying the composition or integrating additives could enhance both the biodegradability and strength of the product, ensuring its viability for diverse applications.

Summary of Findings

The results of the study highlight significant differences between Product A and Product B due to their varying coconut coir contents, particularly in terms of tensile strength and biodegradability. Product A, with 50% coconut coir, demonstrated lower tensile strength, supporting only 17.555 kg (172.91 Newtons) before failure, making it less suitable for applications requiring durability. In contrast, Product B, containing 75% coconut coir, showed superior tensile strength, withstanding 28.367 kg (278.61 Newtons) before breaking, and exhibited greater flexibility and resilience under stress. In terms of biodegradability, Product A disintegrated rapidly, losing 50 grams of its weight within 10 days, reflecting its strong biodegradability but also compromising its structural integrity and lifespan. Product B, however, decomposed more slowly, shedding only 20 grams of its initial weight, which can be attributed to the higher coconut coir content that enhances durability. Overall, the findings reveal a trade-off between strength and biodegradability, with Product A being more suitable for situations requiring quick decomposition, while Product B is better for applications needing a balance of durability and mild biodegradability. Optimizing coconut coir concentration around 75% may offer an effective balance between strength and environmental benefits.

Conclusion

Lastly, it is suggested that Product B which is composed of 75% coconut coir, has a tensile strength that is higher than that of the control sample, and is also biodegradable. Product B also met well on tensile strength pulling it to failure at 28.367 kg (278.61N); hence it is ideal for use in areas that require high strength. Also, it proved lesser biodegradation where it only reduced its weight by 20 grams after 10 days and can be attributed to the higher percentage of coconut coir which provide higher structural strength. Therefore the results point out that Product B is equally the best when it comes to strength and degradation and therefore it is suitable for use in areas that will be required to have both strength and moderate destruction of the environment. The findings show that 75% coconut coir has the greatest mechanical application and slower degradation rate to back the sturdiness of the material and its sustainability. This

tallies with the existing literature that has pointed to the fact that constituent composition determines the kind of desired performance that is obtained in a particular system (Akinyemi & Dai, 2020).

Recommendation

The best density of coconut coir should be 75% for any methods that need the enhancement of both strength and biodegradation. Each concentration offers improved tensile strength complemented by relatively moderate decomposition rates that qualifies such polymers for loading purposes and products that require high strength and green compliance. For cases where the substrate needs biodegradation at a faster rate, then there is need to use less coconut coir since it hinders a slow rate of degradation. Subsequent studies must be initiated to assess the rate of degradation of products that are made of coconut coir in diverse conditions of environment like greater humidity or different types of soil. Furthermore, the modifications of coconut coir with other natural fibers, for example banana fibers added to the mix, could improve both these aspects of the material: Strength and biodegradation. There is a potential for coconut coir-based materials to be used instead of non- biodegradable conventional products in several industries especially in the packing, construction and burial products industries. Finally, more research should be done to better understand durability that is longer than the currently desired life cycle and to study how some of the unique materials perform under conditions that simulate their real life use so that manufacturing techniques might be adjusted to fine-tune their characterist.

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