**EVALUATING THE EFFICACY OF PUNGAPONG (*AMORPHOPHALLUS PAEONIIFOLIUS*) PLANT**

**AS FIBER FOR** **PAPER MAKING**

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**CHAPTER I**

**INTRODUCTION**

Paper trash is one of the environmental issues that our community is dealing with. Excessive use of paper without having decent knowledge of its influence towards our environment would create different environmental consequences, and deforestation is one. Harvesting a large number of trees for paper production reduces the sustainability of our biodiversity and decreases the absorption of carbon dioxide, contributing to climate change. However, the researchers of this study have found a possible and efficient solution for this problem. And it is through recycling paper and using it as one of the ingredients of Pungapong (*Amorphophallus paeoniifolius*) in paper making.

Bagolong (2017) The implementation of Republic Act 9003 or known as the "Ecological Solid Waste Management Act of 2000" highlights the proper way of segregating waste disposal, including paper wastes. Recycling paper waste and combining it with Pungapong (*Amorphophallus paeoniifolius*) fibers will offer a sustainable approach to paper manufacture. This process not only helps reduce reliance on traditional wood pulp but also to provide a valuable use for agricultural waste and promote a circular economy. By integrating Pungapong (*Amorphophallus paeoniifolius*) into the paper recycling process, people are able to explore the potential of creating high-quality and eco-friendlier paper products while contributing to waste reduction and resource conservation. Pungapong (*Amorphophallus Paeoniifolius*) is one source of fiber for paper-making due to its robust and fibrous structure.

The plant's large leaves and stems are rich in cellulose, the primary component needed for paper production. fibers from Pungapong are also fast-growing and abundant, making them renewable resources that can be harvested with minimal environmental impact. Moreover, integrating Pungapong fibers into paper making could yield unique benefits. The natural strength of the fibers could produce paper with enhanced durability, while the plant's quick growth cycle would ensure a consistent and sustainable supply. Additionally, using Pungapong in paper making may offer cost advantages, particularly in regions where the plant grows abundantly. Pungapong fibers could play a crucial role in creating more sustainable, eco-friendly paper products.

The researchers of this study aimed to evaluate the efficacy of Pungapong (*Amorphophallus paeoniifolius*) as a viable fiber for paper making. By investigating the plant's fiber characteristics, production potential, and environmental impact the researchers are hoping to contribute to the development of more sustainable paper-making processes. This study also seeks to see whether Pungapong (*Amorphophallus paeoniifollus*) can be a fiber for paper making. In the means of not only meeting the technical requirements for paper manufacturing but also to reduce the ecological association with conventional paper sources.

**STATEMENT OF THE PROBLEM**

This research study aimed to evaluate the efficacy of the Pungapong (*Amorphophallus paeoniifolius*) plant as fiber for paper making. Specifically, the researchers sought to answer the following questions:

1. What is the level of efficacy of Pungapong (*Amorphophallus paeoniifolius*) as a fiber plant for paper in different concentration level?
2. 300g:200g
3. 250g:250g
4. 200g:300g
5. What is the level of acceptability of Pungapong (*Amorphophallus paeoniifolius*) fiber as paper in terms of:
6. Color
7. Odor
8. Writability
9. Texture
10. Is there any significance difference between the level of efficacy and the level of acceptability in using different concentration?

**OBJECTIVES**

This study aims to seek the result of the following objectives:

1. Identify the level of efficacy of Pungapong (*Amorphophallus paeoniifolius*) plant as a fiber plant for paper in different concentration levels?
2. 300g:200g
3. 250g:250g
4. 200g:300g
5. Determine the level of acceptability of Pungapong (*Amorphophallus paeoniifolius*) fiber as paper in terms of:
6. Color
7. Odor
8. Writability
9. Texture
10. Analyze any significance difference between the level of efficacy and the level of acceptability in using different concentrations?

**SCOPE AND DELIMITATION**

This study mainly focused on the Pungapong (*Amorphophallus paeoniifolius*) plant as fiber for paper making including its key characteristics, procedure, and the level of its acceptability as paper in terms of the different concentration level. The researchers are also including the Grade-12 students of King Thomas Learning Academy Inc. As respondents that will be evaluating the effectiveness of the Pungapong paper. The respondents will be selected using random sampling.

The researchers will not be including any comparison of Pungapong (*Amorphophallus paeoniifolius*) plants to other plants that are used in paper making.

**SIGNIFICANCE OF THE STUDY**

The study will benefit the followings:

**Students**. This study will help the students to have more sufficient reusable paper with the use of Pungapong (*Amorphophallus paeoniifolius*) as fiber for paper making.

**School**. This study will help enlighten the school to reduce and recycle paper wastes leading to new possible school policy that implements proper recycling of consumed paper.

**Department of Agriculture.** This study will help the Department of Agriculture to promote the use of non-wood plants such as the Pungapong (*Amorphophallus paeoniifolius*) as an ingredient for paper making. Thus, reducing the risk of deforestation.

**Department of Environment and Natural Resources.** This study will help the Department of Environmental and Natural Resources to mobilize the citizens in protecting our natural environment by boosting the use of non-wood materials in paper making.

**Future Researchers**. This study can be a source of reliable information for the future researchers in expanding their study about the Pungapong (*Amorphophallus paeoniifolius*) plant as fiber in paper making.

**CHAPTER II**

**REVIEW OF RELATED LITERATURE AND STUDY**

The study reviewed and introduced literature and studies that are relevant to the current state of knowledge-gathering. The researchers gained valuable and worthwhile knowledge to support the study from the clear understanding and ideas obtained from this review.

**REVIEW OF RELATED LITERATURE**

According to Chattopadhyay (2020), The study concluded jute and kenaf fibers offer sustainable alternatives for paper production. Future research directions include blending fibers, exploring additives, and investigating environmental impacts. This research supports eco-friendly packaging and printing industries. The results showed jute paper exhibited superior tensile strength and tear resistance, while kenaf paper demonstrated higher opacity and whiteness. Conversely, jute paper displayed higher yellowness. Kenaf paper showed better transmittance and reflectance.

As stated by Chen (2020), The study revealed that pulping and bleaching processes generated the highest VOC emissions during processing, while mechanical processing emitted more VOCs than chemical processing. During end-use, paper drying and cutting released significant VOCs, whereas printing and writing activities generated minimal odor emissions. The findings highlight the contribution of paper-related odor emissions to indoor air pollution and potential harm to human health and environmental quality.

To mitigate these issues, the researchers recommend implementing VOC-reducing technologies in paper mills, optimizing processing conditions and developing eco-friendly paper products.

As indicated by Duran (2019), Volatile organic compounds (VOCs) from papers made from hardwood, softwood, recycled fibers and non-wood plant fibers. The results revealed distinct odor profiles for each fiber source, with hardwood emitting aldehydes and terpenes, softwood releasing resin-related compounds, and recycled fibers showing lower VOC emissions. The findings highlight the significance of fiber source selection on paper product odor, indoor air quality and product development. Optimizing fiber selection and processing conditions can minimize undesirable odors. The study recommends fiber sourcing strategies, process modifications and developing eco-friendly paper products to improve odor quality.

As claimed by (2021), Jute paper demonstrated exceptional tensile strength, tear resistance and optical properties, attributed to uniform fiber distribution, high crystallinity and low lignin content. These findings suggest jute fibers are ideal for sustainable paper production, particularly for packaging, printing and writing applications. Future research directions include blending jute with natural fibers, exploring additives and investigating environmental impacts.

As stated by Thomas and Sundararajan (2021), Bamboo, hemp and flax fibers demonstrate superior strength and durability, while recycled fibers and agricultural waste offer eco-friendly options. Nanocellulose and fungal-based fibers also show promise.

Alternative fibers enhance sustainability, reduce environmental impact and expand applications in packaging, textiles and bioproducts. Future research will focus on scaling production, optimizing processing and developing new products.

As reported by Wang (2021), The writability and printability of papers made from alternative fibers like bamboo, hemp, flax and recycled fibers. Results showed these papers exhibit improved writability due to surface smoothness, enhanced printability with optimal ink absorption and comparable quality to traditional wood-pulp papers. This suggests alternative fibers offer sustainable production options, enabling optimized processing conditions and expanded applications in printing, writing and packaging industries.

**REVIEW OF RELATED STUDIES**

The study by Ali & Noor (2018) Research into the potential of Pungapong fibers may reveal insights into their writability characteristics, as preliminary assessments suggest that its fibers could promote better ink retention (Ali & Noor, 2018). Explores the potential of Pungapong fibers for enhanced ink retention in paper production.It provides a foundational reference for evaluating the performance of writing mediums and assesses Pungapong's (Amorphophallus Paeoniifolius) efficacy as a raw material for paper production, particularly for writing and printing applications. The research also explores the cellulose content analysis of plant-based fibers, which is crucial for strong and durable paper. The study also highlights the importance of eco-friendly papermaking techniques and the relationship between fiber properties and ink absorption in paper production.

According to the study of Chen et al. (2021) Writability, defined as the ability of paper to provide a suitable surface for writing instruments, is often examined in relation to paper texture and porosity. Chen et al. (2021) demonstrated that papers with a finer texture offer better ink absorption and smoother writing experiences. The writability characteristics of paper made from different plant fibers is relevant to research evaluating the efficacy of Pungapong (Amorphophallus Paeoniifolius) plant as fiber for papermaking because it highlights the importance of fiber texture and porosity in determining paper quality. Demonstrates that finer texture leads to better ink absorption and a smoother writing experience. This finding suggests that the texture of the Pungapong fibers would be a crucial factor to consider when evaluating its suitability for papermaking.

The study of Jain and Kumari's (2021). Study on the color properties of paper derived from Amorphophallus paeoniifolius fibers is crucial for evaluating the efficacy of Pungapong (Amorphophallus Paeoniifolius) plant as a papermaking fiber. The study reveals that Pungapong fibers have a bright white pulp due to their low lignin content, which results in a brighter, whiter paper. This is desirable for artistic and publishing purposes, as lower lignin content leads to better ink absorption and less yellowing over time. The study also suggests that Pungapong fibers could potentially compete with traditional papermaking fibers in terms of color properties, making it a viable alternative for paper production. This research underscores the potential of Pungapong as a sustainable and aesthetically appealing paper production alternative.

Studies conducted by Lambert et al. (2019) indicate that the texture of paper is directly influenced by the fiber characteristics, such as fiber length and surface roughness. Papers made from longer, well-distributed fibers tend to have a smoother finish, which enhances writability and printability (Lambert et al., 2019). The unique structural properties of Pungapong, particularly its fibrous nature, may provide a desirable texture that could cater to various writing. The connection between the study of paper texture and the research on Pungapong as a fiber source highlights the potential for creating a sustainable and high-quality paper alternative. By exploring the unique properties of Pungapong fibers and their potential for producing paper with desirable texture, the researchers are contributing to a more environmentally responsible and innovative approach to papermaking. The success of this research could lead to a future where paper production is more sustainable, less reliant on traditional wood pulp sources, and capable of delivering high-quality paper products that meet the needs of diverse users.

According to the study of Suti et al. (2022). The odor of paper is not commonly discussed, but it can be a significant sensory aspect that influences user preference. Studies indicate that plant fibers can impart distinct smells to the finished product based on their chemical composition. For example, Siti et al. (2022) explored various natural fibers, noting that certain fibers contributed pleasant earthy aromas, while others emitted pungent odors detrimental to user experience. Given the specific profile of Pungapong, it is essential to assess how the extraction and processing of its fibers might influence the final odor profile of the paper product (Siti et al., 2022). The study on paper odor provides a crucial perspective for the research on Pungapong papermaking. By acknowledging the importance of odor in user preference and integrating odor assessment into the research, researchers can ensure that the final Pungapong-based paper product not only meets sustainability goals but also delivers a positive sensory experience for users.

**SYNTHESIS**

The primary distinction between non-wood fibers and Pungapong fibers lies in the level of research, technological development, and mass-production readiness. Non-wood fibers have been extensively studied and utilized in the paper industry, with established pulping methods and production techniques. Conversely, the adoption of Pungapong fibers is in its nascent stage. As Heni et al. (2023) highlighted, further investigation into the effectiveness, quality, and financial feasibility of Pungapong fibers is necessary to ensure their suitability for large-scale use. Non-wood fibers and Pungapong fibers are derived from renewable sources, positioning them as sustainable alternatives for papermaking. Both exhibit significant potential for mitigating the environmental impact of traditional wood-based paper production, a major contributor to deforestation and global warming (Clemente et al., 2019). While non-wood fibers are a well-established resource, Pungapong fibers are emerging as a promising alternative, supported by recent studies. Non-wood fibers and Pungapong fibers share key attributes that contribute to their suitability as alternatives to wood fibers. According to Hendro et al. (2016) and Przybysz et al. (2018), both fiber types align with the increasing demand for eco-friendly raw materials in the paper industry. Pungapong fibers, specifically derived from Amorphophallus paeoniifolius, exhibit comparable cellulose content, tensile strength, and fiber length to traditional wood fibers (Heni et al., 2023). This makes them an environmentally friendly option capable of addressing the unsustainable reliance on trees. Kamoga et al. (2013) further emphasize the convenience of non-wood materials due to their abundance, short regeneration periods, and diverse sourcing options, including agricultural residues, grasses, and fibrous fruit shells. Similarly, Pungapong’s fast-growing nature and adaptability to various climates enhance its sustainability potential. Both fiber types thus contribute to reducing the carbon footprint of the paper industry. Its utilization could significantly reduce dependence on wood, thus alleviating deforestation and promoting environmental conservation. Pungapong (Amorphophallus paeoniifolius) is a fast-growing plant that thrives in diverse climatic conditions, making it a resilient and plentiful resource.











Figure 1. Theoretical Framework

**THEORETICAL PARADIGM**

The Production Theory by Ragnar Frisch (1965) focused in the satisfactory procedure for defining what in principle should be considered as essential for the concept 'constant technique', is first to define quantitatively what should in the analysis be considered as 'factors' and as a 'product' (or 'products'), and next to postulate that the dependence of product quantity(-ies) on factor quantities remains the same.

The concept of disruptive innovation theory was first introduced by Bower and Christensen (1995) in 1995 when they researched the disk-drive industry (Christensen et al., 2015; Gobble, 2016; King & Baatartogtokh, 2015; Nagy et al., 2016; Schmidt & Druehl, 2008).Christensen, et al. (2018) describes that as the first interviews with the disk-drive managers were conducted, the managers discussed the concept resource-allocation process which is known for favoring sustaining innovation (Bower, 1970). This meant focusing on new product development which offers high margins by targeting large markets with identifiable customers and deprioritizing smaller markets with less defined customers.

According to Ajit K Ghosh (2011), the Paper Drying Theory has been processed by contact drying with steam heated cylinders is the predominant method of drying in paper and paperboard machines. Besides conductive heat transfer between hot cylinder surface and the wet web, the role of air that is either the drying medium or surrounds the drying atmosphere is very significant. Paper drying is associated with both heat and mass transfer. The heat energy released when steam condenses is transmitted through the dryer shell to the wet paper and this constitutes the heat transfer aspect of drying.

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Figure 2. Conceptual Framework

**CONCEPTUAL PARADIGM**

The **input** presents the statement of the problems that aimed and focused on the level of effectiveness, acceptability, and concentration of Pungapong (*Amorphophallus paeoniifolius*) fiber for paper making, as well as the significant differences of the level of acceptability and concentration of Pungapong (*Amorphophallus paeoniifolius*) as fiber for sustainable paper making.

The **process** highlighted the demonstration of the researchers on how the product will be developed through the different processes of the development phase; Collecting of valuable fibers, drying process, soaking process, grinding process, molding process, and the finalization of product. Other actions will also be taken by the researchers to gather data from the grade 12 students of KTLA. This stage consists of the following steps: formulation of observation sheet, validation of observation sheet, selection of respondents, gathering of data, interpretation of data, and drawing of conclusion. Researchers seek to boost knowledge, broaden comprehension, or solve real-world issues in their field of study through this method.

The **output** showed the Effectiveness of the Pungapong (Amorphophallus paeniifolius) Plant as Fiber for Paper Making.

**DEFINITION OF TERMS**

Conceptual and operational definition of term was given to clarify the meaning of the following terms that were used in this study.

**Amorphophallus Paeoniifolius.** The elephant foot yam or white spot giant arum, is a tropical plant native to Island Southeast Asia. In this study, *Amorphophallus paeoniifolius* was a viable fiber for papermaking.

**Wood Pulp.** Wood fiber is reduced chemically or mechanically to pulp and used in the manufacture of paper. A virgin (or primary) fiber derived from harvested Pungapong (*Amorphophallus paeoniifolius*) plants that are specifically grown for papermaking.

**Paper Waste.** Any form of paper that's no longer usable and needs disposing.

**Efficacy.** The ability to produce a desired or intended result. Efficacy is used to see the effectiveness of the Amorphophallus Paeoniifolius as a fiber.

**Fiber.** Is a thin thread of a natural or artificial substance, especially one that is used to make cloth or rope. Fiber is suitable for making paper from.

**Paper.** Thin, flat material made from crushed wood or cloth, used for writing, printing, or drawing on. In this present study, paper will be used as the primary component of the product.

**Plant.** A living organism of the kind exemplified by trees, shrubs, herbs, grasses, ferns, and mosses, typically growing in a permanent site, absorbing water and inorganic substances through its roots, and synthesizing nutrients in its leaves by photosynthesis using the green pigment chlorophyll. In this study, plants are large pieces of equipment and machinery that are used in manufacturing processes.

**Deforestation.** The clearing of land by cutting, burning, and removing trees and other vegetation to make way for human development. In this study, deforestation is used to see the impact of development on the environment.

**Recycling.** The process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products

**Fibrous.** Consisting of or characterized by fibers.

**Tubers.** An enlarged structure that plants use as storage organs for nutrients, derived from stems or roots. Tubers help plants perennate, provide energy and nutrients, and are a means of asexual reproduction.

**Color.** The aspect of things that is caused by differing qualities of light being reflected or emitted by them.

**Odor.** A quality of something that stimulates the olfactory organ. A substance which makes it perceptible to the sense of smell.

**Writability.** Capable of being written or set down in writing.

**Texture.**

**STATISTICAL TREATMENT**

**ASSUMPTION OF THE STUDY**

1.)There are variant parameters or indicators to determine the level of acceptability of the product in terms of its key characteristics.

2.) There are variant parameters or indicators to determine the level of concentration of the product

**HYPOTHESIS**

There is no significant difference among the level of acceptability in terms of the different levels of concentration.

**CHAPTER III**

**METHODOLOGY**

This chapter described the study's research design and instrument additionally, it contained the respondents, research setting, data-gathering procedure, statistical treatment, and more information and understanding.

**Research Design**

This study used an experimental research design to explore the efficacy of Pungapong (*Amorphophallus paeoniifolius*) fiber for paper making. Experimental research design enables the researchers to create a clear plan in figuring out if Pungapong (*Amorphophallus paeoniifolius*) fiber is an effective material for paper making mixed with paper waste and will help the researchers to carefully change things like how will the fiber of Pungapong (*Amorphophallus Paeoniifolius*) will be used to create paper. Experimental researchers can also manipulate the result of the product. It also seeks to know exactly what caused changes in things like the strength and durability of the product like paper, using waste paper and Pungapong (*Amorphophallus paeoniifolius*) fiber. Through experiments, the researchers are able to gather data using the 4-point Likert scale in which it enables employing mathematical analysis to assess the effectiveness and acceptability of the study. This quantitative approach enabled the evaluation of the efficiency of Pungapong (*Amorphophallus paeoniifolius*) as a material for paper making. By assessing factors such as the mechanical and physical properties, the researchers are able to determine whether Pungapong (*Amorphophallus Paeoniifolius*) fiber is able to present a product that is feasible for paper making.

**Research Setting**

This study conducted within the campus of King Thomas Learning Academy, Inc. located in Malubago, Sipocot, Camarines Sur. It is a private educational institution that started in 2010 and is located in the first district of Camarines Sur, recognized by the Department of Education. It is 2.2 kilometers away from Sipocot Central.

**Research Respondents**

The respondents of the study will be the Grade-12 students of King Thomas Learning Academy Inc. The 82 students calculated through the use of Slovin’s formula n = N/(1+Ne^2) mainly the 35 from the STEM strand, 18 from the HUMSS strand, 9 from the TVL strand, 14 from the GAS strand, and 6 from the ABM strand, will represent the 446 population of the grade 12 students. The respondents will participate in the trial and observation of the product. The chosen respondents will then be answering the observation sheet that the researchers will be providing.

**Research Instruments**

In this study, observation sheets were used for the gathering of data. The observation sheets are well crafted and prepared by the researcher to ensure the accuracy of data. The observation sheet consists of 10 questions for every indicator of the three concentration levels. The use of observation sheets will help the researchers to evaluate the effectiveness of Pungapong fiber as paper.

**Validity and Reliability**

To test the validity and reliability of the study, the researchers consulted knowledgeable researcher advisers and other experts in the field. And will be using an observation sheet wherein the chosen respondents will be observing and answering the sheet based on their observed characteristics of the product.

In addition, researchers provided documentation of the survey process to avoid random errors, repeatedly revisit the data to check for emerging themes, and remain true to their readers.

**Statistical Treatment**

The **Frequency and Percentage Distribution** of the efficacy of the pungapong paper in the different concentrations; 300g:200g, 250g;250g, and 200g;300g, as well as the level of acceptability of the paper base on the different indicators will be evaluated using a **Weighted Mean** and **Ranking Technique**. Moreover, the acquired data will be statistically analyzed and managed through the application of **Analysis of Variance (ANOVA)** to assess the significant difference between the level of efficacy and the level of acceptability using the different concentrations.  This statistical treatment will help identify and understand the significance between the mortality rate and acceptability of the chili pepper insecticide, hence providing support to the conclusions and insights gathered from the study.

**Data Gathering**

Given all the parameters and as for the approval of the product, the researchers submitted a request of letter to the administrators of King Thomas Learning Academy, Inc. After the letter is approved, the researchers will then proceed with the gathering of data through an observation sheet. The observation sheet used to identify the acceptability of Pungapong paper and to determine whether there is a significant difference between the level efficacy and level of acceptability using the different concentration levels. The researchers will survey the 82 chosen respondents from the different strands and sections of grade 12 students. Finally, following data collection, the completed forms will be reviewed, tallied, interpreted, and analyzed.

**Materials and ingredients**

This part contains the materials and ingredients that are used in the experiment.

**Table 1.1:** shows the ingredients used in this study with its quantities, description, and its uses.

| Ingredients | Quantities | Uses |
| --- | --- | --- |
| Pungapong | 750g | A tropical plant native to Southeast Asia and is cultivated for its edible tubers.  The fiber found in this plant will serve as the main ingredients in making paper. |
| Paper Wastes | 750g | Paper thrown away as used, not needed, or not fit for use.  Paper waste serves as an ingredient to determine the effectiveness of Pungapong (Amorphophallus paeoniifolius) fiber as paper in terms of the different levels of concentration. |
| Water | 2gal | Water is transparent, tasteless, and odorless liquid.  Used to soften and to soak the ingredients. |

**Table 1.2:** shows the tools used in this study with its quantities and uses.

| Materials | Quantities | Uses |
| --- | --- | --- |
| Gloves | 1pck | It will be used to prevent the irritation in the hands caused by the Pungapong. |
| Paper Molding/  Frame Mold | 1fr. | It will be used in molding the paper. |
| Fabric | 1yrd | It will be used in drying the  Paper. |
| Knife | 1pc | It will be used to cut the plant in thin pieces and get the valuable fibers. |
| Strainer | 1pc | This will be used to remove excess water from the ingredients. |
| Blender | 1pc | This will be used to grind and well mixed the ingredients creating the texture. |

**Making of the Paper**

This section portrayed the step-by-step process in developing the product of Pungapong (Amorphophallus Paeoniifolius) fiber as paper.

1. The Pungapong plant will first be harvested.
2. The Pungapong plant will be gathered.
3. Unnecessary parts of the plant such as rough and itchy skin and leaves will be removed, leaving only the stem containing the fibers inside, necessary for the production of paper.
4. The Stem will then be sliced carefully into thin pieces to collect the valuable fibers.
5. After collecting the fibers from the stem, the fibers will then be placed outside for 1-2 days to achieve the semi-dry texture and to totally execute the plants – that causes it to be itchy and irritating on the skin by using the outdoor drying process.
6. After the 1-2 days of the drying process, the fiber will be soaked in water together with waste paper to soften its texture making it easier to -.
7. After soaking the fiber and waste paper, it will be placed in a strainer to remove excess water.
8. After removing the excess water, the fiber and paper waste will be placed in a blender to well grind and mix the ingredients. After well mixing and grinding the ingredients together, it will again be placed in a large container filled with water.
9. After putting the grinded fiber and waste paper in the large filled with water, the ingredients will be filtered to create the paper, using a handmade paper making frame mold.
10. After molding, the paper will be dried by putting fabric on the top and bottom surface of the molded paper.
11. After drying, the product will be finalized.

**Assumptions**

1. The efficacy of Pungapong (Amorphophallus paeoniifolius) as a fiber source for paper production varies with different concentration levels (300g:200g 250g:250g 200g:300g). This assumption is fundamental to the research question
2. The level of acceptability of Pungapong (Amorphophallus paeoniifolius) fiber as paper is influenced by its color, odor, writability, and texture.
3. Consumers are open to adopting potential materials, Pungapong fiber solutions and are willing to accept any potential differences in acceptability and concentration compared to wood materials for paper making, this assumption addresses the feasibility of paper making by the use of Pungapong fibers.

**Hypothesis**

H0: This study show that there is a significant difference between the level of concentration of 300:200 250:250 and 200:300 of the Pungapong paper product

**CHAPTER IV**

**RESULTS AND DISCUSSIONS**

This chapter presented the results and findings, analysis, and interpretation of data gathered by letting the respondents answer the survey checklists. The findings derived from the analysis of the data are examined for the understanding of the topic discussed.

**Table 2. *Acceptability of Pungapong fiber using its color in 300g:200g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. The Pungapong (A.E.) paper is acceptable in terms of its color. | 3.19 | 1 | Agree |
| 2. The color of Pungapong (A.E.) is acceptable as paper. | 3.09 | 3.5 | Agree |
| 3. The color of Pungapong (A.E.) paper is suitable for high-quality printing applications. | 2.52 | 8 | Agree |
| 4. The color of Pungapong paper is acceptable as it remains stable. | 3.00 | 4 | Agree |
| 5. The color of Pungapong (A.E.) paper is acceptable and aesthetically pleasing | 3.13 | 2 | Agree |
| 6. The color of the Pungapong (A.E.) paper is acceptable as it remains consistent | 2.96 | 5 | Agree |
| 7. The color of Pungapong (A.E.) paper is acceptable and suitable for academic writings. | 2.63 | 7 | Agree |
| 8. The color of Pungapong (A.E.) paper influence its perceived quality | 2.95 | 6 | Agree |
| 9. The final color of Pungapong (A.E.) paper affect its usability for artistic purposes | 3.09 | 3.5 | Agree |
| 10. The aesthetic appeal of Pungapong (A.E.) paper is influenced by its processing techniques. | 2.18 | 9 | Disagree |
| **Average Weighted Mean** | 2.97 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 2, as a result of the data gathering in terms of the color of Pungapong paper in 300g:200g concentration, shows that the statement 1.) The Pungapong (A.E.) paper is acceptable in terms of its color, ranked as one and has the weighted mean of (3.19). The statement lies along the “agree” range. Ranked two, 5.) The color of Pungapong (A.E.) paper is acceptable and aesthetically pleasing, has the weighted mean of (3.13) and lies along the “agree” range. And 2.) The color of Pungapong (A.E.) is acceptable as paper and 9.) The final color of Pungapong (A.E.) paper affects its usability for artistic purposes, both ranked as three, with the weighted mean of (3.09) that also lies along the “agree”. The average weighted mean of statement 1.) – 10.) weighted as (2.97) and is labelled as “agree”. Stating that the color of Pungapong paper is indeed acceptable in the concentration 300g:200g.

The findings in the acceptability of Pungapong in using color in 300g:200g concentration, Pungapong fiber shows a white color of paper that gives an acceptable color that can be used in artistic and creativity purposes. According to Chattopadhyay (2020), jute and kenaf fiber demonstrate the color of the paper. A kenaf paper shows the whiteness of the paper while the jute paper showed the yellowness of it. Based on the study of Jain and Kumari's (2021), the study revealed that Pungapong fibers have a bright white pulp due to their low lignin content, which results in a brighter colored paper.

**Table 3. *Acceptability of Pungapong fiber using its color in 250g:250g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that Pungapong (A.E.) paper is acceptable in terms of its color. | 3.16 | 1.5 | Agree |
| 2.    I think that the color of Pungapong (A.E.)is acceptable as paper. | 3.16 | 1.5 | Agree |
| 3. I observed that the color of Pungapong (A.E.) is suitable for high-quality printing applications. | 2.51 | 8 | Agree |
| 4. I believe that the color of Pungapong (A.E.*)* paper is acceptable as it remains stable. | 2.96 | 5 | Agree |
| 5. I think that the color of Pungapong (A.E.)paper is acceptable and aesthetically pleasing. | 3.11 | 3 | Agree |
| 6. I observed that the color of Pungapong (A.E.)paper is acceptable as it remains consistent. | 3.01 | 4 | Agree |
| 7. I believe that the color of Pungapong (A.E.)paper is acceptable and suitable for academic writings. | 2.73 | 7 | Agree |
| 8. I think that the color of Pungapong (A.E.)paper influence its perceived quality. | 2.91 | 6 | Agree |
| 9. I observed that the final color of Pungapong (A.E.) paper affect its usability for artistic purposes. | 3.15 | 2 | Agree |
| 10. I believe that the aesthetic appeal of Pungapong (A.E.)paper influenced by its processing techniques. | 2.23 | 9 | Disagree |
| **General Weighted Mean** | 2.99 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 3, as a result of the data gathering in terms of the color of Pungapong paper in 250g:250g concentration, showed that statement 1.) I believe that Pungapong (A.E.) paper is acceptable in terms of its color and 2.) I think that the color of Pungapong (A.E*)* is acceptable as paper, both ranked as one and has the weighted mean of (3.16). The statements lie along the “agree” range. Ranked as two, statement 9.) I observed that the final color of Pungapong (A.E) paper affects its usability for artistic purposes, has the weighted mean of (3.15) as lies along the “agree” range. And 5.) I think that the color of Pungapong (A.E) paper is acceptable and aesthetically pleasing, ranked as three, with the weighted mean of (3.11) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.99), labelled as “agree”. Stating that the color of Pungapong paper is indeed acceptable in the concentration 250g:250g.

The study of Wang (2021), provided additional support to the presented study as it examined the writability and printability of papers made from alternative fibers that enhance crafting and sketching. As the Pungapong fiber gives a white color of paper that can be used in crafting and creating dominant and artistic creation. Likewise in the study of Jain and Kumari's (2021), this is desirable for artistic and publishing purposes, as lower lignin content leads to better ink absorption and less yellowing over time.

**Table 4.  *Acceptability of Pungapong fiber using its color in 200g:300g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that Pungapong (A.E.)paper is acceptable in terms of its color. | 3.16 | 3 | Agree |
| 2. I think that the color of Pungapong (A.E.)is acceptable as paper | 3.23 | 1 | Agree |
| 3. I observed that the color of Pungapong (A.E.)is suitable for high-quality printing applications. | 2.43 | 10 | Disagree |
| 4. I believe that the color of Pungapong (A.E.)paper is acceptable as it remains stable. | 3.04 | 6 | Agree |
| 5. I think that the color of Pungapong (A.E.)paper is acceptable and aesthetically pleasing. | 3.09 | 5 | Agree |
| 6. I observed that the color of Pungapong (A.E.)paper is acceptable as it remains consistent. | 3.03 | 7 | Agree |
| 7. I believe that the color of Pungapong (A.E.)paper is acceptable and suitable for academic writings. | 2.70 | 9 | Agree |
| 8. I think that the color of Pungapong (A.E.)paper influences its perceived quality. | 2.95 | 8 | Agree |
| 9. I observed that the final color of Pungapong (A.E.)paper affects its usability for artistic purposes. | 3.22 | 2 | Agree |
| 10. I believe that the aesthetic appeal of the Pungapong (A.E.) paper’s color is influenced by its processing techniques. | 3.15 | 4 | Agree |
| **General Weighted Mean** | 3.00 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 4, as a result of the data gathering in terms of the color of Pungapong paper in 200g:300g concentration, showed that statement 2.) I think that the color of Pungapong (A.E.)is acceptable as paper, ranked as one and has the weighted mean of (3.23). The statement lies along the “agree” range. Rank two, 9.) I observed that the final color of Pungapong (A.E.)paper affects its usability for artistic purposes, has the weighted mean of (3.22) and lies along the “agree”. And 1.) I believe that Pungapong (A.E.)paper is acceptable in terms of its color, ranked as three with the weighted mean of (3.16) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (3.00), labelled as “agree”. Stating that the color of Pungapong paper is indeed acceptable in the concentration 200g:300g.

The findings in the acceptability of Pungapong in using color in 200g:300g concentration, the final color of Pungapong (A.E.) paper affects its usage for artistic purposes because of the whitish color produced by the Pungapong fiber. In connection with it, Rani (2021) states that jute fibers are ideal for sustainable paper production, particularly for packaging and writing applications. Pungapong fiber produces a whitish color of paper that can be used in crafting. In addition, the study of Jain and Kumari's (2021) state that there is high potential in Pungapong as a sustainable and aesthetically appealing paper for production alternative.

**Table 5. *Acceptability of Pungapong fiber using its odor in 300g:200g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (A.E.)paper is acceptable in terms of its odor. | 2.99 | 3 | Agree |
| 2.  I think that the odor of Pungapong (A.E.)is acceptable as paper. | 3.08 | 1 | Agree |
| 3. I observed that the odor of paper made from the Pungapong (A.E.)plant is acceptable for its use in academic purposes. | 2.90 | 5.5 | Agree |
| 4. I believe that the odor of Pungapong (A.E.) *plants* is acceptable and affects the overall use of the paper. | 2.91 | 4 | Agree |
| 5. I think that the Pungapong (A.E.)paper emits an acceptable unique odor. | 2.86 | 7 | Agree |
| 6. I observed that the odor of Pungapong (A.E.) *paper was considered* a pleasant smell to people. | 2.71 | 8 | Agree |
| 7. I believe that the odor of Pungapong (A.E.)paper perceive as a natural characteristic. | 3.04 | 2 | Agree |
| 8. I think that the odor of Pungapong (A.E.)paper is considered odorless. | 2.61 | 9 | Agree |
| 9. I observed that the odor of Pungapong (A.E.)paper likely to change over time or with exposure of different environments. | 2.87 | 6 | Agree |
| 10. I believe that the odor of Pungapong (A.E.)is more noticeable. | 2.90 | 5.5 | Agree |
| **General Weighted Mean** | 2.85 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 5, as a result of the data gathering in terms of the odor of Pungapong paper in 300g:200g concentration, shows that statement 2.) I think that the odor of Pungapong (A.E.)is acceptable as paper, ranked as one and has the weighted mean of (3.08). The statement lies along the “agree” range. Rank two, 7) I believe that the odor of Pungapong (A.E.)paper perceived as a natural characteristic has the weighted mean of (3.04) and lies along the “agree” range. And 1.) I believe that the Pungapong (A.E.)paper is acceptable in terms of its odor, ranked as three with the weighted mean of (2.99) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.85), labelled as “agree”. Stating that the odor of Pungapong paper is indeed acceptable in the concentration 300g:200g.

The findings in the acceptability of Pungapong fiber using its odor in [300](tel:300)g:[200](tel:200)g concentration, it influences the paper’s physical and sensory properties, including its ability to absorb or emit odors. Siti et al., ([2022](tel:2022)). The study on paper odor provides a crucial perspective for the research on Pungapong papermaking. The odor of paper is not commonly discussed, but it can be a significant sensory aspect that influences user preference. Instruments like gas chromatography might identify specific volatile compounds responsible for the odor. It might explore treatments (e.g., soaking, drying) to balance odor while retaining the material's strength and sustainability.

**Table 6. *Acceptability of Pungapong fiber using its odor in 250g:250g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (*Amorphophallus paeoniifolius*) paper is acceptable in terms of odor. | 3.03 | 3 | Agree |
| 2. I think that the odor of Pungapong (*Amorphophallus paeoniifolius*) is acceptable as paper. | 3.06 | 2 | Agree |
| 3. I observed that the odor of paper made from the Pungapong (*Amorphophallus paeoniifolius*) plant is acceptable for its use in academic purposes. | 2.95 | 4 | Agree |
| 4. I believe that the odor of Pungapong (*Amorphophallus paeoniifolius*) plant is acceptable and affects the overall use of the paper. | 2.94 | 5 | Agree |
| 5. I think that the Pungapong (*Amorphophallus paeoniifolius*) paper emit an acceptable unique odor. | 2.90 | 6 | Agree |
| 6. I observed that the odor of Pungapong (*Amorphophallus paeoniifolius*) paper considered a pleasant smell to people. | 2.77 | 8 | Agree |
| 7. I believe that the odor of Pungapong (*Amorphophallus paeoniifolius*) paper perceive as a natural characteristic. | 3.09 | 1 | Agree |
| 8. I think that the odor of Pungapong (*Amorphophallus paeoniifolius*) paper is considered odorless. | 2.58 | 10 | Agree |
| 9. I observed that the odor of Pungapong (*Amorphophallus paeoniifolius*) paper is likely to change over time or with exposure to different environments. | 2.89 | 7 | Agree |
| 10. I believe that the odor of Pungapong (*Amorphophallus paeoniifolius*) is more noticeable. | 2.85 | 8 | Agree |
| **General Weighted Mean** | 2.91 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 6, as a result of the data gathering in terms of the odor of Pungapong paper in 250g:250g concentration, shows that the statement 7.) I believe that the odor of Pungapong (A.E.)paper is perceived as a natural characteristic, ranked as one that has the weighted mean of (3.09). The statement lies along the “agree” range. Rank two, 2.) I think that the odor of Pungapong (A.E.)is acceptable as paper, has the weighted mean of (3.06) and lies along the “agree” range. And 1.) I believe that the Pungapong (A.E.)paper is acceptable in terms of odor, ranked as three, with the weighted mean of (3.03) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.91), labelled as “agree”. Stating that the odor of Pungapong paper is indeed acceptable in the

As supported by Chen ([2020](tel:2020)) during end-use, paper drying and cutting released significant VOCs, whereas printing and writing activities generated minimal odor emissions. Particularly their odor-producing compounds (like volatile organic compounds, VOCs) (e.g., soaking, pulping) influence odor levels. The study recommends fiber sourcing strategies, process modifications and developing eco-friendly paper products to improve odor quality.

**Table 7. *Acceptability of Pungapong fiber using its odor in 200g:300g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (A.E.)paper is acceptable in terms of odor. | 2.89 | 5 | Agree |
| 2. I think that the odor of Pungapong (A.E.)is acceptable as paper. | 3.14 | 1 | Agree |
| 3. I observed that the odor of paper made from the Pungapong (A.E.)plant is acceptable for its use in academic purposes. | 2.85 | 7 | Agree |
| 4. I believe that the odor of Pungapong (A.E.)plant is acceptable and affects the overall use of the paper. | 2.78 | 4 | Agree |
| 5. I think that the Pungapong (A.E.)paper emit an acceptable unique odor. | 2.97 | 6 | Agree |
| 6. I observed that the odor of Pungapong (A.E.)paper considered a pleasant smell to people. | 2.67 | 8 | Agree |
| 7. I believe that the odor of Pungapong (A.E.)paper perceive as a natural characteristic. | 3.01 | 2 | Agree |
| 8. I think that the odor of Pungapong (A.E.)paper is considered odorless. | 2.30 | 9 | Disagree |
| 9. I observed that the odor of Pungapong (A.E.) *paper is likely* to change over time or with exposure to different environments. | 2.92 | 3.5 | Agree |
| 10. I believe that the odor of Pungapong (A.E.)is more noticeable. | 2.92 | 3.5 | Agree |
| **General Weighted Mean** | 2.85 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 7, as a result of the data gathered in terms of the odor of Pungapong paper in 200g:300g concentration, shows that the statement 2.) I think that the odor of Pungapong (A.E.)is acceptable as paper, ranked as one and has a weighted mean of (3.14). The statement lies along the “agree” range. Rank two, 7.) I believe that the odor of Pungapong (A.E.)paper is perceived as a natural characteristic, that has the weighted mean of (3.01) and lies along the “agree” statement. And 9.) I observed that the odor of Pungapong (A.E.) *paper is likely* to change over time or with exposure to different environments and 10.) I believe that the odor of Pungapong (A.E.)is more noticeable, both ranked as three, with the weighted mean of (2.92) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.85), labelled as “agree”. Stating that the odor of Pungapong paper is indeed acceptable in the concentration 200g:300g.

Optimizing fiber selection and processing conditions can minimize undesirable odors. As supported by Duran ([2019](tel:2019)), researchers analyzed volatile organic compounds (VOCs) from papers made from hardwood, softwood, recycled fibers and non-wood plant fibers. the importance of odor in user preference and integrating odor assessment into the research, researchers can ensure that the final Pungapong-based paper product not only meets sustainability goals but also delivers a positive sensory experience for users.

**Table 8. *Acceptability of Pungapong fiber using its writability in 300g:200g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (A.E.)paper is acceptable in terms of its writability. | 3.10 | 2 | Agree |
| 2.    I think that the paper produced from Pungapong (A.E.)is acceptable for its smooth surface. | 2.56 | 8 | Agree |
| 3. I observe that the paper made from the Pungapong (A.E.)plant is acceptable for its use in writing purposes. | 2.66 | 5 | Agree |
| 4. I believe that the texture of the Pungapong (A.E.)paper is acceptable to enhance writing experience. | 2.58 | 7 | Agree |
| 5. I think that the Pungapong (A.E.)paper is acceptable in terms of its writability tasks. | 2.62 | 6.5 | Agree |
| 6. I observe that the Pungapong (A.E.)paper is acceptable in terms of its comfortable writing experience. | 2.51 | 9 | Agree |
| 7. I believe that the Pungapong (A.E.)paper is suitable for various writing instruments, such as pens and pencils. | 2.78 | 3 | Agree |
| 8. I think that the performance of Pungapong (A.E.)paper as writing material is highly acceptable. | 2.75 | 4 | Agree |
| 9. I observe that the Pungapong (A.E.) paper is considered suitable for high-quality writing applications. | 2.62 | 6.5 | Agree |
| 10. I believe that the overall writing experience on Pungapong (A.E.)paper is highly acceptable. | 3.27 | 1 | Strongly Agree |
| **General Weighted Mean** | 2.74 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 8, as a result of the data gathering in terms of the writability of Pungapong paper in 300g:200g concentration, shows that the statement 10.) I believe that the overall writing experience on Pungapong (A.E.)paper is highly acceptable, ranked as one with the weighted mean of (3.27). The statement lies along the “agree” range. Rank Two, 1.) I believe that the Pungapong (A.E.)paper is acceptable in terms of its writability that has the weighted mean of (3.10) and lies along the “agree” range. And 7.) I believe that the Pungapong (A.E.)paper is suitable for various writing instruments, such as pens and pencils, ranked as three, with the weighted mean of (2.78) and that lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.74), labelled as “agree”. Stating that the writability of Pungapong paper is indeed acceptable in the concentration 300g:200g.

The result was supported by Wang, et al. (2021) study that shows how the writability of Pungapong in the concentration 300g;200g is similar with alternative fiber papers (e.g., bamboo, hemp) in the literature results showed these papers exhibit improved writability due to surface smoothness, enhanced printability with optimal ink absorption and comparable quality to traditional wood-pulp papers.

**Table 9. *Acceptability of Pungapong fiber using its writability in 250g:250g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (A.E.)paper is acceptable in terms of its writability. | 3.29 | 1 | Strongly Agree |
| 2. I think that the paper produced from Pungapong (A.E.)is acceptable for its smooth surface. | 2.47 | 10 | Disagree |
| 3. I observe that the paper made from the Pungapong (A.E.)plant is acceptable for its use in writing purposes. | 2.92 | 2 | Agree |
| 4. I believe that the texture of the Pungapong (A.E.)paper is acceptable to enhance writing experience. | 2.72 | 7 | Agree |
| 5. I think that the Pungapong (A.E.)paper is acceptable in terms of its writability tasks. | 2.75 | 6 | Agree |
| 6. I observe that the Pungapong (A.E.)paper is acceptable in terms of its comfortable writing experience. | 2.52 | 9 | Agree |
| 7. I believe that the Pungapong (A.E.)paper is suitable for various writing instruments, such as pens and pencils. | 2.89 | 3 | Agree |
| 8. I think that the performance of Pungapong (A.E.)paper as writing material is highly acceptable. | 2.85 | 5 | Agree |
| 9. I observe that the Pungapong (A.E.) paper is considered suitable for high-quality writing applications. | 2.62 | 8 | Agree |
| 10. I believe that the overall writing experience on Pungapong (A.E.)paper is highly acceptable. | 2.87 | 4 | Agree |
| **General Weighted Mean** | 2.79 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 9, as a result of the data gathering in terms of the writability of Pungapong paper in 250g:250g concentration, shows that the statement 1.) I believe that the Pungapong (A.E.)paper is acceptable in terms of its writability, ranked as one and has the weighted mean of (3.29). The statement lies along the “agree” range. Rank two, 3.) I observe that the paper made from Pungapong (A.E.)plant is acceptable for its use in writing purposes, that the weighted mean of (2.29 and lies along the “agree” range. And 7.) I believe that the Pungapong (A.E.)paper is suitable for various writing instruments, such as pens and pencils, ranked as three, with the weighted mean of (2.89) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.79), labelled as “agree”. Stating that the writability of Pungapong paper is indeed acceptable in the concentration 250g:250g.

From these findings, the data evaluates how acceptable the paper is for writability, including its compatibility with various writing instruments. In support of this findings, Chen et al. (2021) highlight the importance of fiber properties in determining writability, implying that the success of Pungapong fibers in papermaking will depend on their ability to achieve the desired texture and porosity. Chen et al. (2021) demonstrated that papers with a finer texture offer better ink absorption and smoother writing experiences. The findings of Acceptability of Pungapong fiber using its writability in 250g:250g concentration and Chen et al. (2021) by showing that Pungapong paper, likely due to its texture and porosity, provides a surface suitable for writing.

**Table 10. *Acceptability of Pungapong fiber using its writability in 200g:300g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. I believe that the Pungapong (A.E.)paper is acceptable in terms of its writability. | 3.04 | 1 | Agree |
| 2.    I think that the paper produced from Pungapong (A.E.)is acceptable to its smooth surface. | 2.13 | 10 | Disagree |
| 3. I observe that the paper made from Pungapong (A.E.)plant is acceptable for its use in writing purposes. | 2.66 | 4 | Agree |
| 4. I believe that the texture of the Pungapong (A.E.)paper is acceptable to enhance writing experience. | 2.52 | 6 | Agree |
| 5. I think that the Pungapong (A.E.)paper is acceptable in terms of its writability tasks. | 2.63 | 5 | Agree |
| 6. I observe that the Pungapong (A.E.)paper is acceptable in terms of its comfortable writing experience. | 2.44 | 7 | Disagree |
| 7. I believe that the Pungapong (A.E.)paper is suitable for various writing instruments, such as pens and pencils. | 2.85 | 2 | Agree |
| 8. I think that the performance of Pungapong (A.E.)paper as writing material is highly acceptable. | 2.75 | 3.5 | Agree |
| 9. I observe that the Pungapong (A.E.)paper is considered suitable for high-quality writing applications. | 2.32 | 8 | Disagree |
| 10. I believe that the overall writing experience on Pungapong (A.E.)paper is highly acceptable. | 2.75 | 3.5 | Agree |
| **General Weighted Mean** | 2.61 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 10, as a result of the data gathering in terms of the writability of Pungapong paper in 200g:300g concentration, shows that statement 1.) I believe that the Pungapong (*Amorphophallus paeoniifolius*) paper is acceptable in terms of its writability, ranked as one with the weighted mean of (3.04). The statement lies along the “agree” range. Rank two, 7.) I believe that the Pungapong (*Amorphophallus paeoniifolius*) paper is suitable for various writing instruments, such as pens and pencils, that has the weighted mean of (2.85) and lies along the “agree” rang. And 8.) I think that the performance of Pungapong (*Amorphophallus paeoniifolius*) paper as writing material is highly acceptable. And 10.) I believe that the overall writing experience on Pungapong (*Amorphophallus paeoniifolius*) paper is highly acceptable, both ranked as three with the weighted mean of (2.75) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.61), labelled as “agree”. Stating that the writability of Pungapong paper is indeed acceptable in the concentration 200g:300g.

The concentration indicates that the Pungapong fibers in this ratio has suitable cellulose content and structural properties to meet the users' expectations for writing. In support of this findings, Ali & Noor ([2018](tel:2018)) emphasize the importance of eco-friendly papermaking techniques using plant-based fibers like Pungapong. Ali & Noor ([2018](tel:2018)) connect fiber properties like texture and porosity to ink absorption and retention, which are critical for smooth and effective writing. Together, they underline Pungapong's potential as a sustainable and effective material for paper production.

**Table 11. *Acceptability of Pungapong fiber using its texture in 300g:200g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. The Pungapong (A.E.) paper is acceptable in terms of its texture. | 2.94 | 4.5 | Agree |
| 2. The texture of Pungapong (A.E.) is acceptable as paper. | 3.05 | 1 | Agree |
| 3. The texture of paper made from the Pungapong (A.E.) plant is acceptable for its use in academic purposes. | 2.86 | 6 | Agree |
| 4. The texture of the Pungapong (A.E.) plant is acceptable and affects the overall use of the paper. | 2.96 | 3 | Agree |
| 5. The texture of Pungapong (A.E.) paper is acceptable and suitable as a paper. | 3.01 | 2 | Agree |
| 6. The texture of Pungapong (A.E.) paper considered pleasant to people. | 2.91 | 5 | Agree |
| 7. The Pungapong (A.E.) paper acceptable in providing a fine texture. | 2.78 | 7.5 | Agree |
| 8. The fineness of the texture of Pungapong (A.E.) paper acceptable in contributing to a more positive experience in using the paper. | 2.94 | 4.5 | Agree |
| 9. The Pungapong (A.E.) paper acceptable to have a uniform texture. | 2.78 | 10 | Agree |
| 10. The texture of Pungapong (A.E.) paper perceived as appealing to the people. | 3.09 | 7.5 | Agree |
| **General Weighted Mean** | 2.93 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 11, as a result of the data gathering in terms of the texture of Pungapong paper in 300g:200g concentration, shows that the statement 2.) The texture of Pungapong (A.E.) is acceptable as paper, ranked as one with the weighted mean of (3.05). The statement lies along the “agree” range. Rank two, 5.) The texture of Pungapong (A.E.) paper is acceptable and suitable as a paper that has the weighted mean of (3.01) and lies along the “agree” range. And 4.) The texture of the Pungapong (A.E.) plant is acceptable and affects the overall use of the paper, ranked as three with the weighted mean of (2.96) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.93), labelled as Agree. Stating that the texture of Pungapong paper is indeed acceptable in the concentration 300g:200g.

The results demonstrate acceptable quality, making it suitable for paper making. It's acceptable texture, coupled with Lambert et al.'s ([2019](tel:2019)) findings, the study explores the relationship between fiber characteristics and paper texture. The research indicates that fiber length and surface roughness directly influence paper texture, with longer, well-distributed fibers producing smoother finishes. Notably, the unique fibrous structure of Pungapong may provide desirable textures. Likewise in Chen et al.'s ([2021](tel:2021)) findings, the study highlights the crucial role of texture and porosity in determining paper quality. The research demonstrates that the finer textures significantly enhance ink absorption and writing experiences. This finding implies that fiber texture and porosity are vital factors in evaluating paper quality.

**Table 12. *Acceptability of Pungapong fiber using its texture in 250g:250g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. The Pungapong (A.E.) paper is acceptable in terms of its texture. | 2.81 | 5.5 | Agree |
| 2. The texture of Pungapong (A.E.) is acceptable as paper. | 2.96 | 2 | Agree |
| 3. The texture of paper made from the Pungapong (A.E.) plant is acceptable for its use in academic purposes. | 2.81 | 5.5 | Agree |
| 4. The texture of the Pungapong (A.E.) plant is acceptable and affects the overall use of the paper. | 2.82 | 4.5 | Agree |
| 5. The texture of Pungapong (A.E.) paper is acceptable and suitable as a paper. | 2.90 | 3 | Agree |
| 6. The texture of Pungapong (A.E.) paper is considered pleasant to people. | 2.82 | 4.5 | Agree |
| 7. The Pungapong (A.E.) paper is acceptable in providing a fine texture. | 2.67 | 7 | Agree |
| 8. The fineness of the texture of Pungapong (A.E.) paper is acceptable in contributing to a more positive experience in using the paper. | 3.00 | 1 | Agree |
| 9. The Pungapong (A.E.) paper is acceptable to have a uniform texture. | 2.80 | 6 | Agree |
| 10. The texture of Pungapong (A.E.) paper is perceived as appealing to the people. | 2.95 | 3 | Agree |
| **General Weighted Mean** | 2.85 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on the shown Table 12, as a result of the data gathering in terms the texture of Pungapong paper in 250g:250g concentration, shows that statement 8.) The fineness of the texture of Pungapong (A.E.) paper is acceptable in contributing to a more positive experience in using the paper, ranked as one and has the weighted mean of (3.00). The statement lies along the “agree” range. Ranked two, 2.) The texture of Pungapong (A.E.) is acceptable as paper, that has the weighted mean of (2.96) and lies along the “agree” range. And 10.) The texture of Pungapong (A.E.) paper perceived as appealing to people, ranked as three, with the weighted mean of (2.95) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted as (2.85), labelled as “agree”. Stating that the texture of Pungapong paper is indeed acceptable in the concentration 250g:250g.

The findings in Acceptability of Pungapong (amphopalluis) fiber as an alternative paper with 250g:250g concentration level, exhibits acceptable texture, with respondents agreeing on its fineness and acceptability. In connection to Wang et al.'s (2021) study, it demonstrates alternative fibers (e.g. bamboo, hemp, flax) exhibit improved writability and printability due to the surface smoothness and optimal ink absorption. Pungapong's fine texture and fibrous structure make it suitable for paper production. Likewise in findings of Lambert et al.'s (2019) study, underscores the influence of fiber characteristics (length, surface roughness) on paper texture. Pungapong's unique fibrous structure may provide smooth finishes. With this finding, it highlights the Pungapong's potential for high-quality paper production.

**Table 13. *Acceptability of Pungapong fiber using its texture in 200g:300g concentration***

| **Statement** | **Weighted Mean** | **Rank** | **Interpretation** |
| --- | --- | --- | --- |
| 1. Pungapong (A.E.) paper is acceptable in terms of its texture. | 2.80 | 3.5 | Agree |
| 2. The texture of Pungapong (A.E.) is acceptable as paper. | 2.80 | 3.5 | Agree |
| 3. The texture of paper made from the Pungapong (A.E.) plant is acceptable for its use in academic purposes. | 2.58 | 7 | Agree |
| 4. The texture of the Pungapong (A.E.) paper affect the overall use of the paper. | 2.82 | 2 | Agree |
| 5. The texture of Pungapong (A.E.) paper is acceptable and is suitable as a paper. | 2.75 | 5.5 | Agree |
| 6. The texture of Pungapong (A.E.) paper is considered pleasant to people. | 2.77 | 4 | Agree |
| 7. The Pungapong (A.E.) paper is acceptable in providing a fine texture for writing. | 2.51 | 8 | Agree |
| 8. The fineness of the texture of Pungapong (A.E.) paper acceptable in contributing to a more positive experience in using the paper. | 2.75 | 5.5 | Agree |
| 9. The Pungapong (A.E.) paper acceptable to have a uniform texture. | 2.65 | 6 | Agree |
| 10. The texture of Pungapong (A.E.) paper perceived as appealing to people. | 2.91 | 1 | Agree |
| **General Weighted Mean** | 2.73 |  | **Agree** |

**Legend:**

*Strongly Agree (4.00 – 3.26)), Agree (3.25 – 2.51), Disagree (2.50 – 1.76), Strongly Disagree (1.75 – 1.00)*

Based on Table 13, as a result of the data gathering from the Grade-12 students in terms of the texture of Pungapong paper in 200g:300g concentration, shows that the statement 10.) The texture of Pungapong (A.E.) paper perceived as appealing to people, ranked as one and has the weighted mean of (2.91). The statement lies along the “agree” range. Ranked two, 4) The texture of Pungapong (A.E.) paper affects the overall use of the paper, has the weighted mean of (2.82) and lies along the “agree” range. 1.) Pungapong (A.E.) paper is acceptable in terms of its texture. And 2.) The texture of Pungapong (A.E.) is acceptable as paper, both ranked as three, with the weighted mean of (2.80) that also lies along the “agree” range. The average weighted mean of statement 1.) – 10.) weighted (2.73), labelled as “agree”. Stating that the texture of Pungapong in the concentration of 200g:300g is indeed acceptable.

Students rated the texture as appealing, acceptable for overall use and suitable as paper. In connection to Chen et al.'s ([2021](tel:2021)) findings, the study emphasizes the importance of texture and porosity in determining paper quality. Finer textures enhance ink absorption and smoother writing experiences. Fiber characteristics, such as the surface roughness, impact paper texture. This framework provides a comprehensive approach to evaluating paper quality based on texture. Likewise in Wang et al.'s ([2021](tel:2021)) findings, the study demonstrates alternative fibers, such as bamboo, hemp, flax and recycled fibers. Surface smoothness is significantly enhanced, leading to better ink absorption and print quality. It is also implying that Pungapong's texture, influenced by its fibrous structure, offers suitable paper production options. By leveraging alternative fibers, researchers can develop innovations, eco-friendly paper products with good quality texture.

**CHAPTER V**

**SUMMARY, CONCLUSION, AND RECOMMENDATION**

This chapter presents the summary findings, conclusions, and recommendations of the study. From the findings, conclusions were drawn from which the recommendations were based.

**Summary**

The research paper titled "Evaluating the Efficacy of Pungapong (Amorphophallus paeoniifolius) Plant as Fiber for Paper Making" aims to assess the effectiveness of Pungapong fibers at varying concentration levels and their acceptability in papermaking. The study addressed three primary problems: (1) determining the efficacy of Pungapong fibers for paper across different concentrations, (2) evaluating their acceptability based on specific quality indicators, and (3) establishing any significant differences between efficacy and acceptability at these varying concentrations. The study's respondents comprise 82 Grade-12 students from King Thomas Learning Academy Inc., selected using Slovin’s formula (n = N/(1+Ne²)) to ensure a representative sample from a total population of 446 students. The research uses a quantitative approach, specifically employing a 4-point Likert scale for data collection. This method allows for mathematical analysis, which assists in quantifying the effectiveness and acceptability of using Pungapong fiber in conjunction with waste paper. The primary instrument for data collection in this study is the observation sheet, which has been meticulously designed to ensure data accuracy. This tool aids researchers in effectively evaluating the performance and viability of Pungapong fiber as a raw material in paper production. The research employs a comprehensive statistical treatment to analyze and manage the acquired data effectively. The primary methods used include weighted mean, ranking technique, and analysis of variance (ANOVA).

**Problem 1**

***What is the level of efficacy of Pungapong (Amorphophallus paeoniifolius) as a fiber plant for paper in different concentration levels?***

1. ***300g:200g***
2. ***250g:250g***
3. ***200g:300g***

***Findings***

1. Based on the result, several important points were drawn from the data gathered through the survey about the acceptability of efficacy of Pungapong (Amorphophallus paeoniifolius). To begin, the Pungapong at all concentrations (300g:200g, 250g:250g, and 200g:300g) received a general consensus of agreement.
2. Based on the result, the students' highest mean scores were 200g:300g concentration where respondents agreed because it is most suitable in writing purposes.
3. Based on the result, all concentrations (300g:200g, 250g:250g, and 200g:300g) were considered as acceptable as paper and for writing purposes.
4. Based on the result, the 200g:300g is the most suitable and acceptable for writing purposes because it is perceived to indicate greater effectiveness. higher concentrations (250g:250g and 200g:300g) were the most effective than the 300g:200g.

**Conclusion**

Based on the findings of the study, it is concluded that the Pungapong (Amorphophallus paeoniifolius) was generally acceptable in terms of color, odor, texture, and writability across the three different concentrations (300g:200g, 250g:250g, and 200g:300g). All were considered as acceptable paper and can be used in writing and artistic purposes, and is suitable for various writing instruments, but still requires improvements. The Pungapong (Amorphophallus paeoniifolius) varying intensity as a measure of effectiveness.

**Recommendation**

**Problem 2**

***What is the level of acceptability of Pungapong (Amorphophallus paeoniifolius) fiber as paper in terms of:***

1. ***Color***
2. ***Odor***
3. ***Writability***
4. ***Texture***

**Findings**

1. Based on the result, the students prefer using Pungapong (Amorphophallus paeoniifolius) paper in terms of color in 200g:300g concentration because it is acceptable as paper (WM, 3.23), can be used in artistic purposes (WM, 3.22), it gives aesthetically appeal (WM, 3.15). The average weighted mean of 3, interpreted as Agree.
2. Based on the result, the students prefer using Pungapong (Amorphophallus paeoniifolius) paper in terms of odor in 250g:250g concentration because it is acceptable as paper (WM, 3.06) and it perceive as a natural characteristic (WM, 3.09). The average weighted mean of 2.91, interpreted as Agree.
3. Based on the result, the students prefer using Pungapong (Amorphophallus paeoniifolius) paper in terms of writability in 250g:250g concentration because it is acceptable as paper (WM, 3.29), it can be use in writing purposes (WM, 2.92), and it is suitable for various writing instruments (WM, 2.89). The average weighted mean of 2.79, interpreted as Agree.
4. Based on the result, the students prefer using Pungapong (Amorphophallus paeoniifolius) paper in terms of texture in 300g:200g concentration because it is acceptable in paper (WM, 3.05), it is suitable as a paper (WM, 3.01), and affects the overall use of the paper (WM, 2.96). The average weighted mean of 2.93, interpreted as Agree.

**Conclusion**

Based on the findings, this study demonstrated the level of acceptability of Pungapong (Amorphophallus paeoniifolius) paper. These findings supported the acceptability in terms of color, odor, writability and texture. The researchers also draw the conclusion that the Pungapong (Amorphophallus paeoniifolius) paper is acceptable and suitable to be a fine paper. The Pungapong (Amorphophallus paeoniifolius) paper come out to be aesthetic, suitable for writing and can be used in artistic purposes of the students.

**Problem 3**

***Is there any significance difference between the level of efficacy and the level of acceptability in using different concentrations?***

**Findings**

Base from the results of the data, findings revealed that there is a significant difference between the level of efficacy and level of acceptability in terms of the different concentration

**Conclusions**

The study implied that there is a significant difference between the level of efficacy and level of acceptability of the paper in terms of the different concentration.

**Recommendation**

The researchers advised that, despite the finding that there is a significant difference between the level of efficacy and the level of acceptability in terms of the different concentrations of the paper, we should concentrated on how to improve the quality of the paper, especially its color and texture. It is also advised to invest in better grinders to achieve qualified qualities of a paper.

(Findings: PALE Method??)

**Conclusion**

Based on the findings of this study, it is concluded that there is indeed a significant difference between the level of efficacy and level of acceptability of Pungapong (Amorphophallus Paeoniifolius) plant fiber as paper in the different concentrations. These findings support the acceptability of the paper terms of its color, odor, writability and texture.  The researchers also draw the conclusion that Pungapong paper is suitable to be a fine paper that is efficient, eco-friendlier, and easy to use for students.

**Recommendation**

1. Since the results of the collected and interpreted data showed that Pungapong (Amorphophallus Paeoniifolius) plant fiber is efficient and acceptable in terms its different concentrations, the researchers recommend the use of Pungapong plant in paper production companies as a major alternative and an eco-friendlier ingredient in paper production. Its unique fiber properties may provide improvement in the strength, durability, and texture of a paper. In addition, it could mitigate biological issues associated with the production of conventional papers.
2. The researchers also recommend that schools must highlight the issue about the continuous increase of paper wastes inside the school facilities. Encouraging students and involving recycling of paper wastes associated with organic non-wood plants like Pungapong in art classes or in environmental school organizations like SEPO will not only reduce the waste papers, but will also help the students enhance their creativity and problem-solving skills.
3. For better improvement, it is recommended to invest in quality grinders to enhance the paper’s good texture and better coloration.

(Findings, Conclusion, and Recommendation should be discussed in paragraph form per SOP)