HOLY CROSS COLLEGE OF CALINAN, INC.

DAVAO – BUKIDNON HIGHWAY, CALINAN POBLACION, DAVAO CITY

Papaya *(Carica papaya)* Peels as Alternative Source of Paper

Tocmo, Princess Angel T.

Acierto, Karajid

Payot, Eldwood

Simangan, Riza Vaneza

Enoch, Joash Terrence Marc

April 2023

Chapter 1

INTRODUCTION

Background of the study

The world's publishing sector is facing a significant crisis due to growing demands of raw materials and the disruption of supply chains, that further causes a worldwide shortage of paper. According to a statement made by Brian O'Leary, executive director of Book Industry Study Group, the diminished printing capacity is a long-term effect. This idea was agreed by Pascal Lenoir, the President of the French SNE Production Committee, who in an interview expressed the on going challenges of paper production in France as a result of paper mills having reduced their production of paper for books and magazines and instead utilized the pulps into making cardboard and other packing materials that are more in demand. The cost of paper has also increased 10–20% in Australia, which has led to a 15% increase in local print expenses. Additionally, there are erratic increases in transportation costs, 4 times as much as previous prices. Due to this, Australian publishers are turning to domestic printing more and more, which has caused printers to become congested. Publishers in Turkey have been observing how this sequence of events is escalating the nation's financial issue at the same time. The cost of printing a book in Turkey has increased by at least 200% since 2002 as a result of rising book paper costs, an 80%+ increase in exchange rates, and skyrocketing costs for other materials needed in book production. (International Publishers Association, 2022)

The Philippines has a total of 37 pulp and operating mills and and as a whole, has a capacity of 786,600 tons per year of different grades and kinds of paper. According to a study conducted by the Phoenix Group of Companies in 2022, the supply of paper for the country had a shortage because demands for paper in the country rose and the supply sank. Reports show that the Philippines' annual per capita consumption of paper is 13kg compared to the world's consumption of 43kg. The main factors of paper production in the country are recycled fibers or used papers. This is due to the limited local wood supply and the expensive cost of importing pulp into the country

In Davao City, paper factories are a growing industry. The AVLB Asia Pacific Conglomerate is one of the biggest producer of paper and cardboard in the country. Its main

product line is corrugated packaging materials for fresh fruit export like Cavendish Bananas, and Pineapples to China, Japan, Korea, and the Middle East. (AVLB Asia Pacific Conglomerate, 2016) Moreover, an alarming amount of deforestation has occurred and up to 40% of the world's timber is utilized in the production of paper. The negative effects paper manufacture has on the environment and the society which we live in is growing. Paper production also contributes to air pollution that increases the tendency of developing acid rain and greenhouse gasses by releasing nitrogen dioxide, sulfur dioxide, and carbon dioxide into the atmosphere (Kempner, 2016). Some businesses in the pulp and paper sector had also left big environmental footprints. The construction of pulp plantations on converted natural forests and irresponsible harvesting from those areas are endangering vulnerable ecosystems and species and cause soil erosion and other disasters (World Wild Life, 2022). With these negative consequences and problems about paper manufacture to the environment and to the pulp sector, the researchers desire to make an alternative source of paper production through Papaya *(Carica papaya)* peels.

The process of paper production includes two main factors: water and fiber. Cellulose fibers are extracted from resources and are later converted into a pulp. The pulp will be combined with water and together will undergo a process of production (Casey, 2017). Papaya *(Carica papaya)* on the other hand has been proven to be a good source of fiber and other nutrients such as pantothenic acid, folate, Vitamin A, and magnesium (Medical News Today, 2017). The peels of Papaya *(Carica papaya)*, like its fruit, are also shown to be rich with dietary fibers (Zhang, Zeng, Pan, Chen, W., Huang, Chen, H., Li, 2017).

Papaya is a tropical fruit under the Caricae family and has the appearance of yellow and green color. It has been used mostly in the cosmetic field because of its nutrients that are good for the skin. It is mainly produced in Brazil, Mexico, Nigeria, Indonesia, China, Peru, Thailand and the Philippines. According to researchers, Papaya *(Carica papaya)* is an important fruit grown in and exported from the Philippines (Chua, 2018) because of its ubiquitous nature and the fact that the Philippines is one of the main exporters of Papaya in Asia. There are places in the Philippines that are ample with Papaya such as Cavite, South Cotabato, Central Luzon, Misamis Oriental, and other regions especially in Mindanao. Because of this massive and rich production, there are Papayas that become wastes and land in dumpsites. That is why, other than wanting to make an alternative source of paper and help aid the pollution caused by paper manufacture, the researchers

also want to lessen the landfill problems the country is having. Solid waste management remains a major challenge in the Philippines especially in urban areas like Metro Manila. Improper waste disposal, inefficient waste collection and lack of disposal facilities are among the dominant concerns in the country's solid waste management (Woima, 2019).

The use of Papaya (*Carica papaya*) peels as paper is deemed feasible because past research has been able to prove that other resources especially those that are considered to be wastes are transformable into paper (Wastes Home, 2016) so long as it meets the requirements of paper production like fiber. Following the details stated above, the researchers conclude that the negative impacts of paper production can be amended and Papaya (*Carica papaya*) peels have the qualities to amend the problem. With this, the researchers will conduct an experiment to identify whether or not Papaya *(Carica papaya)* peels can be an alternative source of paper production or not.

Statement of the problem

This study aims to determine if Papaya (*Carica papaya*) peels can be an alternative source of making paper. It will answer the question:

1) Can Papaya *(Carica papaya)* peels be an alternative source of paper production?
2) Can the Papaya (*Carica papaya*) peels be more durable than regular paper?
3) Can the paper made from Papaya *(Carica papaya)* be suitable for writing?

Hypothesis

Ha: If Papaya (*Carica papaya*) peels can be made into paper, then it can be an alternative source for paper production.

H_0: If Papaya (*Carica papaya*) peels cannot be made into paper, then it cannot be an alternative source for paper production.

Ha: If Papaya peel fiber can be an alternative source for paper production, then it can be more durable than regular paper.

Ha: If papaya peel can be an alternative source for paper production, then it can be suitable for writing.

Scope and delimitations

The researchers will only determine if Papaya (*Carica papaya*) peels can be an alternative source of paper. The Papaya *(Carica papaya*) peels to be used in the study are under no specific

variety. The researchers will only use the peels of ripe Papaya. The researchers will use water from the tap.

Significance of the study

The study will determine whether or not Papaya *(Carica papaya*) peels can be an alternative source of paper production to help aid environmental crises like deforestation and air pollution that affects not only humans but also the wildlife. The study also aims to provide another pulp source not only in the country but also across the world especially to regions who are lacking due to the limited fiber present in their areas. In addition, the study aims to properly utilize the ample amount of Papaya (*Carica papaya*) supply in the country that mostly becomes waste and to also lessen landfill problems not only nationally but also internationally. Lastly, the study will help the growing body of knowledge by providing new information about the extent of Papaya *(Carica papaya*) peels' properties.

Definition of terms

Paper- A thin material produced by pressing converted cellulose fiber.

Paper production- The process of making paper.

Alternative source- Another raw material that can serve as a substitute to the original source.

Chapter 2

METHODOLOGY

The Papaya (*Carica papaya*) peels and its properties that will affect the result of the experiment will be the independent variable. The number of Papaya (*Carica papaya*) peels and the amount of water to be used will serve as the controlled variable. The quality and the further outcome of the paper will be the dependent variable.

The process will include one set-up, three trials, and four phases, namely: Phase I- Material and ingredients; Phase II- Preparation of Papaya (Carica papaya) peels as a pulp; Phase III- Molding of the pulp; Phase VI- Disposal of materials and ingredients used.

Phase I- Materials and ingredients

The researchers will use 4 pounds of Papaya *(Carica papaya)* peels and 3L of water following a related study conducted by the Mother Earth News in 2017 about leaves being turned into paper by following the measurements above. A large basin will be used to hold the water and

pulp mixture. A mold and deckle will be soaked inside the basin and will be used to mold the pulp. Thin sheets of fabric will be used to dry up the molded pulp.

Phase II- Preparation of Papaya (*Carica papaya*) peels as a pulp

The Papayas will be gathered from different sources, some will be bought from the local market and some will be from neighborhood plantations. After gathering the Papayas (*Carica papaya*), the researchers will first wash their hands with running water and soap and peel the Papayas (*Carica papaya*) and will store the fruit and use it to make by-products that they can eat and sell. The peels will be soaked under normal water for an hour to remove any other excess papaya fruit inside it. The researchers will also test if there are still Papaya *(Carica papaya)* remains through touching the peels and seeing if there is still a glossy and sticky-like texture present or not since glossiness and stickiness are some of the characteristics of Papaya *(Carica papaya)* fruit considering its juicy and slimy nature. After that, the researchers will boil the collected Papaya (*Carica papaya*) peels in medium heat until it simmers to extract fibers out of the peels. After boiling, the Papaya (*Carica papaya*) peels will be neutralized for around 10 minutes and will be put into a blender to produce a pulp. The blended Papaya (*Carica papaya*) peels will be dissolved into the 3L of water inside a large basin. The researchers will then mix it so no clumps of fiber will be left.

Phase III- Molding of the pulp

The researchers will use a mold and a deckle to make the paper. The mold is where a screen or a mesh will be attached, it will drain out the water and help the fibers to assemble. The deckle will be put on top of the mold. It will help shape the paper and give it thickness. After the mold and deckle is all set, the researchers will put it under the mixture of water and pulp. The mold and deckle will scoop up the pulp and drain excess water. The paper will be pressed down from the deckle to the thin fabric to dry it up by hanging. The researchers will repeat this process for three

more times. After an hour of exposure to sunlight and wind, the pulp will dry up and it will be gently pulled away from the fabric.

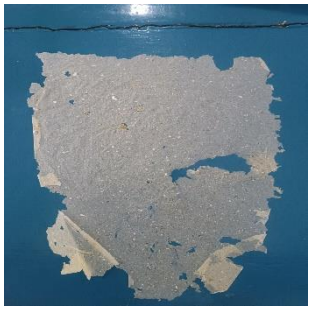
Phase IV- Disposal of materials and ingredients used

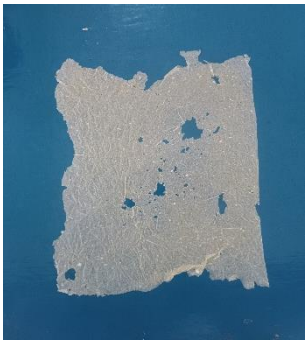
The researchers at the end of the experiment will clean the used materials. The mold and deckle will be washed and the fabrics will be set for laundry. The fruits of the Papaya will be transformed to another by-product that the researchers will sell. Since the peels were used in the experiment, there is really not that much of garbage left. The residue of the water and the pulp mixture will be disposed properly in the sink. Remaining trash will be segregated to biodegradable and non-biodegradable classifications and will be given to local garbage collectors. The researchers will then wash their hands with soap and water.

Chapter 3

RESULTS AND DISCUSSIONS

This chapter contains the results and the observations the researchers had made after conducting the study.

Trial 1		• Thin • Slightly smooth in texture • Yellowish in color • Has notable spots • When tore apart, fibers show up • When soaked into water it absorbs the water and gets wet like industrial paper

Trial 2		• As thin as the paper from trial 1 • Rough and wrinkled in texture • Yellowish in color • Has smaller spots • When tore apart, fibers show up • When soaked to water, it absorbs the water and gets wet like industrial paper
Trial 3		• Thicker than the papers from Trial 1 and Trial 2. • Rough and crispy texture • Has no spots • When tore apart, fibers show up • When soaked to water, it absorbs the water and gets wet like industrial paper • Papaya *(Carica papaya)* peels residue are more evident

The result of the experiment shows that the pulp out of Papaya (*Carica papaya)* was able to dry and was turned into paper. The paper is thin, yellow in color, and is slightly rough and wrinkly in texture. The texture of the paper, however, depends on how the researchers molded the pulp. There are some pulp residue that remained sticking onto the fabric and was not pulled away resulting for the final product to have a few spots and holes over it aside from that of the Trial 3. When the paper is tore apart, bunch of fiber shows up, these fibers are from the fibers present in the peels of Papaya *(Carica papaya)*. And when soaked into water, it gets wet and absorbs it like how industrial paper does.

Chapter 4

CONCLUSION AND RECOMMENDATION

Conclusion

After the experimentation and following the methods, the results show that the peels of Papaya (*Carica papaya*) can be made into paper. The paper product is suitable for writing notes,

stationeries, and journaling but is not advised to be used for formal documents since it is thin. Thus, the researchers therefore conclude that Papaya (*Carica papaya*) peels can be an alternative source for paper production.

Recommendation

The researchers recommend to the future researchers:

1) To try using the peels of an unripe Papaya
2) To try using thick fabric that is not shiny and does not absorb water.
3) To use a specific variety of Papaya.
4) To mold a thicker pulp.
5) To scoop out the pulp for more than 3 times

References

AVLB Asia Pacific Conglomerate. (2016). Retrieved from Paper Index: https://www.paperindex.com/profile/avlb-asia-pacific-conglomerate-inc/19052208/45619

International Publishers Association. (2022, April 2). Retrieved from International Publishers Association: https://www.internationalpublishers.org/copyright-news-blog/1205-paper-shortages-a-global-printing-and-publishing-crisis?fbclid=IwAR216LH91v_ofNITp-4YPpYPNZZUj9QM2oAH9VfyYnYT-OidNu9ECB701iI

Wastes Home. (2016, February 21). Retrieved from EPA's Wave Archive: https://archive.epa.gov/wastes/conserve/materials/paper/web/html/papermaking.html?fbclid=IwAR1RJUvyGKfYG9A-FkuFlh9tnaRUwMN454lE3QrIU2yVV24Lk6z3Ikw4gTI

Medical News Today. (2017, December 21). Retrieved from medicalnewstoday.com: https://www.medicalnewstoday.com/articles/275517?fbclid=IwAR3HD1XbNs5o0eu3rqrAKqE-shJFpte8N2AYcTyqR9jux_YMcrU54qrBym4#risks

Woima. (2019). Retrieved from woimacorporation.com: https://woimacorporation.com/drowning-in-waste-case-manila-the-philippines/

American Forest & Paper Association. (2022). Retrieved from afandapa.org: https://www.afandpa.org/paper-wood-products/paper#:~:text=Benefits%20of%20Using%20Paper,and%20secure%20forms%20of%20documentation.

World Wild Life. (2022). Retrieved from worldwildlife.org: https://www.worldwildlife.org/industries/pulp-and-paper#:~:text=Deforestation%20and%20Forest%20Degradation&text=Irresponsible%20harvesting%20from%20natural%20forests,species%2C%20and%20cause%20soil%20erosion.

Casey, R. (2017, July 17). *Casey Printing*. Retrieved from caseyprinting.com: https://www.caseyprinting.com/blog/how-is-paper-made

Chua, Y. S. (2018). *The Philippines Fresh Papaya Export Value Chain*. Retrieved from The Philippines Fresh Papaya Export Value Chain.com: https://cpb-ap-se2.wpmucdn.com/blog.une.edu.au/dist/4/1340/files/2018/03/AAP-Vol-21-Paper-7-Chua-2nz75wa.pdf

Kempner, D. (2016, December 06). *aiim+*. Retrieved from community.aiim.org: https://community.aiim.org/blogs/dennis-kempner/2016/12/06/impacts-of-paper-on-the-environment?fbclid=IwAR17Ya4dfivTaaMcTYxfnZ_-wgSVaWQxVFGM3yyeHFzpxJkIi2u5ML-UcRc

Zhang, W., Zeng, G., Pan, Y., Chen, W., Huang, W., Chen, H., et al. (2017, May 13). *National Library of Medicine*. Retrieved from https://pubmed.ncbi.nlm.nih.gov/: https://pubmed.ncbi.nlm.nih.gov/28606515/#:~:text=These%20results%20indicate%20that%20papaya,a%20potential%20functional%20food%20ingredient.