Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
DIVISION OF CITY SCHOOLS - VALENZUELA
VALENZUELA CITY SCHOOL OF MATHEMATICS AND SCIENCE
A. PABLO ST., MALINTA, VALENZUELA CITY

THE POTENTIAL OF MANILA CLAM SHELLS (*Venerupis philippinarum*) AS CHITOSAN-BASED BIOPLASTIC

A Research
Presented to the Faculty of the
Science Department of the
Valenzuela City School of Mathematics and Science

In Partial Fulfillment
Of the Requirements for the subject
RESEARCH IV

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Research Adviser

June 2023

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APPROVAL SHEET

This Research entitled **"THE POTENTIAL OF MANILA CLAM SHELL (*Venerupis philippinarum*) AS CHITOSAN-BASED BIOPLASTIC"**,prepared and submitted by **ASHLEY NICOLE C. DACANAY, JUAN MIGUEL L. DE ONON, RAM CHRISTAN B. HALCON, AND LEAL ISAIAH M. JUAT** in partial fulfillment of the requirements in **RESEARCH IV** has been examined and is recommended for approval and acceptance.

DEMAR G. BAYONA
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The potential of Manila clam shells (*Venerupis philippinarum*) as chitosan-based bioplastic

Proponents: Ashley Nicole Dacanay, Leal Isaiah Juat, Juan Miguel De Onon, Ram Christan Halcon

School: Valenzuela City School of Mathematics and Science

Abstract

This study explores the potential of Manila clam shells (*Venerupis philippinarum*) as a chitosan-based bioplastic. Moreover, the study outlines several processes in extracting chitin from Manila clam shells, including mechanical treatment, deproteinization, demineralization, and the bioplastic solution (Majekodunmi S., 2016). Aside from that, ANOVA is the statistical tool utilized in the study since it compares three sets of observable data for research testing. The product's tensile strength and water absorption are two characteristics tested. As for the results, although the product was missing a few components, it still performed identically to regular plastic in terms of lack of water absorption and nearly the same tensile strength. It may not be appropriate for all uses. However, it could be used as a plastic cover to enhance performance. This can only imply that this product has emerged as a viable substitute for biodegradable plastics and has demonstrated the feasibility of using Manila clam shells as a bioplastic. Additionally, future researchers may find this study to be a valuable resource as they explore more widespread and extensive chitosan-based bioplastic approaches.

Keywords: Manila clam shells, Chitosan-based bioplastic, Chitin extraction, Characteristics, Regular plastic, Viable substitute, Feasibility, Future researchers

INTRODUCTION

According to the DeNR, There are at least 2.7 million metric tons of plastic waste in the Philippines, where 7,000 metric tons of plastic garbage are produced every day. Studies reveal that there are now 5.25 trillion macro and microparticles of plastic in the world's oceans, and that this has an effect on the natural environment because plastics take up to a thousand years to decompose. Fortunately, related studies have revealed that some polymers, like chitin, can completely degrade by bacteria in 7 weeks due to their biodegradability unlike their traditional counterparts (Zhou Y. et al. 2022). In actuality, chitosan-based products have already entered the industry and used for a variety of purposes, including as a bioplastic, only serves to demonstrate

how successful it is and how much potential it has to replace non-degradable plastics due to its exceptional qualities, including biodegradability, strength, elongation, and non-toxicity. The primary components of chitin are also frequently occurring byproducts of the food processing industry (Silva H. et al. 2022). As a result, there is a prospective substitute which is not only better for the environment but also more beneficial than regular plastic in terms of waste management.

Although Manila clam shells (*Venerupis philippinarum*) are widespread in the Philippines and are sold there as the Manila Clam, between 1,000 and 1500 tons of these shells are discarded annually (Recev et al., 2017). Given that chitin is one of the most prevalent polymers in nature (Gaisal M. et al., 2018) and that Manila clam shells correspond to a relative of crustaceans that has been shown to contain 30% to 50% chitin, they can be used as a source of chitin (Hajji S. et al., 2019). For example, related literature suggests that crab shells are an excellent source of chitin (Fernando L. et al., 2017). Considering that they contain calcium carbonate, manila clam shells are a great source of bioplastics that are good for the environment. Studies have shown that bioplastics made from manila clam shells are used in packaging, cutlery, agricultural films, and as replacements for single-use plastic due to the fact that they have desirable qualities like degradation, low toxic content, and potential antibacterial action (Cariaso B., 2022). These studies concluded that Manila clam shells are an excellent source of chitin because of their abundance and high chitin concentration. This can imply that Manila clam shells can be used instead of being wasted as an alternative to creating a chitosan-based bioplastic.

Environmental problems, particularly those caused by plastics and their slow decomposition rate, are one of mankind's fundamental issues in the twenty-first century. Research on various strategies, such as using ecological resources to produce biodegradable plastic, is being done to

decrease the adverse effects of plastics. So, to promote sustainability rather than the conventional plastics frequently used nowadays, the potential of Manila clam shells (*Venerupis philippinarum*) as chitosan-based bioplastics was thoroughly investigated. Perishable plastics decompose over time, lowering waste production and landfill litter (Vettkötter, 2019). Bioplastics, made from natural materials, help conserve non-renewable energy sources like petroleum. (Psadmin, 2018). Additionally, bioplastics can help manufacturers expand their feedstocks and reduce their dependence on fossil fuels, which can be very advantageous for many different types of businesses (Barett, 2019). Also, as it will serve as a reminder to them to always look for people who could resolve any discrepancies and give crucial data about the study, chitosan-based bioplastic, this study will be a wonderful aid to alternative researchers (Steffen, 2019).

The primary objective of this research is to determine whether or not it is financially viable to use Manila clam shells as a source of biowaste in the production of bioplastic products that are both environmentally conscious and beneficial to society (Tonuk, 2016). The development of a high-quality product with the ability to reduce the use of fossil fuels, the creation of waste plastic, the release of methane from landfills, and the emissions of carbon dioxide are proposed to arise from converting Manila clam shells into a bioplastic product. When appropriately reinforced, bioplastics centered on chitin could help reduce the generation of both plastic waste and agricultural waste. Therefore, the data results and analysis will ultimately be a crucial resource for the researchers as they look for more comprehensive and widespread strategies to protect and preserve the environment in the upcoming future.

MATERIALS AND METHODS

Preparation of Materials

Chitosan extraction from Manila clam shells (V. philippinarum) through four steps: mechanical treatment, deproteinization and demineralization. (Majekodunmi S., 2016). The main materials utilized in this experiment is the Manila clam shells, powdered using mortar and pestle. The other main components are the chemicals used, Sodium Hydroxide and Hydrochloric Acid. The materials that come with these procedures are the two hotplates used to heat the solutions, stirring rods, beakers for the number of setups, strainer, filter paper, pipette & aspirator, and thermometer. A precision scale was used after every treatment to measure the grams. After the demineralization, the shells are oven dried for the bioplastic solution, which consists of glycerin, vinegar and water.

Mechanical Treatment

The discarded Manila clam shells were cleaned, washed, and left to be dried, then pulverized with a mortar and pestle. The large pieces were filtered out with a strainer (Majekodunmi S., 2016).

Deproteinization

In removing the protein from the Manila clam shell, the purified chitin's molecular weight and intrinsic qualities were adversely affected by strong acid (Percot A. et al.). This strong acid, Sodium Hydroxide (NaOH), in a weight-to-weight ratio of 3g:1g of powdered shell and pellets of NaOH, respectively. The experiment utilized 120 grams of powdered shell and 40 grams of pellet NaOH in 500 ml of water and was heated with a hotplate at 60° C for 1 hour. This setup

was done three times to get larger samples, the first setup being a small amount to test the effect of the liquid NaOH on the solution. After the neutralization, it was drained, washed, dried, and measured using a precision scale.

Demineralization

The minerals in Manila clam shells, calcium carbonate, and calcium phosphate, were removed in this process. In a weight-to-volume ratio of 1g:16.67ml of water with 7% Hydrochloric Acid (HCl). The experiment utilized 60 grams of deproteinized shells and 930 ml of water, and 70 ml of HCl; this treatment will last 4 hours. Four other setups were made to increase the amount of sample, consisting of 30 grams of deproteinized shell and 465 ml of water, and 35 ml HCl using the only available size of a beaker, 600 ml. After the 4 hours, the demineralized shells were collected, washed and were oven-dried for 30 minutes, and weighed using a precision scale.

Bioplastic Solution

This study used a combination of Glycerol and chitosan extracted from Manila clam shells, vinegar, and water. Three different set-ups were prepared using varying amounts of chitosan, namely 5 grams, 10 grams, and 15 grams. For Set A, 15 grams of chitosan from Manila clam shells were mixed with 5 ml of Glycerol, 5 ml of vinegar, and 30 ml of water. After 30 seconds of stirring, the mixture was steamed in water heated to 60 degrees Celsius. The same process was repeated for Set B, using 10 grams of chitosan, and for Set C, using 5 grams of chitosan. After steaming, the samples were molded and allowed to sit at room temperature for two days until they were dry.

Table 1

Control and Experimental Setups

Variable	Experimental (Manila Clam Shells)
Amount of Powdered Shells (g)	120
Amount of NaOH Sodium Hydroxide	40 g of pellet NaOH in 500 ml of water (Ratio: 3g:1g), 60° C for 1 hour
Amount of HCl Hydrochloric Acid	1g:16.67ml of water with 7% HCl left for 4 hours
Independent Variable	Amount of powdered shells
Dependent Variable	Amount of chitosan extract
Controlled Variable	Amount of sodium hydroxide, amount of hydrochloric acid

Tensile Strength Testing

The researchers performed two tests to evaluate the characteristics of the bioplastic samples produced. The first test was the Tensile strength test, where the samples were cut into eight by three inches and hung vertically on a stand. A hook was attached to the base of the plastic, and weights were gradually added until the sample was either elongated or torn apart. This was done to measure the strength of the bioplastic (Tan et al.,2022).

Testing of Water Absorption

The second test performed was the Water absorption test. Each set-up was cut into five samples measuring three by three inches. The samples were dried using a blower and weighed before being submerged in distilled water in sealed containers for 24 hours to assess their water

absorption capacity. To calculate the amount of water absorbed, the samples were taken out of the containers, dried using paper towels, and weighed again after 24 hours (Jones et al.,2022).

One-Way ANOVA was used to evaluate the data acquired by the researchers. This type of Analysis of Variance deals with statistics that have only one changing independent variable, and in this case, the modified concentrations of chitosan in different samples.

$$F_{\text{adsorption isotherm}} = \frac{MST}{MSE}$$

$$F_{\text{time of exposure}} = \frac{MST}{MSE} \quad F_{\text{between interaction}} = \frac{MST}{MSE}$$

Where:

$F_{\text{adsorption isotherm}}$ = ANOVA for the adsorption isotherm

$F_{\text{time of exposure}}$ = ANOVA for the time of exposure

$F_{\text{between interaction}}$ = ANOVA for the interaction

MST = Mean of sum of square due to treatment

MSE = Mean of sum of squares due to error

RESULTS

TENSILE STRENGTH

Table 2

Decision and statistical analysis of data

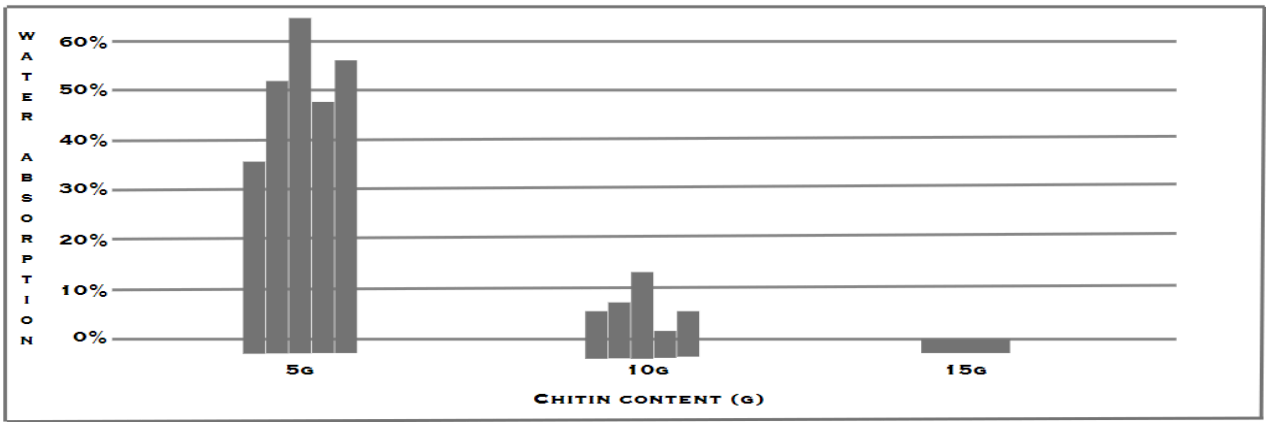
df	F Value	F crit	Decision	VI
2	12.15	3.01	H_o is Rejected	Significant

The table above shows the statistical analysis results to determine whether there is a significant difference in the data. The computed F Value, 12.15292, exceeds the F crit value of 3.011286. Therefore the H_o is rejected.

WATER ABSORPTION

Figure 1

Percentage of water absorbed after experimentation



The figure above shows the correlation between the percentage and the chitin content of the bioplastic and shows that the more chitin content, the more durable the product is.

DISCUSSION

In the study on using Manila clam shells as chitosan-based bioplastic, the researchers tested the samples using water absorption and tensile strength tests. The results were then analyzed using ANOVA to determine if significant differences existed between the three set-ups with different amounts of chitosan. Based on the ANOVA results, the null hypothesis can be rejected in favor of the alternative hypothesis.

Tables 4 and 7 show the decisions led by the results shown by One-Way ANOVA. Further discussing accepting and rejecting the null hypothesis comes down to certain conditions in ANOVA. Wherein the computed F Value has to be larger than the F Crit Value to have a significant difference, researchers reject H_o, the null hypothesis, and accept the alternative (Smith et al., 2018). Furthermore, this test was conducted on both tensile strength and water absorption (Jones et al.,2022).

The alternative hypothesis suggests a significant difference in the water absorption and tensile strength of the bioplastic samples made with different amounts of chitosan. The ANOVA results show that there is indeed a significant difference in the water absorption and tensile strength of the samples made with different amounts of chitosan (Tan et al.,2022).

These results have important implications for using Manila clam shells as a source of chitosan for bioplastic production. By testing the samples made with different amounts of chitosan, the researchers could identify the optimal amount for producing bioplastic with the desired properties (Miller et al., 2022).

Overall, accepting the alternative hypothesis and rejecting the null hypothesis is an important step in scientific research as it helps to confirm or refute a hypothesis. In this case, the ANOVA results provide valuable information on using Manila clam shells as a sustainable source of chitosan for bioplastic production (Nguyen et al., 2022).

CONCLUSION

It has been determined that Manila clam shells could be a valuable source of chitosan-based bioplastic. The product demonstrated promising results that were comparable to those of ordinary market plastic. Although lacking several essential components, such as a strong base, the bioplastic exhibited no evidence of water absorption, and its tensile strength was practically as high as that of commercial plastic. Fundamentally, even if it might not be suitable for all applications, the bioplastic could be used successfully as a plastic cover to enhance its performance.

RECOMMENDATION

The researchers recommend that despite the potential of bioplastic made from chitin extracted from Manila clam shells as an environmentally-friendly alternative to conventional petroleum-based plastics, its strength, and durability still need to be on par with market-grade plastics. Hence, it may not be appropriate for applications that demand high levels of durability, such as heavy-duty packaging or large containers. The researchers encourage future researchers to consider the biodegradibility when evaluating the suitability of bioplastics derived from Manila clam shells for specific products or applications.

ACKNOWLEDGEMENT

We want to express our sincere appreciation to several individuals who were crucial in assisting us in completing our research paper. Our deepest gratitude goes to Mr. Demar G. Bayona, our research advisor, for his invaluable counsel and unwavering support, which motivated us to overcome numerous obstacles during the research process.

Mr. Mark Allen Dela Cruz, our laboratory technician, was extremely generous in allowing us to use the laboratory facilities and equipment necessary for conducting our experiments. With his help, we were able to conduct the research.

We want to thank our qualified scientist, Leal Christian M. Juat, for guiding us as we conducted tests on tensile strength and water absorption.

Additionally, we appreciate the guidance and assistance of our school principal, Mr. Jaime S. De Vera, and our former school principal, Mrs. Juliana T. Alvarez, who provided assistance and advice on our research.

We want to convey our deepest appreciation to our parents and guardians for their constant support and understanding during this research process. They were a constant source of inspiration for us, giving us the strength to keep going despite difficulties.

Last, we owe our accomplishment to the kindness and mercy of the All-Powerful God, who gave us the direction, fortitude, and information we needed to accomplish our research goals. We are incredibly grateful for His favor and constant assistance throughout this venture.

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APPENDICES

Appendix A- Approved Research Plan

RESEARCH PLAN

Tentative Title

The potential of Manila clam shells *(Venerupis philippinarum)* as chitosan-based bioplastic

Proponents

Leader: Ashley Nicole C. Dacanay

Members:

1. Ram Christan B. Halcon
2. Juan Miguel L. De Onon
3. Leal Isaiah M. Juat

Proposed Date

Start: Third Week of February 2023

End: Second Week of April 2023

Rationale

Plastic waste in the Philippines is at least 2.7 million metric tons, and, according to the DENR, produces 7000 metric tons of plastic waste daily (Cariaso B., 2022). Furthermore, globally, statistics concluded that there are now 5.25 trillion macro and micro pieces of plastic in our ocean (Parker L., 2022). Furthermore, plastic bags can take 1000 years to disintegrate, thus affecting our environment. (Polka E. 2018). A related study stated that microorganisms could completely degrade chitin bioplastic in 7 weeks (Zhou Y. et al., 2022). Chitosan-based products

have already existed and been commercialized for many different applications, and that also applies to it being used as bioplastic; main sources are also common byproducts of the food processing sector and have grown at a sturdy pace, thus only proving how effective it is and how much potential it has as a replacement for non-degradable plastics (Priyadarshi R. & Rhim J., 2020; Elieh-Ali-Komi D. & Hamblin M. 2016). Specifically, it has exceptional properties such as biodegradability, strength, elongation, and non-toxicity (Silva H. et al., 2022). This is a potential replacement, not only helpful to the environment in waste management and the expense compared to standard plastic.

Manila clam shells (*Venerupis philippinarium*) are found throughout the Philippines (Adams R. et al., 2018) and are sold in markets as the Manila Clam; however, leftover clam shells are left unused around 1,000 - 1500 tons each year (Recev et al., 2017). Manila clam shells can be used as a source of chitosan (Andrew S. et al., 2018). Chitin is one of the most widespread polymers in nature (Gaisal M. et al., 2018). Chitin is a biopolymer and polysaccharide composed of modified glucose chains (Mutmainna I. et al., 2019). Chitin is often considered a component of bioplastic for its advantages, such as biodegradable, stable chemical reactions (Abdullah et al., 2020), non-toxic, and low chemical selectivity (Augustin E. et al., 2017). The literature claims that crab shells are a great source of chitin (Fernando L. et al., 2017).

Manila clam shells can be a great source of chitin since it is a shellfish that also has 30%-50% chitin (Hajji S. et al., 2019). It is an effective material as a bioplastic since chitin bioplastic exhibits high barrier and flame resistance, resilience to high temperatures, mechanical characteristics like elongation and better tensile strength, and properties of soil deterioration (Zhou Y. et al., 2022). These studies concluded that Manila clam shells are a great source of chitin due to their abundance and high chitin content. The lack of studies utilizing Manila clam

shells as a source of chitin also shows a need for more studies about its bioplastic properties. However, studies show that Shrimp can already be used in making bioplastics. This will help determine if Manila clam shells have the potential to be more effective than Shrimp chitosan-based bioplastic since they are both shellfish that produce chitin.

One of humanity's primary concerns in the twenty-first century is environmental challenges. Plastics, with their slow degradation rate, are one of the main causes of these problems. Studies in different approaches are being conducted to lessen the negative impacts of plastics, such as using ecological resources to create biodegradable plastic. The potential of Manila clam shells (V. philippinarum) as Chitosan-Based Bioplastic was thus extensively studied by researchers to promote sustainability instead of the traditional plastics often used today. Perishable plastics disintegrate over time, reducing the quantity of waste produced and the amount of litter in landfills (Vettkötter, 2019). Bioplastics aid in conserving non-renewable energy sources like petroleum because they are created from natural ingredients. (Psadmin, 2018). Additionally, bioplastics can lessen reliance on fossil fuels, promote industry sustainability, and enable manufacturers to diversify feedstocks, which can be very advantageous to many businesses, particularly those that will be greatly and favorably affected by this study (Barett, 2019). Furthermore, this study will be a great help to alternative researchers since it will act as a reminder to them to always look for individuals who might be able to fill in any gaps and supply important information when it comes to the study, chitosan-based bioplastic (Steffen, 2019).

The main objective of this study is to explore the viability of using Manila clam shells as a source of biowaste in the creation of helpful bioplastic bags and kind to the environment to benefit society by reducing plastic waste. Moreover, it supports the biocomposite industry by

offering new options and solutions. The production of plastic waste and agricultural waste could be reduced with the use of bioplastics based on chitin when reinforced properly.

A. Problem Being Addressed

Statement of the Problem

General Question:

1. Can chitosan extracted from Manila clam shells be effectively utilized as a material for bioplastic production?

Specific Questions:

1. How quickly does the Manila clam shells chitosan-based bioplastic degrade?

2. What is the efficacy of Manila clam shells chitosan-based bioplastic in terms of:

2.1 Water Absorption 2.2 Tensile Strength

B. Goals

- To utilize the chitin extracted from the Manila clam shells *(Venerupis philippinarum)* as a component of bioplastic in an effort to replace non-biodegradable plastics.
- To determine which chitosan-proportion has better properties in terms of water absorption and tensile strength.

C. Description in detail of methods and procedures

C1. Procedures

Preparation of Materials

Chitosan extraction from Manila clam shells (V. philippinarum) through four steps: mechanical treatment, deproteinization and demineralization. (Majekodunmi S., 2016). The main materials utilized in this experiment is the Manila clam shells, powdered using mortar and pestle. The other main components are the chemicals used, Sodium Hydroxide and Hydrochloric Acid. The materials that come with these procedures are the two hotplates used to heat the solutions, stirring rods, beakers for the number of setups, strainer, filter paper, pipette & aspirator, and thermometer. A precision scale was used after every treatment to measure the grams. After the demineralization, the shells are oven dried for the bioplastic solution, which consists of glycerin, vinegar and water.

Mechanical Treatment

The discarded Manila clam shells were cleaned, washed, and left to be dried, then pulverized with a mortar and pestle. The large pieces were filtered out with a strainer (Majekodunmi S., 2016).

Deproteinization

In removing the protein from the Manila clam shell, the purified chitin's molecular weight and intrinsic qualities were adversely affected by strong acid (Percot A. et al.). This strong acid, Sodium Hydroxide (NaOH), in a weight-to-weight ratio of 3g:1g of powdered shell and pellets of NaOH, respectively. The experiment utilized 120 grams of powdered shell and 40 grams of

pellet NaOH in 500 ml of water and was heated with a hotplate at 60° C for 1 hour. This setup was done three times to get larger samples, the first setup being a small amount to test the effect of the liquid NaOH on the solution. After the neutralization, it was drained, washed, dried, and measured using a precision scale.

Demineralization

The minerals in Manila clam shells, calcium carbonate, and calcium phosphate, were removed in this process. In a weight-to-volume ratio of 1g:16.67ml of water with 7% Hydrochloric Acid (HCl). The experiment utilized 60 grams of deproteinized shells and 930 ml of water, and 70 ml of HCl; this treatment will last 4 hours. Four other setups were made to increase the amount of sample, consisting of 30 grams of deproteinized shell and 465 ml of water, and 35 ml HCl using the only available size of a beaker, 600 ml. After the 4 hours, the demineralized shells were collected, washed and were oven-dried for 30 minutes, and weighed using a precision scale.

Bioplastic Solution

This study used a combination of Glycerol and chitosan extracted from Manila clam shells, vinegar, and water. Three different set-ups were prepared using varying amounts of chitosan, namely 5 grams, 10 grams, and 15 grams. For Set A, 15 grams of chitosan from Manila clam shells were mixed with 5 ml of Glycerol, 5 ml of vinegar, and 30 ml of water. After 30 seconds of stirring, the mixture was steamed in water heated to 60 degrees Celsius. The same process was repeated for Set B, using 10 grams of chitosan, and for Set C, using 5 grams of chitosan. After steaming, the samples were molded and allowed to sit at room temperature for two days until they were dry.

Table 1

Control and Experimental Setups

Variable	Experimental (Manila Clam Shells)
Amount of Powdered Shells (g)	120
Amount of NaOH Sodium Hydroxide	40 g of pellet NaOH in 500 ml of water (Ratio: 3g:1g), 60° C for 1 hour
Amount of HCl Hydrochloric Acid	1g:16.67ml of water with 7% HCl left for 4 hours
Independent Variable	Amount of powdered shells
Dependent Variable	Amount of chitosan extract
Controlled Variable	Amount of sodium hydroxide, amount of hydrochloric acid

Tensile Strength Testing

The researchers performed two tests to evaluate the characteristics of the bioplastic samples produced. The first test was the Tensile strength test, where the samples were cut into eight by three inches and hung vertically on a stand. A hook was attached to the base of the plastic, and weights were gradually added until the sample was either elongated or torn apart. This was done to measure the strength of the bioplastic (Tan et al.,2022).

Testing of Water Absorption

The second test performed was the Water absorption test. Each set-up was cut into five samples measuring three by three inches. The samples were dried using a blower and weighed before being submerged in distilled water in sealed containers for 24 hours to assess their water

absorption capacity. To calculate the amount of water absorbed, the samples were taken out of the containers, dried using paper towels, and weighed again after 24 hours (Jones et al.,2022)

One-Way ANOVA was used to evaluate the data acquired by the researchers. This type of Analysis of Variance deals with statistics that have only one changing independent variable, and in this case, the modified concentrations of chitosan in different samples.

$$F_{\text{adsorption isotherm}} = \frac{MST}{MSE}$$

$$F_{\text{time of exposure}} = \frac{MST}{MSE} \quad F_{\text{between interaction}} = \frac{MST}{MSE}$$

Where:

$F_{\text{adsorption isotherm}}$ = ANOVA for the adsorption isotherm

$F_{\text{time of exposure}}$ = ANOVA for the time of exposure

$F_{\text{between interaction}}$ = ANOVA for the interaction

MST = Mean of sum of square due to treatment

MSE = Mean of sum of squares due to error

Characterization

Tensile Strength

Tensile strength is a film's resistance to breaking under tension or the stress it can withstand while being pulled before breaking. The universal tensile machine, 5 kN Instron, will be used to determine the tensile characteristics of the specimens. The obtained tensile strength results will then be subjected to a Dependent T-test (Corrosionpedia, n.d. 2020).

C2. Risk and Safety

Before experimenting, the researchers will receive safety training and review permission when performing the tasks. It can be difficult to extract Chitin from Manila clam shells (*Venerupis philippinarum*). The researchers will not perform the extraction, but they must wear protective equipment while preparing and observing the experiment. The researchers are vulnerable to health risks, physical injury, and psychological harm. High and low-pH chemicals, such as hydrochloric acid and sodium hydroxide solutions, are also used in extraction processes (Majekodunmi S., 2016). Hydrochloric acid is a corrosive chemical that, if consumed, can cause damage to the eyes, skin, and mouth. Sodium hydroxide is a strong base at pH 13. There would be no injuries or accidents if chemicals were handled safely. Experimentation must take place in a laboratory outfitted with all necessary equipment. Wear protective clothing, goggles, and gloves; avoid eating in the lab; practice hygiene; use proper chemical storage containers; stay focused and not distracted; label your workspace to be more organized; and avoid eye or skin contact with chemicals. These are safety precautions that should be taken. Before you begin, double-check that everything is in order.

C3. Data Analysis

Distinction between the variables in this study, specifically the chitosan will be measured using a comparative statistical tool. To identify which amount of the variable will produce greater results than the traditional bioplastic to chitin studies, in terms of the different characteristics also considering the cost and advantages the Manila clam shells will provide. The examination of qualitative data for the mentioned characteristics is the main emphasis of this study. The obtained data's significant variations will be analyzed and evaluated.

Comparing the differences from two related groups has a proper statistical tool to be used and it is known as the One-Way ANOVA. The researchers will utilize this tool because the study has a variable that utilizes three set-ups, given that the researchers will test the variable and finally the characteristics are tested and thus, One-Way ANOVA (ASC, n.d.). The results are to be collected from the different processes mentioned in the characterization section of the paper, specifically water absorption and tensile strength.

One-Way ANOVA Formula:

$$F_{\text{adsorption isotherm}} = MSE/MST$$

$$F_{\text{time of exposure}} = MSE/MST$$

$$F_{\text{between interaction}} = MSE/MST$$

Where:

$F_{\text{adsorption isotherm}}$ = ANOVA for the adsorption isotherm

$F_{\text{time of exposure}}$ = ANOVA for the time of exposure

$F_{\text{between interaction}}$ = ANOVA for the interaction

MST = Mean of sum of square due to treatment

MSE = Mean of sum of squares due to error

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Checklist for Adult Sponsor (1)

This completed form is required for ALL projects.

To be completed by the Adult Sponsor in collaboration with the student researcher(s):

Student's Name(s): Ashley Nicole C. Dacanay, Juan Miguel De Onon, Ram Christan Halcon, Leal Isaiah Tuat

Project Title: The potential of Manila clam shells (Venerupis philippinarum) as chitosan-based bioplastic

1. ☑ I have reviewed the ISEF Rules and Guidelines, including the science fair ethics statement.
2. ☑ I have reviewed the student's completed Student Checklist (1A) and Research Plan/Project Summary.
3. ☐ I have worked with the student and we have discussed the possible risks involved in the project.
4. ☐ The project involves one or more of the following and requires prior approval by an SRC, IRB, IACUC or IBC:
   - ☐ Humans
   - ☐ Vertebrate Animals
   - ☐ Potentially Hazardous Biological Agents
     - ☐ Microorganisms ☐ rDNA ☐ Tissues
5. ☐ Items to be completed for **ALL PROJECTS**
   - ☑ Adult Sponsor Checklist (1)
   - ☑ Student Checklist (1A)
   - ☑ Research Plan/Project Summary
   - ☑ Approval Form (1B)
   - ☐ Regulated Research Institutional/Industrial Setting Form (1C) (when applicable; after completed experiment)
   - ☐ Continuation/Research Progression Form (7) (when applicable)

Additional forms required if the project includes the use of one or more of the following (check all that apply):

☐ **Humans,** including student designed inventions/prototypes. (Requires prior approval by an Institutional Review Board (IRB); see full text of the rules.)
- ☐ Human Participants Form (4) or appropriate Institutional IRB documentation
- ☐ Sample of Informed Consent Form (when applicable and/or required by the IRB)
- ☐ Qualified Scientist Form (2) (when applicable and/or required by the IRB)

☐ **Vertebrate Animals** (Requires prior approval, see full text of the rules.)
- ☐ Vertebrate Animal Form (5A) - for projects conducted in a school/home/field research site (SRC prior approval required
- ☐ Vertebrate Animal Form (5B) - for projects conducted at a Regulated Research Institution. (Institutional Animal Care and Use Committee (IACUC) approval required prior experimentation.)
- ☐ Qualified Scientist Form (2) (Required for all vertebrate animal projects at a regulated research site or when applicable)

☐ **Potentially Hazardous Biological Agents** (Requires prior approval by SRC, IACUC or IBC, see full text of the rules.)
- ☐ Potentially Hazardous Biological Agents Risk Assessment Form (6A)
- ☐ Human and Vertebrate Animal Tissue Form (6B) - to be completed in addition to Form 6A when project involves the use of fresh or frozen tissue, primary cell cultures, blood, blood products and body fluids.
- ☐ Qualified Scientist Form (2) (when applicable)
- ☐ The following are exempt from prior review but require a Risk Assessment Form 3: projects involving protists, archae and similar microorganisms; projects using manure for composting, fuel production or other non-culturing experiments; projects using color change coliform water test kits, microbial fuel cells; and projects involving decomposing vertebrate organisms.

☐ **Hazardous Chemicals, Activities and Devices** (No SRC prior approval required, see full text of the rules.)
- ☐ Risk Assessment Form (3)
- ☐ Qualified Scientist Form (2) (required for projects involving DEA-controlled substances or when applicable)

☐ **Other**
- ☐ Risk Assessment Form (3)

☐ **I attest to the information checked above and that I have read and agree to abide by the science fair ethics statement.**

Adult Sponsor's Printed Name	Signature	Date of Review (mm/dd/yy)

Phone	Email

Student Checklist (1A)

This form is required for ALL projects.

1. a. Student/Team Leader: Ashley Nicole C. Dacanay Grade: 10

   Email: ashleynicole271125@gmail.com Phone: 09984685343

   b. Team Member: Rom Christan Halcon, Leal Isaiah Juat c. Team Member: Juan Miguel De Onon

2. Title of Project: The potential of Manila clam shells (Venerupis Philippinarum) as chitosan-based bioplastic

3. School: Valenzuela City School of Mathematics and Science School Phone: 291-5591 | 942-9360

   School Address: A. Pablo St. Malinta Valenzuela City

4. Adult Sponsor: Demar G. Bayona Phone/Email: demar.bayona@deped.gov.ph

5. Does this project need SRC/IRB/IACUC or other pre-approval? ☐ Yes (Tentative start date: _____) ☒ No

6. Is this a continuation/progression from a previous year? ☑ Yes ☒ No
   If Yes:
   a. Attach the previous year's ☐ Abstract **and** ☑ Research Plan/Project Summary
   b. Explain how this project is new and different from previous years on
   ☑ Continuation/Research Progression Form (7)

7. This year's experimentation/data collection:

   February 28 2023 (Actual Start Date: (mm/dd/yy))

   March 31 2023 (End Date: (mm/dd/yy))

8. Where will you conduct your experimentation? (check all that apply)
   ☐ Research Institution ☑ School ☐ Field ☑ Home ☐ Other: _____

9. Source of Data:
   ☑ Collected self/mentor ☐ Other Describe/url: _____

10. List the name and address of all non-home and non-school work site(s), whether you worked there virtually or on-site:

Name		
Address:		
Phone/ email		

11. **Complete a Research Plan/Project Summary following the Research Plan/Project Summary instructions must accompany this form.**

12. **An abstract is required for all projects after experimentation.**

Approval Form (1B)

A completed form is required for each student, including all team members.

1. To Be Completed by Student and Parent

a. **Student Acknowledgment:**

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the science fair ethics statement.

Student researchers are expected to maintain the highest standards of honesty and integrity. Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include but are not limited to plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and ISEF.

Ashley Nicole C. Dacanay		January 17, 2023
Student's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

b. **Parent/Guardian Approval:** I have read and understand the risks and possible dangers involved in the **Research Plan/Project Summary**. I consent to my child participating in this research.

Lucille C. Dacanay	Dacanay	January 17, 2023
Parent/Guardian's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. **Required for projects that need prior SRC/IRB approval BEFORE experimentation** (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan/Project Summary** and all the required forms are included. My signature indicates approval of the **Research Plan/Project Summary** before the student begins experimentation.

SRC/IRB Chair's Printed Name

Signature

Date of Approval (mm/dd/yy) (Must be prior to experimentation.)

OR

b. **Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.**

This project was conducted at a regulated research institution **(not home or high school, etc.)**, was reviewed and approved by the proper institutional board before experimentation and complies with the ISEF Rules. **Attach (1C) and any required institutional approvals (e.g. IACUC, IRB).**

SRC Chair's Printed Name

Signature

Date of Signature (mm/dd/yy) (May be after experimentation)

3. Final ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan/Project Summary** and complies with all ISEF Rules.

Regional SRC Chair's Printed Name	Signature	Date of Approval (mm/dd/yy)
State/National SRC Chair's Printed Name *(where applicable)*	Signature	Date of Approval (mm/dd/yy)

Approval Form (1B)

A completed form is required for each student, including all team members.

1. To Be Completed by Student and Parent

a. Student Acknowledgment:

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the science fair ethics statement.

Student researchers are expected to maintain the highest standards of honesty and integrity. Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include but are not limited to plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and ISEF.

JUAN MIGUEL DE ONON		January 17 2023
Student's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

b. Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the **Research Plan/Project Summary**. I consent to my child participating in this research.

FERNANDO DE ONON		January 17 2023
Parent/Guardian's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. Required for projects that need prior SRC/IRB approval BEFORE experimentation (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan/ Project Summary** and all the required forms are included. My signature indicates approval of the **Research Plan/Project Summary** before the student begins experimentation.

SRC/IRB Chair's Printed Name

Signature

Date of Approval (mm/dd/yy) (Must be prior to experimentation.)

OR

b. Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.

This project was conducted at a regulated research institution **(not home or high school, etc.)**, was reviewed and approved by the proper institutional board before experimentation and complies with the ISEF Rules. **Attach (1C) and any required institutional approvals (e.g. IACUC, IRB).**

SRC Chair's Printed Name

Signature

Date of Signature (mm/dd/yy) (May be after experimentation)

3. Final ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan/Project Summary** and complies with all ISEF Rules.

Regional SRC Chair's Printed Name	Signature	Date of Approval (mm/dd/yy)
State/National SRC Chair's Printed Name *(where applicable)*	Signature	Date of Approval (mm/dd/yy)

Approval Form (1B)

A completed form is required for each student, including all team members.

1. To Be Completed by Student and Parent

a. Student Acknowledgment:

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the science fair ethics statement.

Student researchers are expected to maintain the highest standards of honesty and integrity. Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include but are not limited to plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and ISEF.

Leal Isaiah M. Iuat	[signature]	January 17, 2023
Student's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

b. Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the **Research Plan/Project Summary**. I consent to my child participating in this research.

Alma M. Iuat	[signature]	January 17, 2023
Parent/Guardian's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. Required for projects that need prior SRC/IRB approval BEFORE experimentation (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan/Project Summary** and all the required forms are included. My signature indicates approval of the **Research Plan/Project Summary** before the student begins experimentation.

SRC/IRB Chair's Printed Name

Signature

Date of Approval (mm/dd/yy) (Must be prior to experimentation.)

OR

b. Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.

This project was conducted at a regulated research institution **(not home or high school, etc.)**, was reviewed and approved by the proper institutional board before experimentation and complies with the ISEF Rules. **Attach (1C) and any required institutional approvals (e.g. IACUC, IRB).**

SRC Chair's Printed Name

Signature

Date of Signature (mm/dd/yy) (May be after experimentation)

3. Final ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan/Project Summary** and complies with all ISEF Rules.

Regional SRC Chair's Printed Name	Signature	Date of Approval (mm/dd/yy)
State/National SRC Chair's Printed Name *(where applicable)*	Signature	Date of Approval (mm/dd/yy)

Approval Form (1B)

A completed form is required for each student, including all team members.

1. To Be Completed by Student and Parent

a. **Student Acknowledgment:**

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the science fair ethics statement.

Student researchers are expected to maintain the highest standards of honesty and integrity. Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include but are not limited to plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and ISEF.

Sam Christan B. Halcon		January 17, 2023
Student's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

b. **Parent/Guardian Approval:** I have read and understand the risks and possible dangers involved in the **Research Plan/Project Summary**. I consent to my child participating in this research.

Cristine B. Halcon		January 17, 2023
Parent/Guardian's Printed Name	Signature	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. **Required for projects that need prior SRC/IRB approval BEFORE experimentation** (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan/ Project Summary** and all the required forms are included. My signature indicates approval of the **Research Plan/Project Summary** before the student begins experimentation.

SRC/IRB Chair's Printed Name

Signature

Date of Approval (mm/dd/yy) (Must be prior to experimentation.)

OR

b. **Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.**

This project was conducted at a regulated research institution **(not home or high school, etc.)**, was reviewed and approved by the proper institutional board before experimentation and complies with the ISEF Rules. **Attach (1C) and any required institutional approvals (e.g. IACUC, IRB).**

SRC Chair's Printed Name

Signature

Date of Signature (mm/dd/yy) (May be after experimentation)

3. Final ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan/Project Summary** and complies with all ISEF Rules.

Regional SRC Chair's Printed Name	Signature	Date of Approval (mm/dd/yy)
State/National SRC Chair's Printed Name *(where applicable)*	Signature	Date of Approval (mm/dd/yy)

Qualified Scientist Form (2)

May be required for research involving human participants, vertebrate animals, potentially hazardous biological agents, and hazardous chemicals, activities and devices. Must be completed and signed before the start of student experimentation.

Student's Name(s) Ashley Nicole C. Dacanay, Juan Miguel De Onon, Ram Christan Halcon, Leal Isaiah Juat

Title of Project The potential of Manila clam shells (Venerupis Philippinarum) as chitosan-based bioplastic

To be completed by the Qualified Scientist:

Scientist Name: Leal Christian M. Juat

Educational Background: Ateneo College Graduate Degree(s): BS CHEMISTRY – BS MATERIAL SCIENCE ENGINEERING

Experience/Training as relates to the student's area of research: Undergraduate thesis BS Chemistry - Polymeric Materials

Ateneo de Manila University Position/Institution: leal.juat@obf.ateneo.edu Email/Phone:

1. Have you reviewed the ISEF rules relevant to this project and the science fair ethics statement relevant to this project? ☑ Yes ☐ No
2. Will any of the following be used?
   a. Human participants ☐ Yes ☑ No
   b. Vertebrate animals ☐ Yes ☑ No
   c. Potentially hazardous biological agents (microorganisms, rDNA and tissues, including blood and blood products) ☐ Yes ☑ No
   d. Hazardous substances and devices ☐ Yes ☑ No
3. Will this study be a sub-set of a larger study? ☐ Yes ☑ No
4. Will you directly supervise the student? ☑ Yes ☐ No
   a. If no, who will directly supervise and serve as the Designated Supervisor?
   b. Experience/Training of the Designated Supervisor:

To be completed by the Qualified Scientist:

I certify that I have reviewed and approved the Research Plan/Project Summary prior to the start of the experimentation. If the student or Designated Supervisor is not trained in the necessary procedures, I will ensure her/his training. I will provide advice and supervision during the research. I have a working knowledge of the techniques to be used by the student in the Research Plan. I understand that a Designated Supervisor is required when the student is not conducting experimentation under my direct supervision.

Leal Christian M. Juat
Qualified Scientist's Printed Name

Signature

05/23/2023
Date of Approval (mm/dd/yy)

To be completed by the Designated Supervisor when the Qualified Scientist cannot directly supervise.

I certify that I have reviewed the Research Plan and have been trained in the techniques to be used by this student, and I will provide direct supervision.

Designated Supervisor's Printed Name

Signature

Date of Approval (mm/dd/yy)

Phone

Email

Risk Assessment Form (3)

Must be completed before experimentation. Required for projects involving hazardous chemicals, activities or devices and may be needed by other projects.

Student's Name(s) Ashley Nicole C. Dacanay, Juan Miguel De Onon, Ram Christan Halcon, Leal Isaiah Juat

Title of Project The potential of Manila clam shells (Venerupis Philippinarum) as chitosan-based bioplastic

To be completed by the Student Researcher(s) in collaboration with Designated Supervisor/Qualified Scientist: (All questions must be answered; additional page(s) may be attached.)

1. Identify and assess the risks and hazards involved in this project.
   1. Chemical Hazards: The use of sodium Hydroxide (NaOH) and Hydrochloric acid (HCl) can be dangerous if not handled properly. These chemicals can cause irritation and respiratory issues. It is important to use PPE when handling these chemicals.
   2. Inhalation Hazards: Chemicals used in the process may release fumes or gases that can be harmful when inhaled. Ventilation should be provided in the laboratory to reduce risk of exposure.

2. a) List all hazardous chemicals, activities or devices to be used; b) identify and list all microorganisms to be used that are exempt from pre-approval (see Potentially Hazardous Biological Agent rules).
   - Sodium Hydroxide (NaOH)
   - Hydrochloric Acid (HCl)
   - Glycerol
   - Hotplate
   - Beaker
   - Stirring rod
   - Mortar and pestle

3. Describe the safety precautions and procedures that will be used to reduce the risks.
   1. Personal Protective Equipment (PPE) - all individuals should wear appropriate PPE to protect themselves from chemical exposure and physical hazards
   2. Chemical Handling - Sodium Hydroxide (NaOH) and Hydrochloric acid (HCl) are corrosive substances and proper handling procedures should be followed. This include using a appropriate lab apparatus and chemical resistant containers.
   3. Dilution and Mixing - when preparing the solutions, the chemicals should be added to the water slowly and with constant stirring to prevent splashing and spilling to avoid violent reactions.

4. Describe the disposal procedures that will be used (when applicable).
   1. Dilution and Safe Drainage: After neutralization, the solution should be diluted with a lot of water to make disposal safer. The diluted solution can be slowly drained down a sewage drain or water disposal system.
   2. Washing Equipment: To remove any remaining chitosan or chemicals, containing beakers, stirring rods and containers should be thoroughly washed with water preventing contamination and proper waste disposal
   3. Bioplastic Samples: Dry bioplastic samples can be handled as solid waste. The samples can be disposed of as non-toxic biodegradable waste.

5. List the source(s) of safety information.

   Safety Data Sheets (MSDS for Sodium Hydroxide, Hydrochloric Acid and glycerol)

To be completed and signed by the Designated Supervisor (or Qualified Scientist, when applicable):
I agree with the risk assessment and safety precautions and procedures described above. I certify that I have reviewed the Research Plan and the International Rules, including the science fair ethics statement and will provide direct supervision.

Designated Supervisor's Printed Name | Signature | Date of Review (mm/dd/yy)

Experience/Training as relates to the student's area of research

Position/Institution | Phone or email contact information

Continuation/Research Progression Projects Form (7)

Required for projects that are a continuation/progression in the same field of study as a previous project. This form must be accompanied by the previous year's abstract and Research Plan/Project Summary.

Student's Name(s) Ashley Nicole C. Dacanay, Juan Miguel De Onon, Ram Christan Halcon, Leal Isaiah Tuat

To be completed by Student Researcher(s): List all components of the current project that make it new and different from previous research. The information must be on the form; use an additional form for previous year and earlier projects.

Components	Current Research Project	Previous Research Project: Year: 2022
1. Title	The potential of Manila clam shells (Venerupis philippinarum) as chitosan-based bioplastic.	The effectiveness and environmental impact of Manila clam shells (Venerupis Philippinarum) as chitosan-based bioplastic
2. Change in goal/ purpose/objective	To find a alternative way to obtain chitosan · To test the effectiveness of Manila clam shells as chitosan-based bioplaitic.	To produce a high-quality product that has the potential to cut down on the consumption of fossil fuels the production of plastic waste and emissions of carbon dioxide
3. Changes in methodology	The researchers made 6 samples with equal mechanical treatment but with different conditions under the procedures	The researchers made 4 samples with equal mechanical treatment but with different conditions under the procedures
4. Variable studied	Manila clam shells	Manila clam shells
5. Additional changes	Testing: Water Absorption and Tensile Strength Data Analysis: Standard Deviation	Testing: Thickness, Moisture content, Density water solubility, water uptake Tensile strength. Data Analysis: Analysis of Variance (ANOVA)

Attached are:

☐ Abstract and Research Plan/Project Summary, Year 2022

I/we hereby certify that the above information is correct and that the current year Abstract & Certification and project display board properly reflect work done only in the current year.

Ashley Nicole Dacanay — Student's Printed Name(s)

Signature

05/25/23 — Date of Signature (mm/dd/yy)

Appendix B- Photo documentation

Sun drying the Manila clam shells (*Venerupis Philippinarum)*

Using the mortar and pestle on the Manila clam shells (*Venerupis Philippinarum)*

Measuring the powdered shells using the precision digital scale

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NCR City of Manila, First District Philippines
Telefax No.: 8524-3902, 8714-8697
EDNA MONTERO PULIDO - Prop.
VAT Reg. TIN: 247-078-358-00002

SALES INVOICE
(WHOLESALE)
No. 27726

SOLD TO FERNANDO DE ONON
Address: Mahulay Val.
Date: 3-16-2023
Business Style: _____ TIN _____ Terms: _____

Please furnish the following articles / services:

Quantity	ARTICLES	Unit Price	AMOUNT
1BX	GLOVES medium		200.00
500ml	Sodium Hydroxide		800.00
	VATABLE Sales		
	VAT-Exempt Sales		
	Zero Rated Sales	TOTAL SALES	
	VAT Amount	ADD: VAT	
		TOTAL AMOUNT DUE	1,000.00

Order By: _____
Approved By: _____
RECEIVED BY: _____

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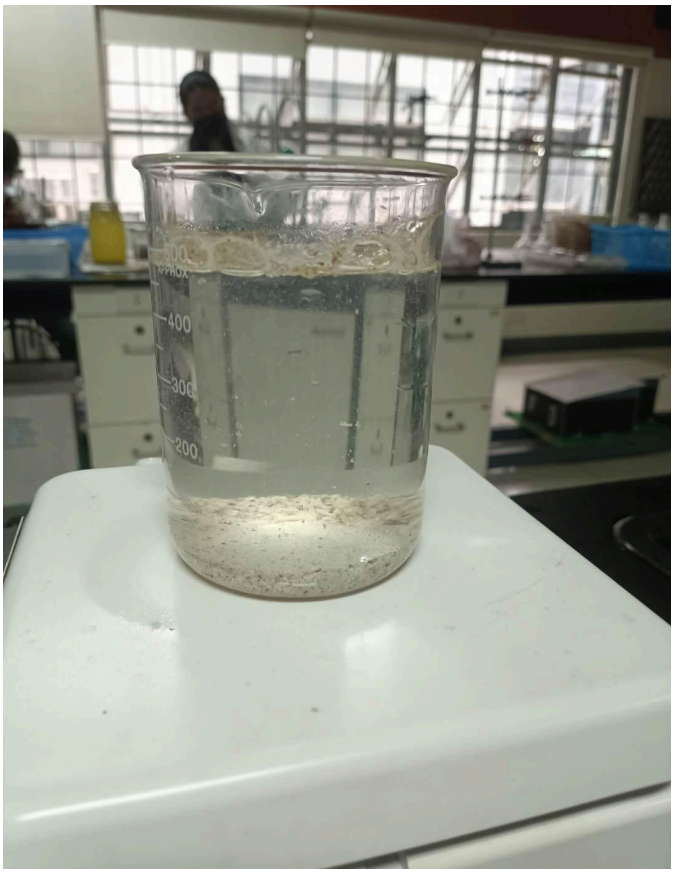
Expired Date: 01-24-2024

"THIS SALES INVOICE SHALL BE VALID FOR FIVE (5) YEARS FROM THE DATE OF ATP"

\Receipt of the materials bought in Puljed Trading in Sta. Cruz Manila



Deproteinization

Straining the excess water (demineralization)

Oven drying the shells

The samples

Preparation for water absorption testing

Tensile strength testing

Appendix C- Data Analysis computations

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	3	0	0	0
Column 2	3	30.06147	10.02049	10.87376
Column 3	3	166.5999	55.53329	96.26094

ANOVA

ce of Varic	SS	df	MS	F	P-value	F crit
Between (	5255.771	2	2627.885	73.5864	6.01E-05	5.143253
Within Gr	214.2694	6	35.71156			
Total	5470.04	8				

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	4	16	4	0
Column 2	4	22.8	5.7	0.113333
Column 3	4	32.8	8.2	0.086667

ANOVA

ce of Varic	SS	df	MS	F	P-value	F crit
Between (	35.70667	2	17.85333	267.8	9.59E-09	4.256495
Within Gr	0.6	9	0.066667			
Total	36.30667	11				

Tensile strength & Water absorption

Appendix D- Communication letters

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
DIVISION OF CITY SCHOOLS - VALENZUELA
VALENZUELA CITY SCHOOL OF MATHEMATICS AND SCIENCE
A. PABLO ST., MALINTA, VALENZUELA CITY

February 21, 2023

MARK ALLEN DELA CRUZ
Laboratory Technician
Valenzuela City School of Mathematics and Science
Malinta, Valenzuela City

Dear Sir:

Good day!

We, **Ashley Dacanay, Ram Halcon, JM De Onon and Leal Juat,** Grade 10 students from Valenzuela City School of Mathematics and Science, would like to request permission to use the Biology Laboratory for the conducting of our mechanical treatment from **12:10 pm** to **3:50 pm** on **February 28, 2023**. If available, we would like to borrow some laboratory equipment, namely four pairs of mortar and pestle. This request is in connection with our research study entitled **"The potential of Manila clamshells (*Venerupis philippinarum*) as chitin-based bioplastic".**

We are hoping for your kind assistance and guidance. Thank you!

Respectfully,

ASHLEY NICOLE DACANAY
Team Leader

Noted by:

DEMAR G. BAYONA
Research Adviser

ALBERT E. TOLENTINO
Head Teacher III
Science Department

Endorsed:

JAIME S. DE VERA, JR.
Principal III

Approved by:

Mark Allen D. Dela Cruz
02-22-2023

(02) 8291-5591
vcsms.valenzuela@gmail.com
www.valscience.webs.com

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
DIVISION OF CITY SCHOOLS - VALENZUELA
VALENZUELA CITY SCHOOL OF MATHEMATICS AND SCIENCE
A. PABLO ST., MALINTA, VALENZUELA CITY

February 21, 2023

Good day Teachers!

We, **Ashley Nicole Dacanay, Ram Christan Halcon, Juan Miguel De Onon and Leal Isaiah Juat**, Grade 10 students from Valenzuela City School of Mathematics and Science would like to request permission to allow us to continue to conduct our experiment, chitin extraction, in the school laboratory from **12:10 pm to 3:50pm on February 28 2023** in connection with our study ***"The potential of Manila clam shells (Venerupis philippinarum) as chitin-based bioplastic."***

We are hoping for your kind consideration.

Thank you!

Sincerely,

ASHLEY NICOLE DACANAY
Team Leader

Noted by:

DEMAR G. BAYONA
Research Adviser

Recommending Approval.

ALBERT H. JOLENTINO
Head Teacher III
Science Department

Approved by:

JAIME S. DE VERA, JR.
Principal III

(02) 8291-5591
vcsms.valenzuela@gmail.com
www.valscience.webs.com

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
DIVISION OF CITY SCHOOLS - VALENZUELA
VALENZUELA CITY SCHOOL OF MATHEMATICS AND SCIENCE

March 15, 2023

MARK ALLEN DELA CRUZ
Laboratory Technician
Valenzuela City School of Mathematics and Science Malinta,
Valenzuela City

Dear Sir:

Good day!

We, **Ashley Dacanay, Ram Halcon, Juan Miguel De Onon** and **Leal Juat,** Grade 10 students from Valenzuela City School of Mathematics and Science, would like to request permission to use the Biology Laboratory from **7:00 pm to 3:50 pm** on **March 17, 2023**. This request is in connection with our research study entitled **"The potential of Manila clam shells *(Venerupis philippinarum)* as chitin-based bioplastic".** This is for the extraction of chitin from the Manila Clam Shells. The materials we would need to borrow, if available, are the following:

- 4 Beaker
- 2 Magnetic Hotplate
- 2 Metal Fry
- Strainer
- Soxhlet extractor
- Graduated Cylinder
- 2 Stirring rod
- Triple bean balance
- Mortar and Pestle

We are hoping for your kind assistance and guidance. Thank you!

Respectfully,

ASHLEY NICOLE DACANAY
Team Leader

Noted by:

DEMAR G. BAYONA
Research Adviser

ALBERT B. TOLENTINO
Head Teacher III
Science Department

Endorsed by:

JULIANA T. ALVAREZ
Principal I

(02) 8291-5591
vcsms.valenzuela@gmail.com
www.valscience.webs.com

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
DIVISION OF CITY SCHOOLS - VALENZUELA
VALENZUELA CITY SCHOOL OF MATHEMATICS AND SCIENCE
A. PABLO ST., MALINTA, VALENZUELA CITY

March 17, 2023

Good day teachers!

We, **Ashley Nicole Dacanay, Ram Christan Halcon, Juan Miguel De Onon and Leal Isaiah Juat**, Grade 10 students from Valenzuela City School of Mathematics and Science would like to request permission to allow us to conduct our experiment, chitin extraction, in the school laboratory from **9:00 am to 3:00pm on March 17, 2023** in connection with our study ***"The potential of Manila clam shells (Venerupis philippinarum) as chitin-based bioplastic."***

We are hoping for your kind consideration.

Thank you!

Sincerely,

ASHLEY NICOLE DACANAY
Team Leader

Noted by:

DEMAR G. BAYONA
Research Adviser

Recommending Approval:

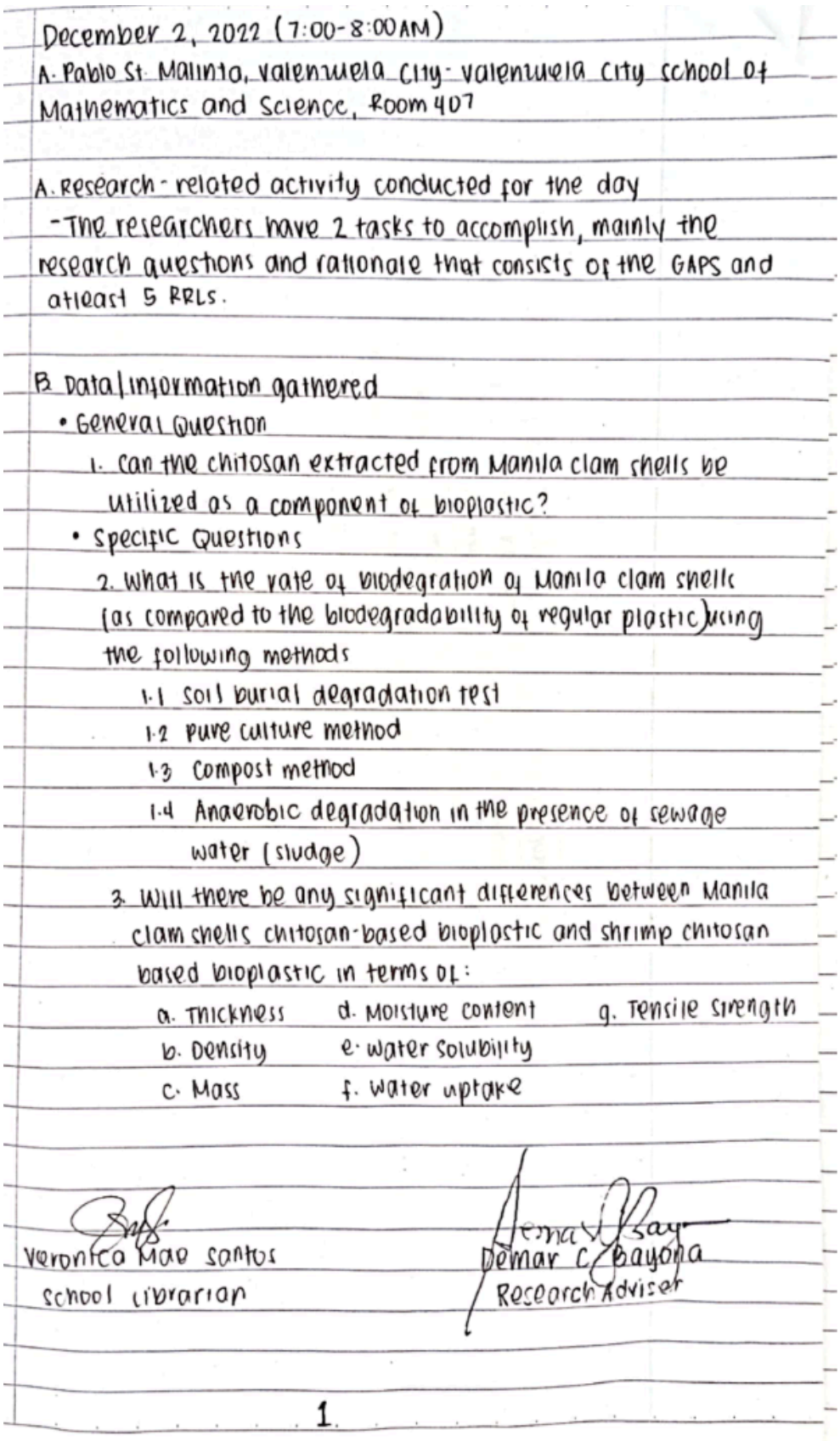
ALBERT B. TOLENTINO
Head Teacher III
Science Department

Approved by:

JULIANA T. ALVAREZ
Principal I

(02) 8291-5591
vcsms.valenzuela@gmail.com
www.valscience.webs.com

Appendix E- Scanned logbook



December 2, 2022 (7:00-8:00AM)
A. Pablo St. Malinta, Valenzuela City- Valenzuela City School of Mathematics and Science, Room 407

A. Research-related activity conducted for the day
-The researchers have 2 tasks to accomplish, mainly the research questions and rationale that consists of the GAPS and atleast 5 RRLs.

B. Data/information gathered
- General Question
  1. Can the chitosan extracted from Manila clam shells be utilized as a component of bioplastic?
- Specific Questions
  2. What is the rate of biodegration of Manila clam shells (as compared to the biodegradability of regular plastic) using the following methods
     - 1.1 Soil burial degradation test
     - 1.2 Pure culture method
     - 1.3 Compost method
     - 1.4 Anaerobic degradation in the presence of sewage water (sludge)
  3. Will there be any significant differences between Manila clam shells chitosan-based bioplastic and shrimp chitosan based bioplastic in terms of:
     - a. Thickness
     - b. Density
     - c. Mass
     - d. Moisture content
     - e. Water solubility
     - f. Water uptake
     - g. Tensile strength

Veronica Mae Santos
School Librarian

Demar C. Bayona
Research Adviser

1

DATE: _____

December 5, 2022 (10:20 - 11:20)
location: A Pablo St. Malinta Valenzuela City - Valenzuela City
School of Mathematics and Science; Room 407

A. Research - related Activity conducted for the Day
- The researchers are given the task to continue the rationale, the researchers investigated for RRL's and other literatures to form the synthesis for the gaps of the rationale

B. Datal information gathered
-(please see the attached document)

Demar Bayona
Research Adviser

DATE:

December 7, 2022 (7:00 - 8:00 am)
4th floor Ampere - Valenzuela City School of Mathematic. Science. A Pablo St, Malinta Valenzuela City

A Research - related activity conducted for the day
- The researchers finalized the draft of the rationale of the study

B Data / information Gathered
- (Please see the attached document)

Demar C. Bayorta
Research Adviser

3

December 9, 2022 (7:00 - 8:00 am)
A. Pablo St. Malinta Valenzuela City - Valenzuela City Schools of Mathematics and Science, Room 407

A. Research - related Activity conducted for the day
The researchers are tasked to consult with their research adviser the revised rationale. The researchers are also tasked to put proper citations and revise the synthesis

B. Data / Information gathered
(Please see the attached document)

Pemar C. Bayona
Research Adviser

DATE: _____

December 19, 2022 (7:00 - 8:00 am)
A. Pablo St. Malinta Valenzuela City - Valenzuela City School of Mathematics and Science

A. Research - related activity conducted for the day
The researchers are tasked to start the methodology and research for the procedures. And also finished the rationale

B. Data / Information Gathered
- The researchers has now listed the procedures, Deproteinization, Demineralization, Deacetylation and Decolorization.

Demar C. Bayona
Research Adviser.

Veronica Mae Santos
School Librarian

DATE:

January 4, 2023 (7:00 am - 8:00 am)

A. Pablo St. Malinta Valenzuela City - Valenzuela City ;
of Mathematics and Science, Room 107

A. Research - related activity conducted for the day.

- The researchers compiled all their works and start to do the characterizations.

B. Data / Information gathered

- characterization has 7 parts, parts that can test each property for the bioplastic.
  (Please see the attached document)

Demar Bayona
Research Adviser

6

DATE: _____

January 6 2023 (7:00 am - 8:00 am)

A. Pablo St. Malinta, Valenzuela City - Valenzuela City School of Mathematics and Science, Room 407

A.

- The researchers started to edit the format of their research paper according to the template given by their adviser. They also analyzed their variables to determine what statistical tool they should use

B. Data / information gathered

Data Analysis: Analysis of Variance (ANOVA) is a statistical tool that separates the components and examine if there are any significant differences

Demar C. Bagona
Research Adviser

DATE:

January 9 2023 (10:20 am - 11:20 am)

A. Pablo St. Malinta Valenzuela City School of Mathematics and Science, Room 407

A Research-related Activity conducted for the day

- The researchers consulted the first draft of their research plan with the research adviser. After that, they started revising and improvising the plan according to what their research adviser said

B Data / information gathered

- The researchers need to mainly revised the format and the data analysis

Demar S. Bayona
Research Adviser

8

DATE: _____

January 11 2023 (7:00 am - 8:00 am)

A. Pablo II Molino valenzuela city - Valenzuela city school of Mathematics and Science, Room 407

A. Research - related Activity conducted for the day

- The researchers continued to revise their research plan specifically the data analysis.

B. Data | Information gathered

Data Analysis The researchers will use the dependent T-test to compare a shrimp shell bioplastic to the Manila clam shell bioplastic. The formula that the researchers will use for the dependent sample T-test is given

$$t = \frac{\sum d}{\sqrt{\frac{n(\sum d^2) - (\sum d)^2}{n-1}}}$$

Demar C. Bayona
Research Adviser

DATE: _____

January 13 2023 (7:00-8:00 am)

A Pablo St. Malinta Valenzuela City - Valenzuela City School of Mathematics and Science, Room 407

A. Research - related Activity conducted for the day

- The research adviser discussed the guidelines of the research defense. The research adviser announced the sequence of the groups that will present and defend their research plan

Demar C. Bayona
Research Adviser

10

DATE: _____

January 24 2023 (2:50 - 3:50 pm)

A. Pablo St. Malinta Valenzuela City - Valenzuela City School of Mathematics and Science

A. Research- related activity conducted for the day

The researchers received their scores from the panelist The researchers also come up of their average out all the scores that their panelist gave. comments and Recommendations were given to improve the research plan

B. Data/ Information gathered

Recommendations from the panelist

Angelique Ann

- Kindly check your questions and parameters
- There are no known issue regarding the supply of bioplastic. Better find other significant uses of the shells
- How will you perform tensile strength on bioplastic

Atanacio, Maria Teresa

- Why compare shrimp to the Manila clam shells

Demar Bayona

- Basis in parameters in methods
- APA

Demar G. Bayona
Research Advisor

11

DATE: _____

February 1 2023 (7:00 am - 8:00 am)

A. Pablo St. Malinta Valenzuela City - Valenzuela City School of Mathematics and Science

A. Research - related activity conducted for the day

- The researchers continued to revise their research plan and applying the recommendations and comments of the panelists

B. Data / Information gathered

- The researchers revised the following parts
  - Statement of the Problem
  - Procedures

(Done in the laptop)

Demar G Bayona
Research Adviser

DATE: _____

February 3 2023 (7:00 am - 8:00 am)
A. Pablo St. Malinta Valenzuela City - Valenzuela City School of Mathematics and Science, Room 407

A. Research-related activity conducted for the day
The researchers consult their paper to their research advisers. ~~to~~ the researchers are advised to correct some of the errors in the paper.

B. Data | information gathered
The researchers revised the following parts
- Format
- APA

(Done in the Laptop)

Demar G. Bayona
Research Adviser

DATE: _____

February 14 2023 (2:50 - 3:50)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A. Research - related activity conducted for the day

The researchers decided to reached out the research institute by sending an email and contacted their phone number. The researchers also bought the Manila clam shells

B. Data / information gathered

The researchers tried to contact the chosen research institute using one of the researchers cellular phone, unfortunately the research couldn't reach them for the meantime

Demar C. Bayona
Research Adviser

DATE: _____

February 15 2023 (7:00-8:00)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A. Research-related activity conducted for the day
The researchers created a time table for the activities that the researchers will conduct in the next weeks

B. Data/information gathered
The timetable is found on the back page of the researchers log book.

Demar B. Bayona
Research Adviser

DATE: _____

February 17 2023 (7:00-8:00 am)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A. Research-related activity conducted for the day
The researchers emailed the DOST testing center regarding the experimentation, and also decided to seek permission with the laboratory technician to use the lab for the mechanical treatment of the Manila clam shells

B. Data/Information gathered
The researchers contacted the testing center via. email (done in phone)

Demar G. Bayona
Research Adviser

DATE: _____

February 20 2023 (10:20 - 11:20 am)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 107

A.
The researchers were contacted by the DOST Testing center about the researchers referral and the researchers consulted the research advisor about the excuse letter and letter of approval for the lab technician. The research advisor gave recommendations to further improve the letter which will be given to the lab technician. The researchers sought to find the lab technician but unfortunately the researchers failed to find the lab technician.

B.
- The DOST-Testing center replied to the researchers inquiry (phone)
- The researchers updated the letter of approval based of the recommendations given by the research adviser.

Demar G. Bayogo
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

February 21 2022 (1:50 - 5:50 pm)

A Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 107

A

The researchers finalized the letters and were given to the research adviser. The researchers tried to find the Head Teacher III of the science department to sign the letters but unfortunately the researchers did not get around and planned to do it ~~tomorrow~~ tomorrow. Also, the researchers tried to reach the DOST-ITDI and after a few mishaps the researchers got in contact with Joanne Macatañga from the standards testing division.

B

- The DOST ITDI referred the researchers to the organic chemistry division (Telephone)
- The researchers contacted the chemical and energy division on the registrar (Telephone)

Demar G. Bayona
Research Adviser

Veronica Mae Santos
School Librarian

18

DATE

February 22 2023 (7:00 am - 8:00 am)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A.

The researchers requested for a signature of the Head Teacher III of the science department for them to conduct the experiment on the laboratory

B.

After signing the letters the researchers gave the letters to the registrar for the letter to be signed by the principal.

Demar G. Bayona
Research Adviser

DATE: _____

February 27 2023 (10:20-11:20am)

A. Pablo St. Malinta Valenzuela City Valenzuela City School of Mathematics and Science, Room 407

A

The researchers finalized the materials and needed letters for the conduction of the mechanical treatment, the signed letters were also submitted to the Research Adviser. Several institutes such as the SGS Philippines, referred by UP Diliman were also contacted still in search for chitin extraction equipments. The laboratory technician was also consulted whether the researchers could conduct the extraction in the school laboratory themselves

B

The researchers contacted the SGS Philippines research institute (Telephone)

Demar G. Bayona
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

February 28 2023 (2:50 - 3:50 pm)
A Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A.
The researchers started doing the mechanical treatment by pulverizing the Manila clam shells.

B.
The researcher pulverized 500 grams of Manila clam shells

Demar G. Bayona
Research Adviser

02/28/2023

MARK Allen Dela Cruz
Laboratory Technician

DATE: _____

March 1 2023 (7:00 am - 8:00 am)

A. Pablo St. Mauna Valenzuela City, Valenzuela City School of Mathematics and Science, Room 1/07

A.

The researchers continued the search for a research institute that was available testing equipment, tried to contact Adamson but unfortunately declined the researchers inquiry while the SGS Philippines will open at 8am and later be contacted by the researchers. Due to this, the researchers consulted the research adviser and was told that the researchers should compose a plan B for certain circumstances

B.

- The researchers contacted the Adamson University thru telephone
- The researchers planned to do the extraction on the school's laboratory

Demar G. Bayona
Research Adviser

DATE: _____

March 3 2023 (7:00 - 8.00 am)

A Pablo St Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 401

A

The researchers received both emails from DOST ITDI and Adamson University about the researchers inquiry. The Adamson University asked the researchers about the specific instruments | equipments the researchers will be using, while the DOST ITDI asked about the requirements and the test procedure the researchers need for the sample.

B

The researcher~~s~~ received and replied to both emails from Adamson and DOST-ITDI

Demar G. Bayona
Research Adviser

March 7 2023 (2:50 - 3:50 pm)

A. Pablo St. Malinta Valenzuela City. Valenzuela City School of Mathematics and Science, ROOM 407

A.

The researchers started to follow the instructions given by the Adamson University regarding for the letter of intent. The researchers began working the format of the paper which will be given to the institute.

B.

- The researchers emailed the Adamson University regarding the format
- The researchers went into the library as they started doing the letter of intem.

Demar G. Bayona
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

March 8 2023 (7:00 - 8:00 am)
A. Pablo St. Malinta Valenzuela City. Valenzuela City School of Mathematics and Science, Room 407

A.
The researchers started to review the prices of the lab materials / equipments the researchers will used in the experiment.

B.
The researchers visited the Adamson University website to review the prices of the lab materials

Jemar G Bayona
Research Advisor

DATE: _____

March 10 2023 (7:00 - 8:00 am)

A. Pablo St. Malinta Valenzuela City; Valenzuela City School of Mathematics and Science, Room 407

A.

The researchers composed and finalized the date of visit, March 14 2023 (Tuesday) and the following letter: letter for of intent for Adamson University and prepared the excuse letter to be used after the visit to the research institute & approved and printed 3 copies of each letter.

B.

- The researchers finalized the letter of intent and excuse letter
- The mentioned letters were also printed and to be later signed by important personels

Demar G. Bayona
Research Adviser

DATE: _____

March 13 2023 (10:20 - 11:20 am)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A

The researchers received an email from the Adamson University requesting the group's leader contact numbers and a representative will be contacting the leader within the day

B

· The researchers received an email from Adamson University

Demar E Bayon
Research Adviser

Verbnica Mae Santos
School Librarian

DATE: _____

March 14 2023 (2:50 pm - 3:50 pm)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A.
The researchers received a follow-up email about the schedule for the laboratory. The Adamson University said that they need to prioritize those who have approved schedules before the transportation strike. So, the researchers decided that ~~[they]~~ the extraction will be done in the school laboratory. The researchers approached the lab technician for permission to use the laboratory this friday and the lab technician agreed. The researchers started doing the letter for the laboratory.

B
- The researchers started doing the letter
- The researchers is currently contacting with DOST ITDI regarding the testing

Demar G Bayona
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

March 15 2023 (7:00 - 8:00 am)
A. Pablo st. Malinta Valenzuela City, Valenzuela City
School of Mathematics and Science, Room 407

A

The researchers consulted the school principal regarding to the researchers choice of chemical which is NaOH because of how corrosive the chemical and it may cause accidents when not used properly, so the researchers had to adjust the amount of NaOH that will be used in the experiment

B

The researchers adjusted the amount will be used for the experment

Demar G. Bayona
Research Adviser

DATE: _____

March 17 2023 (7:00 - 8:00 am)

A. Pablo St. Molinta Valenzuela city, Valenzuela city school of Mathematics and Science, Room 407

A

The researchers started to extract the chitin, the researches started to measure everything they will use and ~~flow~~ they used the sodium hydroxide to deproteinized the powdered shell, then the researchers drained the solution. After that, the researchers began to dilute the hydrochloric acid and combine the mixture then it will be left at 4 hour.

B

The researchers started to extract the chitin.

Demar G. Bayona
Research Adviser

03/17/2023
Mark Allen Dela Cruz
Laboratory Technician

DATE: _____

March 20, 2023 (10:20 - 11:20 am)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science

A

The researchers requested for the use of the school's laboratory from the lab technician, the researcher planned to continue the experiment on March 21 2023, tuesday from 8:00 am - 4.00 pm. After that, the researchers used the remaining time to fix the letter for the lab technician due to the wrong format.

B

- The researchers will continue the experiment on March 21 2023.

Demar G. Bayoja
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

March 21 2023 (2:50 - 3:50 pm)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A.

The researchers continued the experiment by adding more setups that involved the previous processes. The researchers got in contact with the research institute for the testing. The researchers planned to continue the experiment by making the bioplastic mold ~~(which)~~ wherein the substances will be transferred into the mold

B.

The researchers continued the experiment

Demar G. Bayona
Research Adviser

as lulucas
Mark Allen Dela Cruz
Laboratory Technician

DATE: _____

March 22 2023 (7:00 - 8:00 am)

A Pablo St Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A

The researchers are waiting for a response from DOST ITDI although the researchers contacted the institute to double check if the following testing is available. Thickness, Tensile Strength and the institute replied that they have the following testing. The researchers also planned to use the laboratory.

B

The researchers contacted and emailed the research institute

Demar S Bayong
Research Adviser

DATE: _____

March 24 2023 (7:00-8:00 am)

A Pablo St Malinta Valenzuela City, Valenzuela City School of Mathematics, Room 407

A.

After the researchers completed their extracted chitin, the next step is taken to meet the requirements of the contacted research institute, DOST ITDI specifically providing sample chitin bioplastic The researchers made molds and the solution for the bioplastic out of water, vinegar and glycerin

B.

The researchers continued the experiment by making the molds and the solution for DOST ITDI

Demar G. Bayona
Research Adviser

8/30/2023
Mark Allen Dela Cruz
Laboratory Technician

34

DATE: _____

March 28 2023 (2:50 - 3:50 pm)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 107

A

The researchers planned to use the laboratory to finish the solution ~~for~~ of the bioplastic for the research institute. The researchers also started the letter of permission of the school laboratory and excuse letter for the teachers

B

· The researchers started the letters ~~needed~~

Demar G. Bayot
Research Adviser

Veronica Mae Santos
School Librarian

DATE: _____

March 29 2023 (7:00 - 8:00 am)
A. Pablo St Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A.
The researchers finalized the letter and began working on the abstract. The researchers will be using the school laboratory on March 30-31 2023.

B.
. The letter is now submitted to the office of the principal

Demar G. Bayona
Research Adviser

DATE: _____

March 30 2023 (8:00 - 12:30 pm)

A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 407

A

The researchers started to make a larger samples since the rejearchen only made smaller samples. The researchers made 6 samples, 5 samples with 30 g of powderized shells and 1 sample with 60 g of shells. The researchers will continue the experiment tomorrow in making the solution for the mold.

B

· The researchers made large samples of chitin

Demar G Bayona
Research Advisor

03/30/23
Mark Allen Dela Cruz
Laboratory Technician

DATE: _____

March 31 2023 (7:00-8:00 am)
A. Pablo St. Malinta Valenzuela City, Valenzuela City School of Mathematics and Science, Room 107

A. Research-related activity conducted for the day.
The researchers started making the solution for the mold. They started with removing the excess water from the deproteinized chitin then the researchers oven-dried the shells for 30 minutes. The researchers then boiled the water until 70 degrees then transferred it into the blender with the glycerin, vinegar and the oven-dried shells. The researchers then put the mixture into the mold.

B.
- The researchers started making the solution for the mold
- The researchers finished making the mold

Demar G. Bayona
Research Adviser

Mark Allen Dela Cruz
Laboratory technician

April 3 2023 (10:20 - 11:20 am)
A. Pablo St. Molino Valenzuela City, Valenzuela City
School of Mathematics and Science

A.
After consulting to the research adviser, the researchers' edit the manuscript in order to correct some mistakes in the paper. By doing so, the researchers' conducted this activity in the school's library.

B. The researchers edited the following in their manuscript:
- Abstract
- Paragraph formatting
- References

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Veronica ~~Mae~~ Santos
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STATISTICIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed the statistical tool and data analysis in Research manuscript entitled "**THE POTENTIAL OF MANILA CLAM SHELLS (*Tawaregas Philippinarum*)**", developed by **ASHLEY NICOLE C. BACANAY, JUAN MIGUEL BE ONON, RAM CHRISTIAN B. HALCON, and LEAL ISAIAH JUAT.**

Signed this 25th day of May in the year of our Lord, 2023 at Valenzuela City School of Mathematics and Science, Malinta, Valenzuela City

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GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and proofread all the pages of the Research manuscript entitled "**THE POTENTIAL OF MANILA CLAM SHELLS (*Venerupis philippinarum*) AS CHITOSAN-BASED BIOPLASTIC**", developed by **ASHLEY NICOLE C. DACANAY, JUAN MIGUEL L. DE ONON, RAM CHRISTAN B. HALCON, and LEAL ISAIAH M. JUAT.**

Signed this 13th day of June in the year of our Lord, 2023 at Valenzuela City School of Mathematics and Science, Malinta, Valenzuela City.

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