# TARPAULIN SHREDS INCORPORATED IN GEOPOLYMER BRICKS

# WITH PULVERIZED GLASS AS AN ALTERNATIVE

# TO STANDARD BRICKS

# A Research

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# Chapter 1

# The Problem and its Background

In this chapter, the researchers provided a detailed overview about the study, an academic inquiry as to the underlying reason in which the research study was undertaken, hypothesis of the study, theoretical and conceptual bases, significance, the respondents involved, and lastly, a list of terminologies defined in order to better comprehend the study at hand.

BACKGROUND OF THE STUDY

Mineral aggregates (sand and gravel) have been the fastest growing and the most volumetrically extracted material group extracted over the 21st century. This growth has been associated with large-scale ecological degradation and violent localized extractive operations. Further, the ongoing rates of sand extraction are already resulting in emerging global and local sand scarcities. (Bisht, 2021)

As the information extracted from the study conducted by Bischt, the excessive extraction of sand and gravel raises concerns as it causes significant damage to the ecological balance of the areas these materials are extracted from. The knowledge relayed prompted our group to formulate possible solutions to possibly negate or reduce the possible damage to our ecosystems. One such solution our group favors is using unused materials that contain these excessively mined materials. For this solution, we opted to use shattered glass of any kind and incorporate it into concrete bricks. Sand is a vital ingredient in the process of crafting concrete, through recycling unused glass by grinding it finely we can possibly achieve a similar structure with concrete bricks with regular sand without further exploiting nearby habitats.

Another idea came to mind when considering reducing ecological damage, incorporating discarded tarpaulins into concrete bricks to lessen waste and landfill. The product, an alternative to bricks, will be incorporating the tarpaulin by mixing bits of small material into the concrete bricks. This concept gives the discarded tarpaulin another purpose once it is no longer needed, gives bricks more material to work with, and prevents the addition of more non-biodegradable waste into natural habitats.

For those unaware, tarpaulin is a multipurpose textile product made from different coating formulation grade of polymer that has high durability material to withstand hot, windy and raining weather. This causes a problem in which it is difficult to dispose naturally due to its non-degradable characteristic. An experimental investigation was conducted on determining the workability of the concrete mixture with addition of non-degradable crushed polyvinyl tarpaulin using slump test and also the effect on the compressive strength of the concrete mixture by using hydraulic compressive machine. The crushed polyvinyl tarpaulin was proportioned ranging 5% to 30% with respect to cement’s percent by weight in kg. (Salim et al., 2018)

This research aims to test the strength of the modified brick with substituted materials compared with the common bricks currently used in construction. Its goal is to produce a new product that can possibly have a positive effect on the environment without compromising the integrity and durability of the original product it is based on.

STATEMENT OF THE PROBLEM

## In this study, we aim to test the strength of our product “Geopolymer Bricks With Tarp and Glass.” However, we must overcome these following questions for the study to prosper:

## 1. What are the demographic profiles of the respondents in terms of:

## 1.1 Age

1.2 Occupation

## 2. Are the geopolymer bricks with tarp and glass more substantial than normal bricks?

## 3. Does the use of geopolymer bricks with tarp and glass help reduce economic waste?

## 4. Is the use of geopolymer bricks with tarp and glass a sustainable alternative to normal bricks?

HYPOTHESIS

# In this research study, the researchers have utilized the employment of alternative hypotheses. Prior to the conclusions and analyses, the hypotheses will be tested:

# 1.Geopolymer bricks incorporating glass shards and tarpaulin demonstrate significantly greater durability compared to standard cement bricks.

# 2.The incorporation of tarpaulin and crushed glass in pavement brick production is demonstrated to be cost-effective, presenting costs that are either comparable to or lower than standard cement bricks.

**CONCEPTUAL FRAMEWORK**

In order to comprehensively distinguish the variables in this study, Figure 1. presents the conceptual diagram outlining the important parts that will use by the researcher. Particularly, Figure 1. consists of three parts namely, the input, the process and the output.

RESEARCH PARADIGM

OUTPUT

Tarpaulin Shreds Incorporated in Geopolymer Bricks with Pulverized Glass as an Alternative to

Standard Bricks

PROCESS

1. Data Gathering Through,

* 1.1 Survey
* 1.2 Questionnaire

2. Statistical Treatment through the use of;

* 2.1 Frequency Distribution
* 2.2 Percentage
* 2.3 Mean Weighted

2.4 Analysis and Interpretation

3. Analysis Presentation and Interpretation of Data

INPUT

1. Demographic profile of the respondents in terms of:

1.1 Age

1.2 Occupation

2. Substantial of Geopolymer bricks with tarp and glass than normal bricks.

3. Use of geopolymer bricks with tarp and glass to reduce economic waste

4. Sustainable alternative of geopolymer bricks with tarp and glass to normal bricks

Figure 1. Paradigm of the Study

The Input of this study will be derived from demographic profile of the respondents. Another is the substantial of geopolymer bricks with tarp and glass compared to the normal bricks. It was followed by the use of geopolymer bricks with tarp helps to reduce economic waste. Lastly, the sustainability of the alternative to the normal bricks. The process of the study involves the Gathering of Data using survey questionnaire; Evaluation of the results of the survey; Analysis and Interpretation of Data. The output of the study is the tarpaulin shreds incorporated in Geopolymer Bricks with Pulverized Glass as an Alternative to Standard Bricks.

Overall, the conceptual framework as portrayed in Figure 1. indicates the sequence between the three (3) important parts included in the study.

## SIGNIFICANCE OF THE STUDY

This study intends to provide innovative solutions to environmental challenges in the construction industry by addressing the environmental effects of sand extraction and the growing rate of non-biodegradable waste. The addition of shattered glass into geopolymer bricks offers an innovative way to mitigate the environmental damage caused by sand extraction. This study seeks to produce concrete bricks with qualities comparable to the traditional ones by finely grinding discarded glass, reducing reliance on sand extraction, and contributing to environmental preservation.

Furthermore, by combining non-biodegradable garbage, such as polyvinyl tarpaulin, into concrete bricks, the study addresses the environmental effect of non-biodegradable waste, supporting sustainable waste management methods. The importance of this study comes from its potential to provide an environmentally friendly alternative to standard construction materials while maintaining structural integrity. Through the evaluation of the strength of modified bricks compared to traditional ones, the study aims to establish a viable and sustainable construction solution. The proposed geopolymer bricks with tarp and glass have the potential to lessen the environmental effect of construction activities by reusing waste materials into useful building components, hence developing a circular economy. The study's findings are expected to be extremely significant and useful to the following:

Construction Professionals

The study offers important knowledge for construction workers, engineers, and architects. It presents new materials, like geopolymer bricks with shattered glass and tarpaulin which provide eco-friendly alternatives for construction that match sustainable building techniques. It can benefit professionals seeking innovative approaches in the construction industry.

Environmental Conservation Professionals

The study provides environmentally friendly alternatives to traditional building materials. This lessens the damage that sand extraction does to the environment and promotes environmentally friendly waste management techniques.

Waste Management Authorities

The study helps in managing waste sustainably by reusing materials like polyvinyl tarpaulin, reducing pressure on landfills. This promotes the application of circular economy-building ideas.

Educators and Students in Construction-related Fields

The study brings educational benefits through introducing new materials and eco-friendly construction techniques. Teachers can use these findings in their lessons, and learners can learn about environmentally friendly approaches to construction.

Future Researchers

This study sets the foundation for future research in sustainable construction materials. Researchers can use these findings to investigate and explore more applications and improvements for geopolymer bricks with various materials.

## SCOPE AND DELIMITATIONS

This research study focuses on producing an environmentally friendly concrete brick that has similar qualities to the traditional ones by finely grinding discarded glass, reducing reliance on sand extraction. The scope of the study will include one hundred (100) random participants in Brgy. San Bartolome, Quezon City. The respondents will be divided into two categories: Brgy. San Bartolome Citizens, ages ranging from 18 - 50 years old and construction professionals.

This study involves the assessments of the substantial geopolymer bricks with tarp and glass compared to the normal bricks. It was followed by the use of geopolymer bricks with tarps to reduce economic waste. Lastly, the sustainability of the alternative to the normal bricks.

Notwithstanding the fact that the research is intended to meet its goals, there were a number of drawbacks that were unavoidable. This analysis was limited to a small sample size due to time constraints. It will not include any other citizens or construction professionals outside the area of Brgy. San Bartolome, Quezon City.

DEFINITION OF TERMS

In order to come up with a common and unified basis as to the use of terms in this research, the following terms are defined.

Aggregates - a material or structure formed from a loosely compacted mass of fragments or particles or clustered in a dense mass.

Degradation – is the act of lowering something or downcast.

Extraction – the action of taking out something, especially using effort or force.

Scarcities – the state of being scarce or in short supply; shortage.

Tarpaulin – heavy-duty waterproof cloth, originally canvas.

Non-degradable – incapable of being broken down into simple compounds.

Geo-polymer – a new class of building materials that have emerged as an alternative to the existing concretes and possess the potential to revolutionize the building construction industry.

Durability – the ability to withstand wear, pressure, or damage.

Polymer - large molecules made by bonding (chemically linking) a series of building blocks.

Substantial - of considerable importance, size, or worth.

Innovative - (of a product, idea, etc.) featuring new methods.

Mansory - a construction technique that involves stacking materials, such as bricks, stone blocks or concrete blocks, on top of one another to build structures or walls.

# Chapter II

# Review of Related Literature and Studies

## This chapter presents the overview of related literature and studies that the researcher considered in strengthening the claim and importance of the present study. The researchers will also provide a detailed review of the information that is currently available regarding the research.

REVIEW OF LITERATURE

Solid waste management is a significant global environmental challenge, particularly pronounced in developing nations like the Philippines. Diola et al. (2021) investigated the potential of ecobricks blocks for constructing non-loadbearing walls. The study found that as the density of ecobricks increases, the corresponding compressive strength of the blocks also rises. This observation suggests that ecobricks construction can be suitable for applications such as concrete reinforcements and non-structural works, where maximal concrete strength is not a primary consideration. Notably, the use of ecobricks in wall construction was shown to reduce material costs by 72% compared to conventional concrete hollow blocks construction, indicating its potential economic benefits (Diola et al., 2021). These findings contribute valuable insights to the ongoing discourse on sustainable construction practices and waste management.

According to Agrawal, et al (2023), Recycling is processing the used material or waste into new products to prevent the demolition of potentially valuable materials. The increased popularity of using eco-friendly, low-cost, and lightweight construction materials in the building industry has brought about the need to investigate how this can be achieved while benefiting the environment and maintaining the material requirements and their standards.

In the study “Plastic Wastes, and Paper: Eco-Building Materials for Making Sand-Bricks” conducted by Ursua (2019), the researcher aims to focus on the utilization of non-hazardous wastes in making an effective and quality sand brick. Multiple tests were conducted and compared 3 sand bricks with varied material. The researcher remarked that all 3 bricks passed on the compression test and performed excellently on the water absorption test. The findings of this study were anchored from the testing conducted through the utilization of nonhazardous wastes such as plastics, crushed glass bottles, and shredded paper in making sand bricks as eco-building and construction material. The study aimed at the possibility of using these materials in making effective and quality sand bricks as non-load-bearing masonry material.

The production of concrete requires a significant volume of natural aggregates and non-eco-friendly cement. The extraction of natural river sand and stone chips for concrete construction is increasing day by day, paving us to a shortage of natural resources. Every year, the world is producing around 100 metric tons of waste glass (WG), the majority of them are going to landfills that create massive environmental problems. One approach to solve this problem is to transform waste glass into construction materials. Glass is recyclable; however, the melting temperature of the glass is highly dependent on its colour that requires sorting before recycling. To overcome this challenge, many researchers and end-users are using broken glass in concrete either as a binder or aggregates.

Recycling wastes like discarded glass in concrete and mortar for buildings and other structural constructions helps to achieve sustainable buildings. The study conducted by Rivera (2020) shows that reusing some non-biodegradable waste products as alternative ingredients in the manufacture of mortar is an endeavor to assure the sustainability of construction materials. Sand is a key component in the production of mortar, but using waste products like glass as a partial or full substitute will guarantee a decrease in the need to dredge for it, protecting the extremely valuable natural sand resources within the environment. The use of broken waste glass as a partial and full replacement is investigated in this study. The acquired results showed that the crushed or pulverized glass is very effective.

The Philippines is included in the major contributors of by-product waste materials such as waste glass. Large amount of waste glass is produced daily resulting in problem in disposal and control of landfill. Having Crushed waste glass as an alternative will somehow enhance the productivity of concrete, making it more ethical. In construction, concrete is the commonly used medium for different engineering propositions. The waste glass, one of the by-product waste materials is considered harmful to our environment. Local Government Units (LGU) conducted many seminars, outreach, and studies on how to reduce growing waste production due to the ignorance of the people towards proper recycling and segregation of wastes. The Department of Labor and Employment (DOLE) and the Department of Environment and Natural Resources (DENR) had partnered to encourage turning waste products into useful products, through a process known as “Upcycling.” In the study, “Innovative Construction Reinforcement Medium Using Crushed Glass: An Experimental Risk-Waste Reduction Research” conducted by Leron et al. on 2023, the researchers tested the strengths of “Glascrete” (Crushed glass aggregates in concrete) and Conventional concrete. The researchers concluded that the crushed glass can be a full replacement to fine aggregates after analyzing the results of the conducted experiments.

In this study by Pasana et al. (2023), the innovative utilization of ground glass waste as an aggregate filler in concrete is investigated. As the demand for sustainable construction practices rises, there is a growing need to explore alternative materials to improve the environmental impact of concrete structures. This study investigated the effect of paste volume on the properties of fresh and hardened concrete with ground glass waste as aggregate filler. Based on the test results, ground glass waste as aggregate filler negatively affects the workability of fresh concrete, but increasing the amount of paste can mitigate it. The test results have shown that ground glass waste has the potential to be utilized as aggregate filler in concrete mixtures.

According to Singh, et al (2021) There is a necessity for a paradigm shift from cement as a primary binder material to any other sustainable alternative. In the quest for surrogate material, this study is focused on reducing the consumption of cement as a primary binder. Therefore, either partial replacement of cement by supplementary cementitious or (SCM) material or development of a new binder is generally being suggested as an alternative. The by-products like fly ash, metakaolin, slag, rice husk ash, bagasse ash and so on, from agricultural and industrial sectors are being incorporated as SCM. The SCMs are known to undergo pozzolanic reaction to enhance the performance of construction materials. Attempts are also being made to develop cement like binder by alkali activation of silica and alumina rich SCMs, resulting in the formation of three dimensional polymeric chains known as “Geopolymer”.

According to the study of Shilar, et al (2023), Geopolymer has become as an alternative material in construction. Also geopolymer bricks involves a detailed analysis of the sustainability study that includes investigating the effects of granite waste powder and iron chips on structural properties. In making this geopolymer brick, they did a process that called as geopolymerization where they transforms aluminosilicate into high-performance concrete by adding industrial waste. In this study, it really shows that geopolymer bricks offers sustainable alternative to traditional building units while utilizing industrial waste without the compromising of the structural performance. Moreover, this type of brick can be investigated by conducting a long term performance evaluations with a sense of mansory constructions to assess their durability, stability, and the performance.

Celik et al. (2023) demonstrated that the effect of Waste Glass Powder or WGP with fly ash in certain pro-portions on Geo-polymer Concrete or GPC was examined by exchanging different pro- portions of molarity and WGP percentages in GPC. The molarity values of the NaOH dispersion considered in the study were as M11, M13, and M16. It was found that with the addition of WGP, the workability for M11, M13, and M16 NaOH or sodium hydroxide reduced by an average of 17%, 10%, and 67%, respectively. The compressive strength tests, splitting tensile tests, and flexural strength tests were conducted. The workability and setting time were also evaluated. With the addition of WGP, the workability for molarities (M) of 11, 13, and 16 NaOH reduced by an average of 17%, 10%, and 67%, respectively. The results revealed that the slump values reduced as molarity enhanced. Therefore, utilizing 10% WGP and NaOH molarity of 13 is recom- mended to obtain the optimum setting time, workability, and strength for sustainable GPC considering both fresh and hardening properties.

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