EnvironC
Environment Conflict
EnvironC 1(1): 65–71
ISSN 3048-2674

Institute for Advanced Science, Social and Sustainable Future
MORALITY BEFORE KNOWLEDGE

The effect of glass waste on climate change

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Received Date: February 6, 2024 Accepted Date: February 29, 2024

ABSTRACT
Currently, a lot of Glass Waste is scratted everywhere. This happens with the increasing use of glass objects for building needs or household appliances. Glass Waste is waste that is considered dangerous if it is disposed of in any place, because it is feared that it will be stepped on or injure other parts of the human body. As we know, Glass Waste is also very difficult to decompose in the soil, and it takes hundreds of years to decompose. Because Glass is not biodegradable substance, landfill are not an environmentally responsible way to dispose of it. As a result, efficient waste glass management is quite important. Scattered Glass Waste will only add to the problem for the environment, and even worse, it will affect climate change. Climate change will result in many negative things for humans and the environment.

KEYWORDS: climate change; environment; glass waste

1. Introduction

Climate Change is the high change in one or more weather elements in a particular area. While the term “global scale Climate Change” refers to Climate Change on a global scale. Climate Change can be caused by internal or external natural processes, as well as human activities that alter the composition of the atmosphere and land usage. Climate Change is a change in the physical conditions of the earth’s atmosphere, including temperature and distribution of rainfall which has a wide impact on various sectors of human life (Ministry of the Environment, 2001). These physical changes do not happen just for a moment but over a long period of time. LAPAN (2002).

Based on global surface temperature data, the IPCC study (2007) found that there have been 12 warmest years since 1850. In the last 12 years, eleven of the twelve hottest years have occurred. From 1850 to 1899, the overall temperature increase was 0.76 ◦ F. Between 1961 and 2003, the global mean sea level rose at an average pace of 1.8 mm per year, among other things. The entire rise in sea level during the twentieth century is estimated to be 0.17 m. Human activities have contributed to global warming since the mid twentieth century, according to the IPCC study. If no attempts are done to counteract global warming, it will continue to accelerate in the twenty first century.

One of the causes of Climate Change is because of human activities that throw waste carelessly. One of the existing waste is Glass Waste, Glass Waste itself is very difficult to decompose. Glass can be recycled an endless number of times without losing its qualities. Why, with the exception of Europe, are most countries still burying most of their glass as waste by the tonne? According to the US Environmental Protection Agency, the United

Cite This Article:
Pongoh, I. M., & Masjud, Y. I. (2024). The effect of glass waste on climate change. *Environment Conflict*, 1(1), 65-71. https://doi.org/10.61511/environc.v1i1.2024.586

States alone dumped about 7 million tonnes of glass into landfill sites in 2018, accounting for 5.2 percent of total solid municipal waste. Glass manufacture emits at least 86 million tonnes of CO2 per year around the world. However, most of this may be avoided if glass is recycled, and existing technology might make glass production carbon-neutral. It is necessary for countries to stop exporting glass to landfills and to make glass recycling mandatory. Glass is manufactured by heating limestone, sand, and soda ash to a temperature of 1,500 degrees Celsius. Natural gas is used to provide this heat, which accounts for 75 to 85 percent of the carbon emissions produced by the glass industry. The remaining emissions are a by-product of the raw materials' chemical reactions. However, some of these elements can be replaced by cullet, which is crushed recycled glass. There is no CO2 released when cullet is melted. Furthermore, furnaces do not have to burn as hot to melt glass as they do to melt raw materials, resulting in even more carbon savings. When compared to manufacturing glass exclusively from raw materials, adding 10% extra cullet to a furnace reduces CO2 emissions by 5%, according to the European Container Glass Federation (FEVE), a Brussels-based industry body.

2. Methods

The paper that written at this time uses references from literature review. A literature review is a piece of academic writing that demonstrates knowledge and mastery of academic literature on a certain topic. A literature review differs from a literature report in that it includes a critical evaluation of the material. There are four basic goals of a literature review, which is surveys the literature, synthesizes the information in that literature into a summary, critically analyses the information gathered by identifying gaps in current knowledge, by showing limitations of theories and points of view and by fourmulating areas for further research and reviewing areas controversy, and presents the literature in an organized way.

This paper's techniques include conducing extensive research and selecting relevant literature on the subject. The basic concept is to use through a variety of information resources, such as databases like Google Scholar and through other media. Because this paper discusses about Glass Waste, therefore the keywords I use are "The Effect of Glass Waste on Climate Change". There are many papers that discuss this topic, the various effects of Glass Waste itself.

3. Results and Discussion

Glass has a chemical composition and phase that is similar to standard SCMs. Sodalimeisilicate glass, alkali silicate glass, and boro-silicate glass are among the chemical varieties of glass. Waste Glass was gathered from recycled clear glass bottles, cleaned, and crushed with a jet mill equipment. The ground glass was sieved to get the right particle size.

Fig. 1. Glass powder
(Alwared et al., 2018)

The Glass Powder displays an amorphous pattern, according to an X-ray diffraction test. When particle size is less than 75m, the high peak reflects silica, which is possibly pozzolanic.

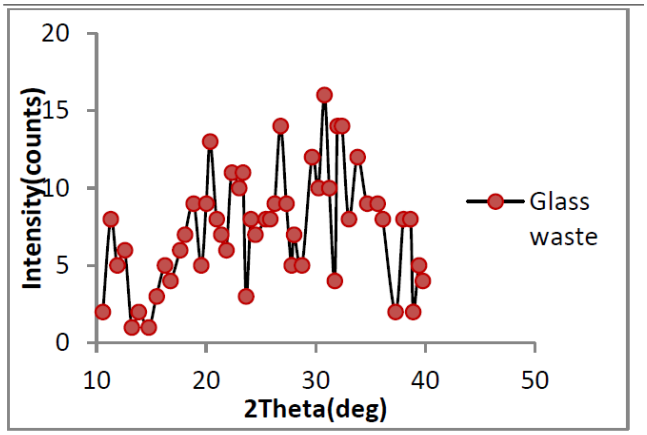

Fig. 2. X-ray analysis for waste glass
(Alwared et al., 2018)

The compressive strength of specimens with Waste Glass revealed that it rose up to 10% cement substitution, and that increasing the percentage results in a drop in concentrate compressive strength. At the age of 240 days, a 10% replacement of cement resulted in 30% increase in compressive strength. The use of ten percent Waste Glass by weight as a partial replacement for cement improves: 1) Reference concentrate's flexural strength. At the age of 240 days, it had risen by 11.64. 2) At the age of 240 days, water absorption improves. It has desclined by 29.41%. 3) At the age of 150 days, the depth of water penetration had dropped somewhat by 43.75 percent. 4) A 4% reduction in the corrosion of steel reinforcement.

3.1 Workability

The addition of 25 percent to 100 percent waste glass to mortar raised the flow value by 4% to 15%. Glass aggregate has a higher fineness modulus, a lower water absorption capacity, and a smoother surface texture than sand, which accounts for the increased flow.

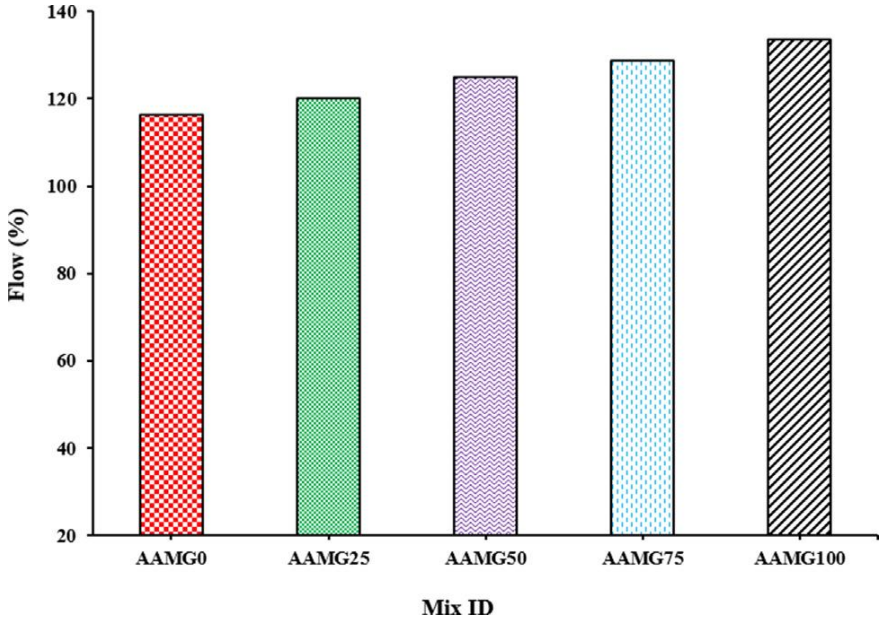

Fig. 3. Flow of alkali-activated mortars containing different percentages of waste glass aggregate
(Khan and Sarker, 2020)

Glass aggregate has a higher fineness modulus, a lower water absorption capacity, and a smoother surface texture than sand, which helps it flow. According to the study, increasing the fineness modulus of fine aggregate boosted concrete workability by reducing total surface area, which lowered water demand. As a result, the effect of glass aggregate on the workability of alkali-activated mortar in this study followed the same pattern as prior research.

3.2 Compressive strength

At 7, 14, 28, and 90 days, the alkali-activated mortars containing varied percentages of glass fine aggregate had different compressive strengths. It was discovered that when the amount of glass aggregate in the mortar increased, the compressive strength of the mortar fell significantly. When 100 percent sand was replaced with glass aggregate, the compressive strength of alkaliactivated mortar reduced from 71 MPa to 66 MPa after 28 days. Because of the smoothness of the glass surface, there is an insufficient connection between the glass aggregate and the binder matrix. Furthermore, the angularity of glass aggregate may generate internal voids, which has a detrimental impact on compressive strength development.

For example, at 7 and 14 days, mortars containing 25 percent to 100 percent glass aggregate had 4 percent to 12 percent lower compressive strengths than mortars using natural sand. However, when utilizing 25 percent to 100 percent glass aggregate, the glass aggregate mortars had just 2% to 5% lower compressive strengths than the reference mortar after 90 days. The dissolving of very tiny glass particles in alkaline liquid, which strengthened the gel network of the alkali-activated system by the contribution of more silica, is linked to the strength growth of glass aggregate mortars at later ages.

3.3 Drying shrinkage

The influence of waste glass fine aggregate on alkali-activated mortar drying shrinkage. The drying shrinkage of the mortars was reduced at all ages when the glass aggregate content was increased. At 90 days, the drying shrinkage of alkali-activated mortar reduced steadily from 1938 microstrain for 100% sand to 1620 microstrain for 100% glass aggregate. The high elastic modulus and low water absorption capacity of glass aggregate are responsible for the reduction of drying shrinkage.

Many writers have looked into the economic, environmental, and engineering benefits of reusing waste-glass powder (WG) as a partial cement replacement. As these studies show, depending on the size of the glass particles, the reuse of WG in the concrete industry is accompanied by two antagonistic behaviors: the alkali– silica reaction (ASR), which has negative effects, and the pozzolanic reaction, which improves the mechanical and physical properties of concrete. The idea of employing waste glass in concrete is not new; in the 1960s, attempts were made to use crushed waste glass as a substitute for aggregate.

4. Conclusions

Glass is an abiotic material, meaning it cannot be degraded by the earth naturally. Glass is a material that has a significant impact on human lives. However, even glass might have a detrimental impact if the remaining glass, which has been used, is not properly handled. This is referred to as glass garbage.

Glass is manufactured by heating limestone, sand, and soda ash to a temperature of 1,500 degrees Celsius. Natural gas is used to provide this heat, which accounts for 75 to 85 percent of the carbon emissions produced by the glass industry. The remaining emissions are a by-product of the raw materials' chemical reactions. Glass garbage has a detrimental influence on the environment and is potentially hazardous to humans.

Acknowledgement

First of all, the author would like to thank the Lord Jesus Christ, only by His grace this paper can be done. Wanna say Thank You also to the President University and Environmental Engineering lecturer, Dr. Ir. Yunita Ismail Masjud, M.Si, as our supervisor in the Climate Change Adaptation and Mitigation Course, for her guindance during the course. This paper is a part of the final assignment from the subject Climate Change Adaptation and Mitigation

Author Contribution

Conceptualization, I.M.P. and Y.I.M.; Methodology, I.M.P. and Y.I.M.; Software, I.M.P. and Y.I.M.; Validation, I.M.P. and Y.I.M.; Formal Analysis, I.M.P. and Y.I.M.; Investigation, I.M.P. and Y.I.M.; Resources, I.M.P. and Y.I.M.; Data Curation, I.M.P. and Y.I.M.; Writing – Original Draft Preparation, I.M.P. and Y.I.M.; Writing – Review & Editing, I.M.P. and Y.I.M.; Visualization, I.M.P. and Y.I.M.; Supervision, I.M.P. and Y.I.M.; Project Administration, I.M.P. and Y.I.M.; and Funding Acquisition, I.M.P. and Y.I.M.

Funding

This research received no external funding.

Ethical Review Board Statement

Not applicable.

Informed Consent Statement

Not available.

Data Availability Statement

Not available.

Conflicts of Interest

The authors declare no conflict of interest.

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