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Characteristics of "Eco Green Concrete" Concrete with Locagramic Additional Materials

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Abstract

Commonly used concrete is made from a mixture of fine aggregate (sand), coarse aggregate (gravel), cement, and water. These constituent materials come from nature and have been processed and selected according to their needs. As time passes, the widespread use of concrete as a construction material can disrupt the balance of the surrounding environment, given the reduction in the ingredients of concrete available in nature. Therefore, we need an innovation that can be a choice in using concrete without destroying our natural resources, usually called Green Concrete or Eco Green Concrete. In other words, the level in this research is an appropriate technology for replacing building materials. The problem is how much influence the percentage of glass bottle powder, ceramic powder, and granite powder waste has in achieving the slump test value and the planned increase in compressive strength. Know the compressive strength of concrete using added Lokagrmic waste (glass bottle powder, ceramic powder waste, and granite powder waste). The method used is by conducting research in the laboratory, especially the civil engineering laboratory, using a variation of 2.5%, 5% and, 7.5%, 10% loagrik material samples with a treatment time of 3 days, seven days, and 28 days, the next step is to test the compressive strength of concrete and the split tensile strength of the concrete while the concrete made is 20 MPa.

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1 Introduction

The progress of the current global era cannot be separated from developments in the construction sector, which are increasingly creative and innovative. One of them is using concrete as part of building construction. It is relatively strong, can be shaped according to needs, and is more economical than other construction materials that use steel or wood.

Commonly used concrete is made from a mixture of fine aggregate (sand), coarse aggregate (gravel), cement, and water. These ingredients come from nature and have been processed and selected according to their needs. As time goes by, the widespread use of concrete materials for construction can disrupt the balance of the surrounding environment, considering the reduction in the materials that make up concrete available in nature. Therefore, we need an innovation that can be a choice for using concrete without destroying our natural resources, usually called Green Concrete or Eco Green Concrete (Kirthika & Singh, 2020; Suhendro, 2014; Habert et al., 2010).

One alternative that can be done without reducing the strength of the concrete itself is to use additional materials derived from building materials, which can be reprocessed according to needs and minimize the use of cement. For this reason, additional materials are needed, such as glass bottle waste, ceramics, and granite, as a substitute for cement.

Minimizing the use of cement and replacing it by adding some waste which is intended as additional material, raises problems that question how significant the influence of the percentage of glass bottle powder waste, ceramic powder waste, and granite powder waste is in the role of achieving the slump test value and the planned increase in compressive strength (Saputra, 2019; Aıtcin, 2003; Hoseini et al., 2009; Santri et al., 2021).

2 Materials and Methods

This research will be carried out for six months. Testing was carried out at the Pontianak State Polytechnic Civil Engineering Laboratory. Research methods are structured in such a way as to make it easier to research so that it runs more effectively and efficiently. The stages of the implementation procedure are depicted in a flow diagram below:

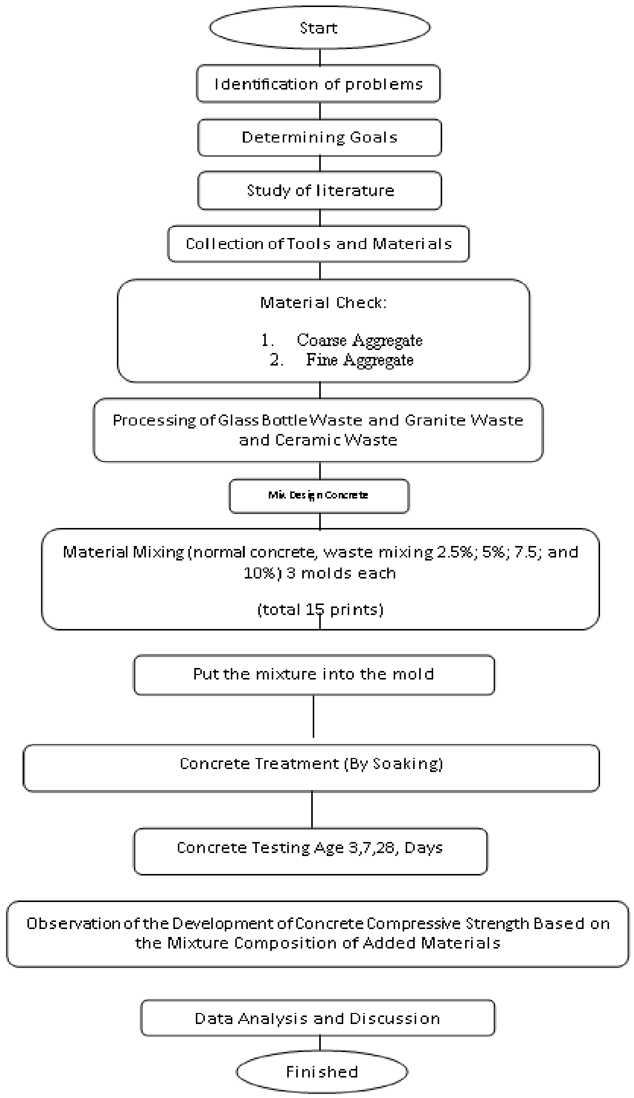

Figure 1. Research flow diagram

Research implementation stage

There are several steps in carrying out this research according to the flow diagram above (figure 1):

1) Prepare tools and materials
2) Carry out aggregate testing
3) Processing glass bottle waste, granite waste, and ceramic waste
4) Create a concrete job mix design
5) Make a test object in the form of a concrete slender measuring 15 cm in diameter and 30 cm high with several variations of grammatically added materials 0 %, 2.5%, 5%, 7.5 %, 10 %
6) Carry out concrete maintenance for three days, seven days, and 28 days
7) Carry out concrete compressive strength and concrete split tensile strength tests

Table 1
Aggregate testing procedures

NO	Examination	Standard Examination	Unit
A	Coarse Aggregate		
1	Graduation	SNI 03-1968-1990	%
2	Abrasion	SNI 03-2417-1991	%
3	Specific Gravity	SNI 03-1969-1990	
4	Moisture Content	SNI 03-1971-1990	
5	Bulk Density	SNI-03-4804-1998	
B	Fine Aggregate		
1	Graduation	SNI 03-1968-1990	%
2	Specific Gravity	SNI 03-1970-1990	
3	Moisture Content	SNI 03-1971-1990	
4	Bulk Density	SNI-03-4804-1998	

Mixed design calculations (Mix Design)

Mixed Design with a strength of 20 MPa

Make test objects with a variety of mixtures

1) Normal concrete without added materials;
2) Normal concrete with added material composition of 2.5%, 5%, and 7.5%, 10% (glass bottle waste, granite waste, and ceramic waste).

For each variation, 3 test objects were made, each with a treatment period of 3 days, 7 days, and 28 days.

3 Results and Discussions

The results of the OK aggregate testing can be seen in Table 2 below:

Table 2
Fine aggregate testing

No	Testing	In the market
1	Water content (%)	0,357
2	BJ and Absorption	
	BJ Bulk	2,5079
	BJ SSD	2,5270
	BJ Apparent	2,5567
	Absorption	0,7600
3	Netto	1,6207
4	Mood content (%)	1,12

Table 3
Coarse aggregate testing

No	testing	In Market
1	Water content (%)	0,5207
2	BJ and Absorption	
	BJ Bulk	2,6638
	BJ SSD	2,6817

	BJ Apparent	2,7123
	Absorption	0,667
3	Content Weight	1,4586
4	Abrasion (%)	14,06

Compressive strength

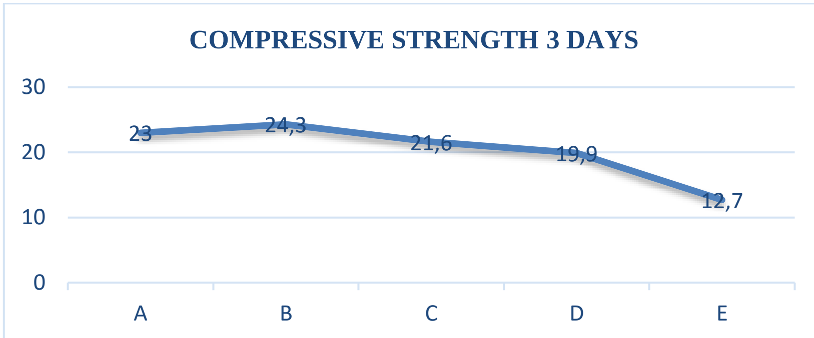

Figure 2. Average compressive strength for each variation

From the picture above, it turns out that the highest compressive strength results are found in variation B, where variation B is with 2.5% added material, which is 24.3 MPa, which is greater than the planned compressive strength, namely 20 MPa, while the lowest variation is in Variation E, which is 12. .7 %

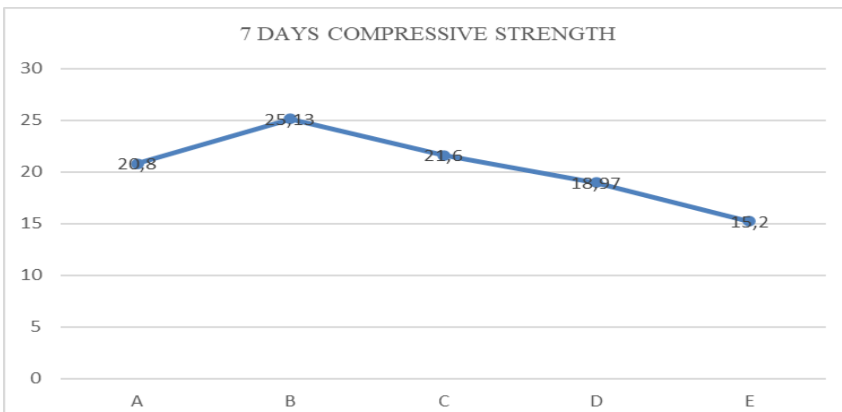

Figure 3. Graph of compressive strength test results at seven days

From the picture above, it turns out that the highest compressive strength results are found in variation B, where variation B is with 2.5% added material, which is 25.13 MPa, which is greater than the planned compressive strength, namely 20 MPa, while the lowest variation is in variation E, which is 19.2. %

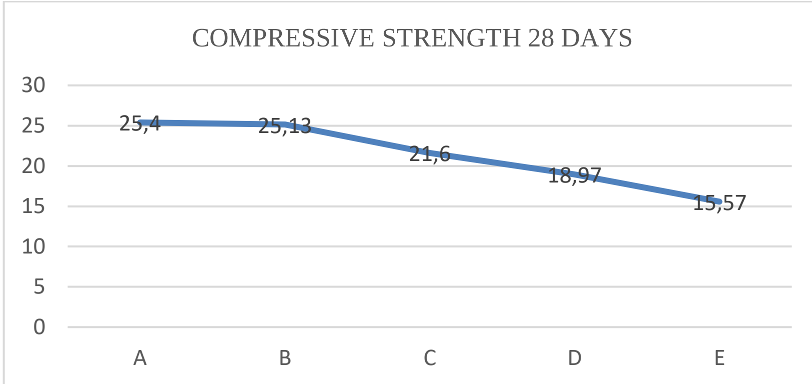

Figure 4. Graph of compressive strength test results at the age of 28 days

From the picture above, it turns out that the highest compressive strength results are found in variation B, where variation B is with 2.5% added material, which is 25.13 MPa, which is greater than the planned compressive strength, namely 20 MPa, while the lowest variation is in Variation E, which is 15.57. Mpa. From the results of observations with different compositions, it was found that the average decrease occurred when using additional waste, and the maximum that occurred when adding waste material was 2.5%, while the minimum compressive strength that occurred when adding 10% of waste was (Batayneh et al., 2007; Meyer, 2009; Army et al., 2022).

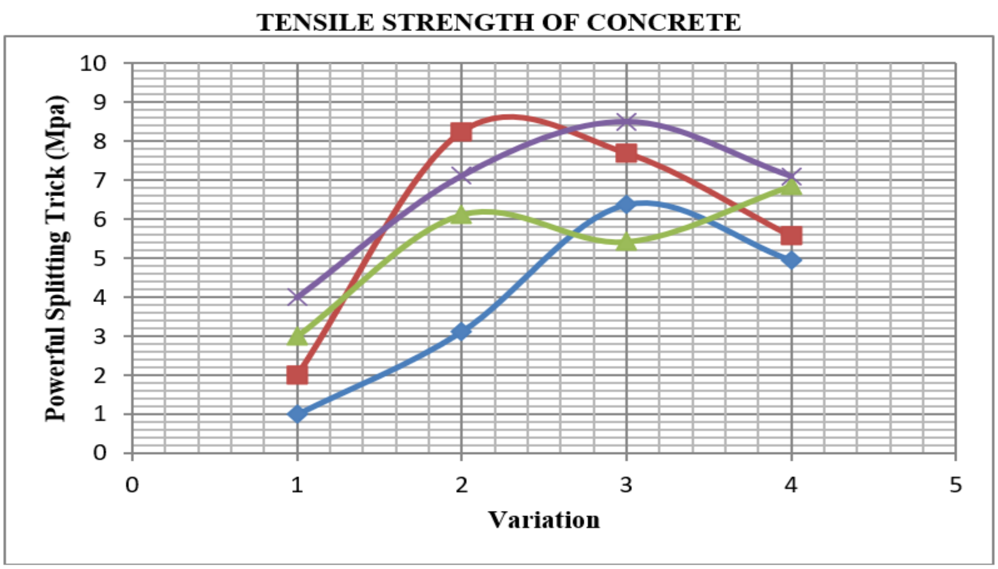

Figure 5. Concrete split tensile strength

From Figure 5, you can see the relationship between the variation, which shows the splitting tensile strength and the age of the concrete. The picture above shows that the maximum splitting tensile strength is 8.2336 MPa for variation 2 for three days of age, while the minimum compressive strength is found in variation 1 for age. Three days with a compressive strength of 3,118 MPa

Lokagramik concrete as "Eco Green Concrete" concrete

The results of making concrete using local grammatical waste showed that glass, granite, and ceramic waste can be used as additional materials for environmentally friendly concrete, provided they are used in concrete with low-strength concrete characteristics (Oikonomou, 2005; Donza et al., 2002; Kirthika et al., 2020).

4 Conclusion

From the results of this research, it was concluded that:

a) The variation of adding Lokagramik waste that produces the most significant strength is the variation with the addition of 2.5% waste, which is the maximum for seven days of concrete with a concrete compressive strength of 25.13 Mpa, while the maximum split tensile strength is 8.4125 at three days. Mpa
b) The slightest variation in the addition of Lokagramik waste is the waste variation of 12.5% in 28 days with a concrete compressive strength of 12.7 Mpa, while the minimum split tensile strength is 4.9815 Mpa.
c) The more Lokagramic Waste is added, the smaller the power.

Environmentally Friendly Concrete using Lokagramik Waste can be used but cannot be used for low-strength.

Conflict of interest statement
The authors declared that they have no competing interests.

Statement of authorship
The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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