Improved Quality Lightweight Concrete Active Pozzoland Waste Tile As Filler With 900◦C Fuel Temperature

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Abstract. The earthquake is a serious threat in the field of construction in archipelagic countries like Indonesia. The heavier the building is, the greater the earthquake force produced. Lightweight concrete is a concrete that has a light density and contains lightweight aggregate. According to SNI-03-3449-2002 lightweight concrete has a weight of not more than 1850 kg / m3. The innovations used are not limited to the addition of aluminum powder additives but also the utilization of waste as a concrete material as an alternative in waste utilization. The result of the addition of tile powder used as filler in each variation can not increase the value of compressive strength but all the result of the test object still meet the criteria of light concrete that is under 1850 kg / m3. The increase in compressive strength occurs in variations 3 and 5 but does not exceed variation 1. In the 5x5 cm paste specimen, the material is mixed without the use of aluminum powder, the results are more optimal, the data obtained is more accurate, this is due to the method of making pasta with only cement and tile dust no material is wasted.

1 Preliminary

The earthquake is a serious threat in the field of construction in archipelagic countries like Indonesia. The heavier the building is, the greater the earthquake force produced. To reduce earthquake force, the building is designed as light as possible. Some technologies continue to be developed to reduce building weight, such as the use of mild steel on roofs and ceilings instead of wood, the use of lightweight concrete bricks instead of bricks on walls.

Lightweight concrete is a concrete that has a light density and contains lightweight aggregate. According to SNI-03-3449-2002 lightweight concrete has a weight of not more than 1850 kg / m3. In this case lightweight concrete on its use can be used in various forms as needed. In the manufacture of non-structural lightweight concrete there is the addition of additives and light aggregates to lighten the weight. One of the uses of additives is the use of aluminum powder. Aluminum powder is used as a developer in cement paste with the aim of reducing the weight of concrete but does not reduce the volume of concrete (Lukman, 2017).Affiliations of authors should be typed in 9-point Times. They should be preceded by a numerical superscript corresponding to the same superscript after the name

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In this research, materials used are sand, cement, tile powder, aluminum powder, and water. However, lime is not added like previous studies because in preliminary studies of lightweight concrete without using lime, the density is still below 1850 kg / m³, and also a decrease in compressive strength if added lime into consideration for the elimination of lime additives. With the temperature that has been determined in the previous lab test, a temperature of 900 ° C was chosen and also the temperature is the maximum temperature in the tile burning in the place of production. The independent variable is tile powder because this research focuses the effect of tile powder as a cement filler on the manufacture of non-structural lightweight concrete. While aluminum powder is determined based on prior research and journals. Then a mechanical test is performed to determine the compressive strength and specific gravity.

2 Research Methodology

Research on the use of tile waste as a partial replacement for cement and the addition of aluminum powder and the addition of lime is carried out from December 2017 to May 2018. This research was carried out in the Structural Laboratory of the Department of Civil Engineering, University of Jember. For X-Ray Diffraction testing conducted in the Central Laboratory of Minerals and Advanced Materials, State University of Malang

2.1 Roof Tile Burning

The tile powder that has been ground until smooth is then carried out by testing the filter No. No. 200. After that, the burning was done with a furnice in the Laboratory of Packaging of the Faculty of Mechanical Engineering, University of Jember. Burning is carried out for 5 hours by gradually increasing the temperature to 900˚C. It was intended to find out the maximum amorphous level obtained from tile powder, and the results of the tile powder that would be added to the lightweight concrete mixture.

2.2 Test object making

Making test specimens is carried out using conventional methods. The use of conventional methods is to make their own mixture of water material, cement, tile powder, sand, and aluminum powder in different proportions. The goal is to find the optimal proportion of each use of the material. Before making a test object, an experiment is made to make a test object. The purpose of making a test specimen is to find out the initial proportion of the main test object to be used. In this study sand, water, and aluminum powder as a control variable, while tile powder, and cement as independent variables in accordance with the research objectives. The use of a proportion of a mixture of water, cement, tile powder, sand, and aluminum powder is planned as follows

Test object	Cement	Tile Powder	*Alumunium powder*	Cement Water Factors	Testing Press (days) 7	14	21	28
BU_1	100%	0%	0.75%	0.6	3	3	3	3
BU_2	100%	5%	0.75%	0.6	3	3	3	3
BU_3	100%	10%	0.75%	0.6	3	3	3	3
BU_4	100%	15%	0.75%	0.6	3	3	3	3
BU_5	100%	20%	0.75%	0.6	3	3	3	3
					15	**15**	**15**	**15**
Total							**60**	

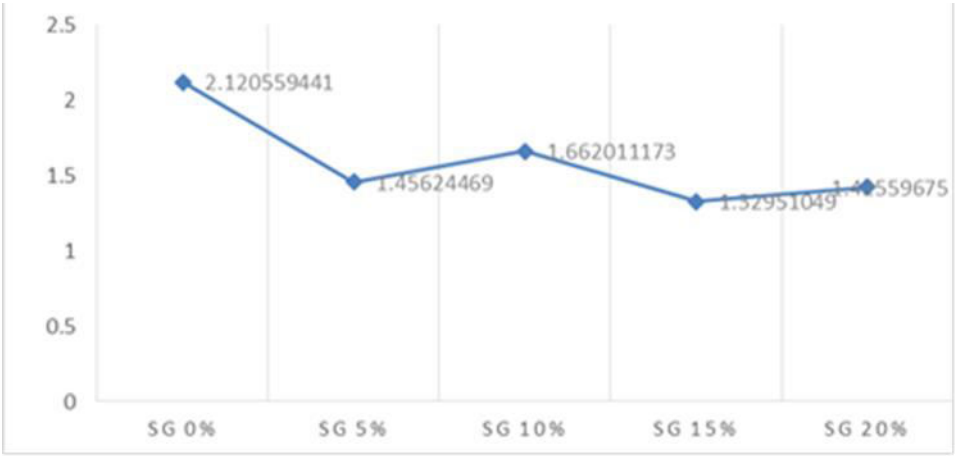
3 Results And Discussion

Compound Name	Perct. [%]	Chemical Formula
Corundum	33,5	Al2O3
Quartz	4,4	SiO2
Hematite	62,1	Fe2O3

Based on ASTM C618-92a chemical requirements that meet pozzoland elements of at least 70% of the amount of SiO2 + Al2O3 + Fe2O3, in the XRD test that has been carried out and XRD data has been cleared using the High Score Plus software meets these requirements which is 100% of the 4 , 4% SiO2 + 33.5% Al2O3 + 62.1% Fe2O3. It can be concluded that the tile powder with 900C combustion is 100% containing pozzoland

Testing of lightweight concrete specimens was carried out at ages 7, 14, 21 and 28 days. Testing carried out on the test object is testing the volume weight and compressive strength. This test is carried out in order to find out the results of the specimen that has been made.

Compressive Strength (Mpa)

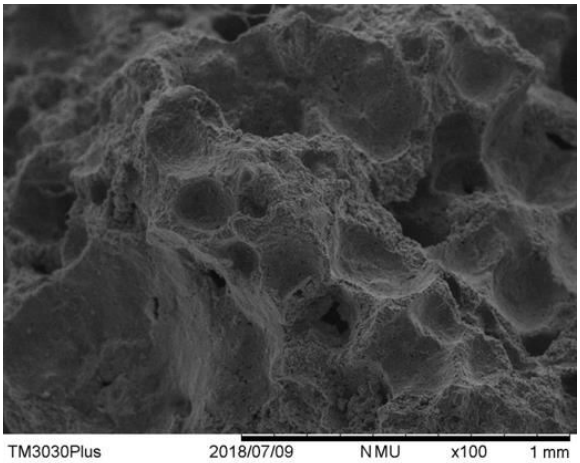


Note: - Variation 1 (0% tile powder, and 0,75% aluminum powder)
- Variation 2 (5% tile powder, and 0.75% aluminum powder)
- Variation 3 (10% tile powder, and 0.75% aluminum powder)
- Variation 4 (15% tile powder, and 0.75% aluminum powder)
- Variation 5 (20% tile powder, and 0.75% aluminum powder)

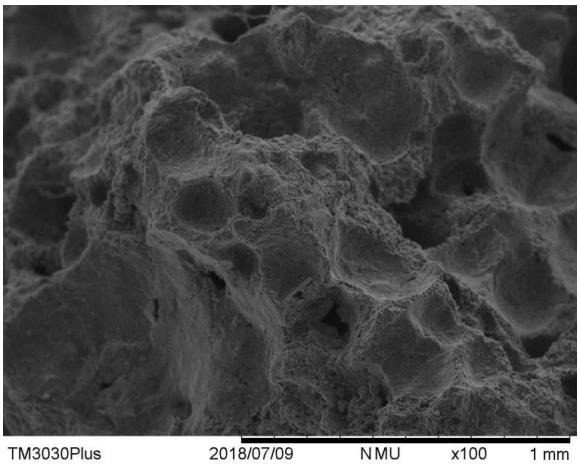
The increase in compressive strength occurs in variations 3 and 5 but does not exceed variation 1. The results of testing the 28-day age test specimen are not far away with the test results at the age of 7, 14, and 21 days. Where there is a decrease in compressive strength in variation 2 and again increases in variation 3 and there is a decrease back in variation 4 and increases again in variation 5. This is influenced by the high absorption value of tile powder. The addition of tile powder that is used as a filler in each variation cannot increase the compressive strength value, but all the results of the test material still meet the criteria of lightweight concrete which is below 1850 kg / m3. With these results the increase in percentage increase results in high absorption by tile powder material, which

makes bubbles from aluminum powder cannot expand perfectly because the water has been absorbed by other materials.

3.1 Scanning Electron Microscope (SEM) Test Results



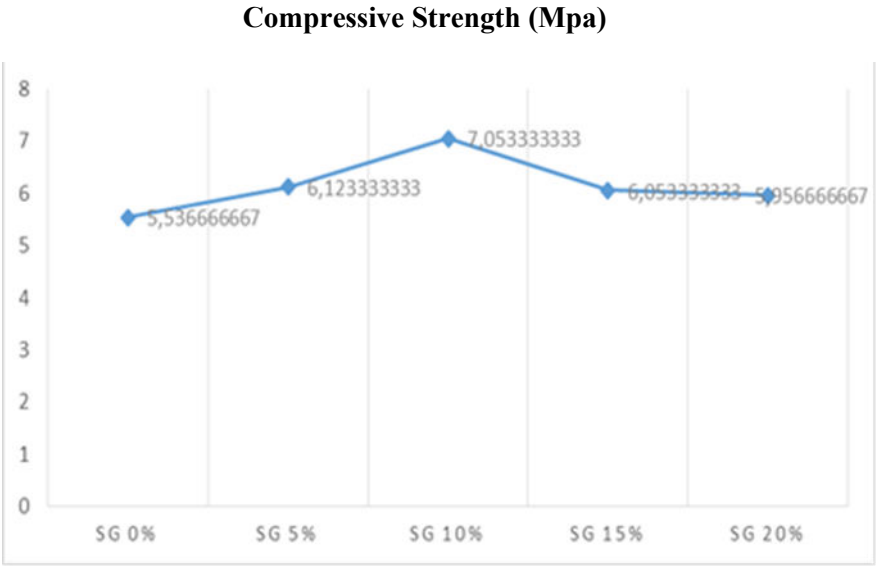
SEM test results of 10% lightweight concrete tile powder



SEM test results of 15% lightweight concrete tile powder

SEM test is done with 100x spread, taken only two stamps, namely 10% and 15% because they see the highest and lowest compressive strengths. Can be seen cavities in concrete more on lightweight concrete with the addition of 15% tile powder, and in lightweight concrete with the addition of 10% tile powder the structure is tighter this results in high compressive strength on 10% tile powder lightweight concrete and also its specific gravity the heaviest among the other 4 variations. With less empty space in the concrete, higher pressure is needed to start cracks, so that the compressive strength of the concrete will be greater (Zulfa, 2017).

3.2 Pasta Testing for 3 Days



The results obtained from the effect of tile powder on the highest compressive strength is found in variation 3 with 10% tile powder with a compressive strength of 7.05 MPa and a weight of 1704 kg / m3. Gradually from variation 1 to variation 3 compressive strength and volume volume increase, but in variation 3 to variation 5 compressive strength and volume volume decrease. Without aluminum powder mixture the role of tile powder as a maximum filler in the variation of the addition of 10% tile powder, because there is no material wasted.

Procedure cutting up to 1/3 part of the test material affects the decrease in compressive strength because it is possible that the main material contained in the tile powder is wasted, so further research is needed so that no cutting procedure is necessary. The higher the addition of tile powder, the more material is wasted from the cutting procedure. The method by means of autoclave is more appropriate to be used in this study because autoclaves can reduce water content in lightweight concrete but still bind between the material contained. The mortar that is autoclaved has a lighter weight than mortar that is not autoclave. So it can be concluded that the replacement of sand filler in mortar with fine ALWA can lighten the weight of the volume, the addition of fly ash in fine ALWA can also reduce the weight of the volume (Nanin, 2013).

4 Conclusion

1. Using the X-RD (High Score Plus) data processing program obtained pozzoland elements that meet the requirements of ASTM C618-92a with the amount of SiO2 (Quartz) 4.4% + Al2O3 (Corundum) 33.5% + Fe2O3 (Hematite) 62 , 1% = 100% SiO2Al2O3Fe2O3 (Pozzoland)
2. Physical properties of lightweight concrete are more fragile than normal concrete in general, because of the lightweight concrete and the number of cavities in it. With the addition of 5% to 20% tile powder, the compressive strength of lightweight concrete decreases but the compressive strength is still in the category of non-structural lightweight concrete with 0.35 Mpa to 7 Mpa, with a volume weight still below 1850 kg / m3. The highest compressive strength results were in variation 1 without additional

tile powder with a compressive strength value of 2.380 Mpa and a volume weight of 1402.951 kg / m3. However, for lightweight concrete with the highest addition of tile powder is found in variation 3 with a compressive strength of 1,817 Mpa and its volume weight is 1530,509 kg / m3. While the results of the lightest volume weight are in variation 4 with a volume weight of 1314,097 kg / m3 and a compressive strength of 1,120 Mpa. But on the results of the paste test without a mixture of aluminum powder, the maximum results obtained with the highest strength in the variation of 3 addition of 10% tile powder.

3. The effect of tile powder on the compressive strength of lightweight concrete tends to decrease, only a mixture of 10% tile powder is close to the value of lightweight concrete compressive strength without the addition of tile powder and also the highest of other variations. Specific gravity or weight increased but still classified as lightweight concrete which is still below 1850 kg / m3.

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