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The Effect of Compressive Strength of Concrete with Epoxy Putty Mixture on Immersion with PDAM Water and Seawater

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ABSTRACT:

Coastal areas are prone to abrasion in some places, such as on the coast of Mempawah at Tanjung Burung Beach. The local community seeks the government to quickly build a concrete breakwater in order to reduce the impact of coastal abrasion. In this case the concrete to be made uses epoxy putty additives where this material aims to reduce absorption and increase the physical quality of the concrete. Before the manufacture of concrete is carried out, first conduct material testing aims to determine the characteristic properties of the material used to comply with the regulations, namely testing the physical and mechanical properties of aggregates (SNI 03-1971-1990). Slump test (SNI 03-1972-1990). Test objects were made with a size of 150 mm x 150 mm x 150 mm (cube) with concrete soaking for 14 and 28 days. For concrete mix variations with the addition of epoxy putty at 0% (normal), 1%, 3%, and 5% with a normal concrete compressive strength plan used 20 MPa. With the addition of epoxy putty in PDAM water immersion, the compressive strength of concrete decreased by 27.31%, 49.31% and 37.24% compared to normal concrete. Meanwhile, with the addition of epoxy putty and concrete immersion in seawater, the compressive strength of concrete increased by 3.18%, 38,59% and 37,53% compared to normal concrete.

Keywords: Concrete compressive strength, epoxy putty, tap water, seawater, concrete absorption

1. Introduction

Concrete is a mixture of fine and coarse aggregate materials, namely sand, crushed stone, by adding enough cement adhesive and water as an auxiliary material for the purpose of chemical reactions during the hardening process (Tjokrodimulyo, 2007). In addition to stone, sand, cement and water, concrete is also sometimes given additional ingredients.

Additives are materials other than normal concrete constituents that are added to the concrete mix, these additives serve to change the properties of the concrete to make it more suitable for certain jobs. In this case, the additive used is epoxy putty, this putty is resistant to rust and good adhesion, but drying is longer. The concrete test will be carried out in the laboratory, where the tests to be carried out are slump test, compressive test and, absorption of concrete against immersion with PDAM water and sea water. For concrete that will be used is wave breaking concrete, where this concrete will be used in coastal areas affected by abrasion (erosion of land by sea waves) this concrete serves as a wave breaker. This concrete is planned to be used in the coastal area of Mempawah part of Tanjung Burung Beach, because in the area is an area that has been abraded. Where, according to Lensa Kalbar (2022) "Since its opening two years ago, an estimated 20 meters of Tanjung Burung Beach area in Tanjung Village, Lower Mempawah District has been eroded. As a result, the land area in the area is decreasing. The community hopes that the local government will immediately install wave breaking stones.

Budi, et al (2018) conducted research on the effect of seawater immersion time on the compressive strength of concrete using 3 variations of cement brands with 10% fly ash. From the results of the study, the compressive strength value of concrete at the age of 7 days, 14 days, and 28 days respectively for Holcim cement is 13.53 MPa, 20.58 MPa, 21.49 MPa, Tiga Roda cement is 14.63 MPa, 17.75 MPa, 22.63 MPa and for Gresik cement is 13.51 MPa,

16.20 MPa, and 19.53 MPa. From the research conducted on Holcim Cement, Tiga Roda Cement and Gresik Cement, it is found that Tiga Roda cement is best used. Showing the results of the research conducted is the higher the absorption, the higher the compressive strength value of concrete.

Wihelmina, et al (2021) The difference in bearing capacity of shallow foundations in peat soil with and without the use of epoxy in Kalimantan construction of residential houses in East Kalimantan will continue to increase, if we do not know the nature and characteristics of peat soil itself, there will be many problems or construction failures. Peat soil, better known as peat soil, has a low bearing capacity and a large settlement. This study aims to determine the bearing capacity and settlement of the soil in East Kalimantan when using a square shallow foundation measuring 2m x2m with a depth of

1.5m and the price efficiency of making foundations when using epoxy paint and not using epoxy paint, as a paint that protects the foundation layer from the high acidity of peat soil. The results of the calculation of the bearing capacity of the soil using the Terzaghi bearing capacity state that the designed foundation meets the requirements of the soil bearing capacity in longterm 74.406t/m2 ⩾ 1.66 t/m2 (qall ⩾ σ max) and shortterm 6.52t/m2 ⩾ 0.57 t/m2 (qall ⩾ σ min). The results of the decline calculation found that the square foundation with a size of 2m x 2m with a depth of 1.5 m meets the decline

requirements because the results of Stotal ⩽ Sijin, namely 0.0355 m ⩽ 0.15333 m. The results of the calculation of the comparison of the Budget Plan for making foundations without epoxy and foundations using epoxy do have differences in costs incurred following the results of the calculated rab can be seen in Table 6. However, the difference is not too far away, it's just that when using epoxy in concrete the foundation has greater durability so that the life of the building can reach the existing standards of around 25-30 years.

Saputra, et al (2017) concluded the results of their research on the curing process of PDAM water, sea water and sewage water can be concluded as follows: At the age of 7 days for the maximum compressive strength value of PDAM water, seawater, and sewage water respectively amounted to

13.522MPa, 8.759 MPa, 10.296 MPa. The compressive strength value of PDAM water at the age of 7 days has increased compared to the compressive

strength value of sea water and comber water, while the compressive strength value of sea water has decreased compared to comber water which has increased. So it can be concluded that the highest compressive strength value is PDAM water at the age of 7 days.

Ahmad (2018) concluded that the results showed that the compressive strength of concrete mixed with seawater (BLT and BLL) increased the compressive strength of concrete mixed with PDAM water (BTT and BTL) followed by a decrease in concrete porosity. The compressive strength of concrete mixed and treated with seawater (BLL) was 352.29 kg/cm2 with a porosity of 17.06% concrete. The compressive strength of concrete mixed with seawater and treated with PDAM water (BLT) was obtained 331.61 kg/cm2 with a concrete porosity of 16.87%. The compressive strength of concrete mixed with PDAM water and treated with PDAM water (BTT) as a comparison concrete was obtained 314.05 kg/cm2 with a porosity of 17.97%. The compressive strength of concrete mixed with PDAM water and treated with seawater (BTL) was 297.80 kg/cm2 with porosity of 16.44%. Good sorptivity of concrete tends to be shown by concrete treated with seawater (BTL and BLL).

Wedhanto (2017) states that concrete that is soaked with seawater for 7 days the compressive strength of concrete increases faster. However, when the concrete is soaked longer the strength tends to decrease. Concrete soaked for 28 days in seawater, concrete using type 1 cement has the highest relative strength.

Lisantono, et al (2018) concluded that the compressive strength value of normal concrete without glass powder is higher than normal concrete with 50% glass powder substitution with a decrease ratio of 0.81 at the age of 14 days and an increase ratio of 1.03 at the age of 28 days, while normal concrete with 50% glass powder substitution and the addition of 10% epoxy experienced an increase in compressive strength than normal concrete with 50% glass powder substitution with a decrease ratio of 0.89 at the age of 14 days and a decrease ratio of 0.98 at the age of 28 days. The flexural strength of concrete with 50% glass powder substitution is greater than that of normal concrete and concrete with 10% epoxy addition and 50% glass powder substitution. The modulus of elasticity of concrete with 50% glass powder substitution was 25813.05 MPa at 14 days and 32441.09 MPa at 28 days. The elastic modulus of concrete with 50% glass powder substitution is higher than normal concrete and concrete with 50% glass powder addition and 10% epoxy. The use of glass powder greater than 50% can reduce the compressive strength value of concrete. The addition of glass powder greater than 50% can make the workability of concrete not so good.

What distinguishes our research is, here we examine breakwater concrete by mixing epoxy putty, which is soaked with sea water and PDAM water. Then compare how the physical properties and mechanical properties.

2. Methodology

The research method used in this research is experimental research method. This research was conducted in the Civil Engineering Laboratory of Pontianak State Polytechnic. The steps and procedures carried out in this study began with obtaining data requirements for coarse and fine aggregates, and the type of mixture to be used in this study. After all the required data is obtained, then proceed with the preparation of the material to be used in the concrete mixture. Then the initial inspection of the material is carried out, whether it meets the requirements or not. The types of checks carried out in the initial inspection are: moisture content, specific gravity, content weight, sieve analysis, and abrasion test. After further inspection, the process of designing the aggregate composition based on the predetermined specifications can be started. At this stage, the composition of the concrete mixture will be determined based on the planning.




Figure 1: Testing the physical properties of the material

This study will observe the behavior of concrete immersed in seawater and PDAM water using epoxy putty mix concrete.

Table 1. Test Item Variables

TEST ITEM	14 days of soaking		28 days of soaking	
	PDAM Water	Sea Water	PDAM Water	Sea Water
NORMAL	3	3	3	3
Epoxy 1%	3	3	3	3
Epoxy 3%	3	3	3	3
Epoxy 5%	3	3	3	3

This research was conducted directly in the Civil Engineering Laboratory of the Civil Engineering Department of Pontianak State Polytechnic. The test object is made with a cube mold measuring 150 mm x 150 mm x 150 mm, the test object to be made will later be tested physically and mechanically after 14 days and 28 days of age. How to test the compressive strength of concrete is done by pressing the cylindrical test object until it is destroyed. Testing compressive strength using a compression test tool (ASTM C 39 / C 39M-05, 2005). The results of compressive strength testing will obtain data in the form of load / load values and displacement / displacement distance. Based on the data obtained, a graph of the relationship between stress and strain can then be made.

Figure 2. Making of test specimens

3. Results and Discussions

Aggregate Moisture Content Testing

The water content of coarse aggregate is 1.142% while the water content of fine aggregate is 2.203% and this value meets the standard specification of water content which is 3%-5%. So that the moisture content in the aggregate is fulfilled.

Specific gravity and absorption testing

The specific gravity and absorption tests of coarse aggregates obtained the specific gravity data used for the design of bulk/specific gravity concrete mixes at SSD (Saturated Surface Dry). The specific gravity of fine aggregate was 2.65 and this value meets the specific gravity specification standard of 2.58 to 2.83. The absorption of coarse aggregate is 0.595%. A wide variety of fine aggregate absorption options are available to you, such as gravity separator, flotation separator, and magnetic separator. The absorption of fine aggregate was 0.251%.

Aggregate Content Weight Testing

The average content weight of coarse aggregate was found to be: 1.53kg/dm³. The minimum weight of coarse aggregate content specified by SNI 03-1973-2008 should be 0.4 to 1.9kg/dm³. Meanwhile, the average content weight of fine aggregates was found to be: 1.64 kg/dm³. The minimum fine aggregate content weight specified according to SNI 03-1973-2008 should be 0.4 to 1.9 kg/dm³.

Aggregate Sift Analysis

From the coarse aggregate sieve analysis test, it is found that the percentage of grain weight through the coarse aggregate sieve analysis meets the max size of 40 mm. Meanwhile, from the fine aggregate sieve analysis test, it is found that the fine aggregate data (sand) is included in the Zone II requirements, which is a rather fine (medium) sand gradation area, this is in accordance with the SNI 03-1968-1990 standard.

Calculation of Abrasion and Wear of Coarse Aggregates

In this abrasion test, researchers used method B with the number of balls 11 pieces and the number of rounds as much as 500 rounds, it can be concluded that from the results of the abrasion wear test of coarse aggregate produces a wear value of 21% Based on the specifications of SNI 03-2417-2008, the specified coarse aggregate wear is a maximum of 40%, thus the coarse aggregate in this study has met the requirements of the concrete mixture.

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Figure 3: Testing the compressive strength of concrete

Table 2: Concrete compressive strength test results (MPa)

Age	PDAM Water				Sea Water			
(days)	0% Epoxy	1% Epoxy	3% Epoxy	5% Epoxy	0% Epoxy	1% Epoxy	3% Epoxy	5% Epoxy
14	35,35	22,32	21,73	18,23	15,34	18,81	20,80	18,22
28	30,24	21,98	15,33	18,98	16,04	16,55	22,23	22,06

From table 2. Above, it can be seen that the compressive strength of concrete with immersion in PDAM water is obtained at the age of 14 days, 28 from with the composition of 0%, 1%, 3%, and 5% epoxy putty obtained concrete compressive strength respectively 35.35 MPa, 30.24 MPa, 22.32 MPa, 21.98 MPa, 21.73 MPa, 15.33 MPa, 18.23 MPa, and 18.98 MPa.

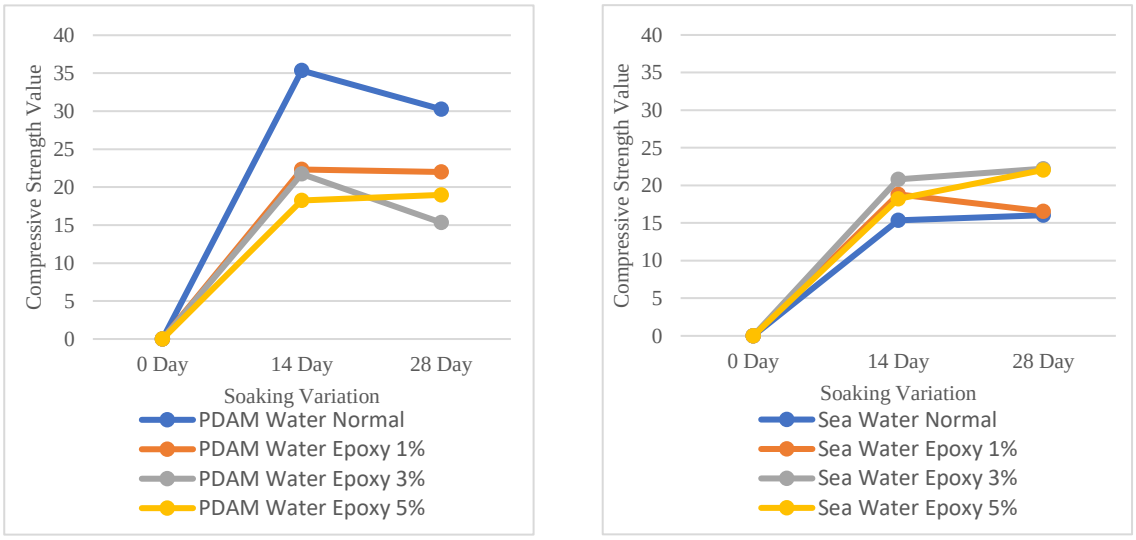

Figure 4: Graph of the compressive strength of concrete with PDAM water and seawater immersion

From Figure 4, it can be seen that with the addition of epoxy putty both 1%, 3% and 5% in the concrete mixture with PDAM water immersion, the compressive strength of concrete aged 14 days, decreased in compressive strength successively by 36.86%, 38.53% and 48.43% compared to normal concrete (0% epoxy putty). As for 28-day concrete, it decreased by 27.31%, 49.31% and 37.24% compared to normal concrete. The compressive strength of concrete with seawater immersion, the compressive strength of concrete aged 14 days increased compared to normal concrete by 22.62%, 35.59%, and 18.77%. As for 28-day concrete, it also increased by 3.18%, 38.59% and 37.53% compared to normal concrete.

4. Conclusion

From the results of the research on the compressive strength of concrete with the addition of epoxy putty, the following conclusions can be drawn: The physical properties of aggregates can be concluded that the moisture content of fine aggregate is 2.203%, coarse aggregate is 1.142%, specific gravity and absorption of fine aggregate is 0.251% coarse aggregate is 0.595%, content weight of fine aggregate is 1.64 kg/dm3 , coarse aggregate is 1.53 kg/dm3, sieve analysis of fine aggregate is 3.107 coarse aggregate is 6.367, abrasion is 21%. With the addition of epoxy putty in PDAM water immersion, the compressive strength of concrete decreased by 27.31%, 49.31% and 37.24% compared to normal concrete. Meanwhile, with the addition of epoxy putty and concrete immersion in seawater, the compressive strength of concrete increased by 3.18%, 38.59% and 37.53% compared to normal concrete..

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