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ADDITION OF BY PRODUCT FROM INDUSTRIAL SEAWEED WASTE AS SAND MIXED MATERIAL ON MANUFACTURE OF CELLULAR LIGHTWEIGHT CONCRETE

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ABSTRACT

The purpose of this study was to determine the effect of addition of by products from seaweed industry as a sand complement material on the manufacture of lightweight concrete(CLC). This research was experimental studied by making lightweight concrete CLC depends on different concentration of complement by products seaweed industry and sand (0%: 100%; 10%: 90%; 20%: 80%; 30%: 70%; 40%: 60% ; 50%: 50. The lightweight concrete quality assay that used on this study was compressive strength, splitting tensile strength, density, and water absorption. The highest compressive strength of lightweight concrete by concentration 50% of addition industrial seaweed byproducts with a large 1,21 MPa. The highest splitting tensile strength was found on the addition of 50% seaweed industrial byproducts with a large 0.122 MPa. The biggest of water absorption of lightweight concrete was found on addittion 50% of industrial seaweed byproducts by 55.25%, While, the highest density was found on the addition of byproducts with a concentration 50 % by 0.87 kg/L.

KEY WORDS : Carrageenan by product, Cellulose, Lightweight concrete

INTRODUCTION

Industrial seaweed byproducts are the remnant products that are obtained after sea-weed processing. It was divided in 2 forms that is solid byproduct and liquid byproduct. The substances that still contained on it was agar, cellulose, protein, etc (Zhang and Zhou, 2018). Industrial seaweed byproduct can be used in various ways.

The lightweight concrete was materials that improved from the common brick concept. Lightweight concrete was the brick that have pores inside that make lighter than the brick before with the same volume of the brick after all. Those pores are produced for a room for the air inside this brick (Rasheed and Prakash, 2018). Lightweight brick claimed stronger than brick. Because, the pores on the brick can hold shock that make broke on the brick if gets a damage from hard shock. (Onoue *et al*., 2015).

Potential of this byproduct as a sand complement on manufactured lightweight concrete CLC (Cellular Light weight Concrete) have a big chance. Because the shape of this byproduct was same with sand when this byproduct was dry (it shape was like coarse sand granule) (Alamsjah *et al*., 2017). On the other hand, in this by product contained a cellulose. Cellulose in product can make more compact and stronger. It is because, cellulose had on of the hidrocoloid that have a power to binding and as filler from product (BeMiller, 2019).

MATERIALS AND METHODS

The materials used as the basic material for making lightweight concrete include, a solid by-product of the seaweed industry from PT. Kappa Carageenan Nusantara (KCN) Pasuruan, sand, Portland cement, Semen Gresik brand, LN sikamen, water, and foam agent.

Manufacturing Lightweight Concrete

Make the mixture between cement and sand, filter solid byproducts, water, and sikamen LN stirred until the mixture was mixed until homogeneous. After the mixture has met the requirements, added a foam agent and stirred until evenly distributed. Then check the density first.

The finished dough was then put into a lightweight cylindrical concrete mold. After 3 day, the lightweight concrete can be removed from the mold. Lightweight concrete then dried for 28 days. After reached 28 days, this lightweight concrete can be tested. The formulation in making lightweight brick is shown in the Table 1.

Parameter

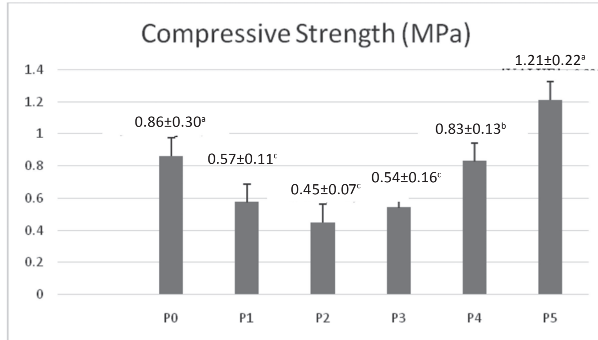
Parameters on this research were compressive strength test, splitting tensile strength test, density test, and water absorption test.

RESULTS AND DISCUSSION

Results

Compressive Strength Lightweight Concrete

Compressive strength and splitting tensile strength were the main parameters in determining the strength of lightweight concrete. The strength of lightweight concrete (compressive strength and tensile strength) in addition to being influenced by the constituent materials, was also influenced by the age of the lightweight concrete. Over time the strength of the cement in the bond will get better. Because the cement inside will continue to strengthen the bond and work of the maximum cement at the age of light brick 28 days. After that the work of cement from not too optimal (Shafigh *et al.*, 2012). The cellulose content in the solid byproducts of the seaweed industry can help strengthen bonds in these light bricks (Dove *et al.*, 2016).



Noticed : Different superscript letters notation in the same column showed the comparison between treatments there were a very significant difference (P <0.05). However, the same superscript indicates that between treatments were not significantly different (P> 0.05).

Fig. 1. Bar chart of the results compressive strength test (MPa)

In the lightweight concrete compressive strength quality test, large compressive strength on lightweight concrete get better results. The best treatment was lightweight concrete with 50% complement by side treatment with 1.21 MPa. While lightweight concrete without the addition of side products have a compressive strength of 0.86 MPa. According to Nugroho (2009) the standard compressive strength of lightweight concrete was 0.7 MPa. The compressive strength of this light weight concrete caused by the strong bonding in the lightweight concrete between the constituent materials.

Splitting Tensile Strength Lightweight Concrete

The splitting tensile strength test results showed that with increasing concentration of the by-product being complemented into lightweight concrete products, the splitting tensile strength of the lightweight concrete has increased. This caused by cellulose contained in the byproducts forming

Table 1. Formulation lightweight concrete

No	Materials	Treatments						Unit
		P0	P1	P2	P3	P4	P5	
1	Cement			524				Gram
2	Sand	1047	943	839	735	631	527	Gram
3	Seaweed by product	0	104	208	312	416	520	Gram
4	Foam agent	10	Ml					
5	Water	450	Ml					
6	Sikamen LN	4	Ml					

strong and long bonds, so that the bond between the materials used in lightweight concrete was getting tighter and stronger (Be Miller, 2019).

The better splitting tensile strength can make the quality of buildings produced better. This was because the higher the splitting tensile strength, the building can reduce the risk of lightweight concrete when they were cracked and split during the transportation process (Ren *et al*., 2018).

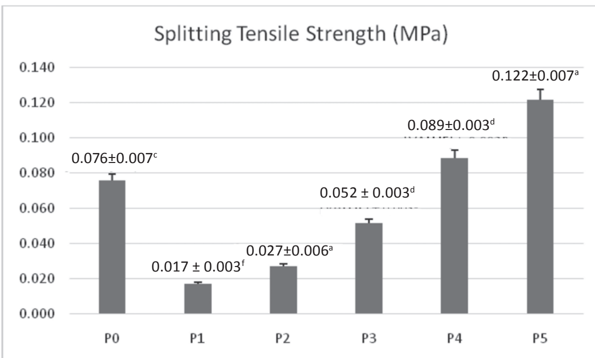


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Fig. 2. Bar chart splitting tensile strength test results (MPa) 3 Density TestLight weight Concrete

The result of the density test of the lightweight concreteproduced increasedwhen the concentration of the supplemented by-productsincreases. The lowest specific gravity is in the treatment without waste with a large 0.77 kg/L and the highest density is found in the treatment of 50% byproduct with a large 0.87 kg/L

Water Absorption Lightweight Concrete

As the concentration of supplemented byproducts

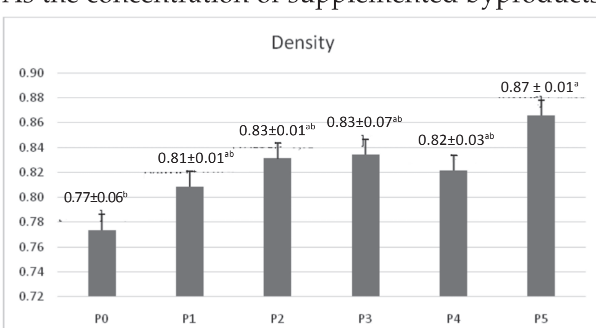

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Fig. 3. Bar chart density test (kg/L)

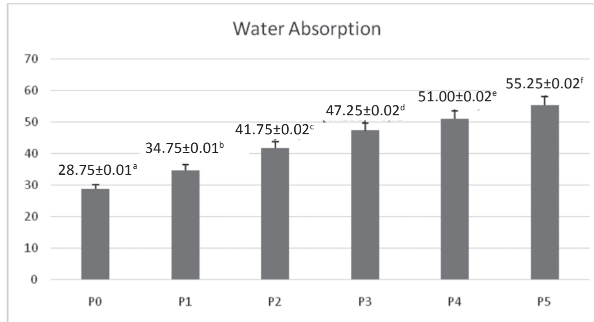

Fig. 4. Bar chart water absorption results test (%)
Noticed : Different superscript letters notation in the same column showed the comparison between treatments there were a very significant difference (P <0.05).

increased, the amount of cellulose found in the ingredients also increases. The more the amount of cellulose in the product, the higher ability of the product to bind water (Alamsjah *et al*., 2017). Cellulose is a substance that is hydrophilic. This was because the cellulose substance has a fairly good water-binding strength (Labidi *et al*., 2019)..

CONCLUSION

The byproducts of the seaweed industry can affect the quality and can be used as a sand complement in making lightweight brick Cellular Lightweight Concrete (CLC).

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