BCMEHC (BRICK FROM COW MANURE, EGG SHELL, HUSK RICE AND CLAY)AS AN ALTERNATIVE TO WASTE TREATMENT LIVESTOCK IN DEPOKREJO VILLAGE, PURWOREJO REGENCY

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Abstract - *Management of livestock waste in Depokrejo village, Ngombol sub-district, Purworejo district has not been implemented optimally. Cow manure waste fall apart on vacant land and has the potential to cause pollution environment and source of diseases. BCMEHC is an alternative in processing of livestock waste. This study aimed to create BCMEHC, and test the quality of BCMEHC as an alternative building material. Construction of the BCMEHC was done in three stages, namely the composite making with varying composition , burning and cooling process. Product testing was done by using brick density test, water absorption test, drop test, and scratch test compared to SNI. Density test for samples A, B, C, D, E are 1.87 gr/cm^3, 1.78 gr/cm^3, 1.65 gr/cm^3 , 1.49 gr/cm^3 , and 0 gr/cm^3 respectively by default minimum according to SK SNI 15-2094-2000 is 1.60 gr/cm^3 – 2.0 gr/cm^3. Power test water absorption for samples A, B, C, D, E are 20%, 18.33%, 16.82%, 11.07% and 0 % respectively with the minimum standard according to SK SNI 03-0691-1996 is maximum 20%. Drop test for samples A, B, and C experienced some rock breaking bricks and samples D were badly broken and E could not be carried out because they were destroyed when droping.*

Keywords: *brick, alternative waste treatment, ow manure, agg shell, husk rice, clay*

1. INTRODUCTION

The problems that is often experienced by the Indonesian people to be dealt with seriously is about environmental pollution, including from livestock waste. The total contributor of greenhouse gases that cause environmental damage comes from livestock waste reaching 13.6% (Shafwan, 2020) which comes from livestock manure and urine. Proper and fast waste treatment is needed by the Indonesian people to reduce environmental damage caused by livestock waste. One of the producers of livestock waste in large quantities but not yet utilized is in Depokrejo village, Ngombo sub-district, Purworejo district with a capacity of holding animals close to 1000 heads with a jumbo size. The livestock waste becomes environmental waste.

Based on research, cow dung contains ammonia gas (NH3) which causes an increase in greenhouse gases which causes global warming and has an impact on the environment and has a negative impact on human health, causing severe eye irritation, shortness of breath, chest pain, puffy lungs and several other diseases. at high levels of ammonia (30,000 ppm) causes burns to the skin (Tati, 2012). The location of the cage is close to the community's house (only about 5-20 m), some even live under the same roof with the livestock they keep. Irritation due to ammonia can occur in the nose and pharynx but does not occur in the trachea, this indicates that ammonia is stored in the upper respiratory tract (Health Protection Agency, 2007).

Cow manure in addition to containing ammonia also contains other elements such as fiber, nutrients and silica. Silica content in cow manure is 9.6% per kg (Tati, 2012). An average cow produces 10-15 kg of manure every day, while jumbo-sized cows (above 450 kg) can produce around 25 kg of manure or more (Muttaqin, 2017). The cow manure produced has not been used optimally by the local community, cow manure is only placed on vacant land without any further processing. Dirt waste that is left scattered on vacant land causes air pollution in the surrounding environment due to the odor produced by the waste, and attracts animals such as flies that have the potential to cause disease in humans. Ammonia gas levels that cause air pollution are those whose concentrations exceed 17 mg/m3 (Ramadhian: 2008).

In overcoming environmental pollution caused by the livestock sector, the Indonesian government in this case the Ministry of Agriculture issued a ministerial regulation as contained in the Minister of Agriculture Decree No. 237/1991 and Minister of Agriculture Decree No. 752/1994, which states that livestock business with a certain population needs to be equipped with waste management and environmental monitoring. The application of the decree from the ministry of agriculture in practice has not been carried out optimally. This cattle waste can be used as bricks as building construction material with the addition of several other materials which are also natural potentials in the village, including rice husk waste, egg shells and a little clay.

Naturally, the process of decomposing rice husks takes a long time. This causes a buildup that can cause problems in the environment. Chemical content in

rice husk consists of 50% cellulose, 25-30% lignin, and 15-20% silica (Bakri, 2009, Budirahardjo, et.al, 2014). Egg shells are used as a mixture of bricks because the content of egg shells can increase the compressive power of bricks, and act as water absorption. Egg shells contain 98.2% calcium carbonate, 0.9% magnesium and 0.9% phosphorus (Yuwanto, 2010).

The bricks produced from a mixture of several materials have advantages over ordinary bricks, including having stronger resistance but with a lighter mass so as to reduce soil loads, can withstand extreme weather due to the silica content in it and have water absorption according to SNI standards. In addition to being an alternative solution for processing livestock waste, it is hoped that it can become a creative industrial sector that improves the economic level of the community in Purworejo district. This research aimed to create BCMEHC (Brick from Cow Manure, Egg Shell, Husk Rice and Clay), and test the quality of BCMEHC as an alternative building material

2. METHOD

Materials and tools that prepared consisting of Cow Manure (CM), Egg Shell (E), Husk Rice (H) and a little Clay (Cl), water, firewood, the mattock, grinder, sand sieve, furnace, digital scale, ruler and a moulder. Construction of the BCMEHC was done in three stages, namely the composite making with varying composition, burning and cooling process. Composite divided into five variation with different concentration of Composite A consist 0% CM, 0% E,0% H and 100% Cl.

Compoiste B consist 10% CM, 5% E,5% H and 80% Cl, Composite C consist 20% CM, 5% E,5% H and 70% Cl. Composite D consist 30% CM, 5% E,5% H and 60% Cl and composite E consist 50% CM, 5% E,5% H and 40% Cl. The next step is adding water as a solvent on each composite in order to plastis condition and homogonesous of brick material and then must moulded in 17.6 x 8.7 x 3.4 cm^3. This product is dried under sunlight for 1 week, and then burning in furnace 5 hours. After that, this brick can be colded in the room temperature. The final product is tested by using brick density test, water absorption test (Umar, 2018), drop test, and scratch test compared to SNI (Standar Nasional Indonesia).

The equation used the calculation of mass density is (Giancoli, 2001)

$$\rho = \frac{M}{V} \tag{1}$$

Where ρ is mass density , M is the mass and V is the volume of material, Whereas the equation used the calculation of water Absorsion is (Sears and Zemansky, 2002)

$$S = \frac{Mw-Md}{Md} x\ 100\% \tag{2}$$

Where S is water absorbtion percentation, Mw is wet mass, Wd is dry mass

3. RESULT AND DISCUSSION

A. Create BCMEHC

Of all the brick-making processes, the burning stage has very important role that greatly determines the bricks quality. Flame temperature stability should be maintained for the 3 days first using high heat. After three days the bricks are covered by straw in order to obtain the homogoneous of the temperature spreading between the lower and the top of that brick. At the time of the brick already covered with straw, the burning process using low heat. Bricks are adjusted to the existing size on the market with a length of 17.6 cm, a width of 8.6 cm and a height of 3.3 cm and a mass dry about 900 gr. The brick that created with five variation composition is shown in figure 1

Sample A Sample B Sample C Sample D Sample E

Figure 1. The bricks with five variation of compotition of Cow Manure (CM), Egg Shell (E), Husk Rice (H) and a little Clay (Cl),

B. The density test

Testing the quality of bricks begins by testing the density of the bricks with sample codes A, B, C, D, E. Each sample consists of 3 (three) codes sample. The first step is to calculate the length (p), width (l), and height (t) for each sample code then weigh using digital scales. The next step is to calculate the volume of each code sample and calculate density mass use equation 1.

Table 1. Density Mass of Brick

Sample		Lenght (m)	Weight (m)	High (m)	Volume (m^3)	Mass (gr)	Density (gr/cm^3)	Average Density
A	1	17.5	8.6	3.3	496.65	940	1.89	1.87
	2	17.5	8.6	3.4	511.70	950	1.86	
	3	17.6	8.6	3.4	514.63	940	1.85	
B	1	17.6	8.6	3.3	499.99	900	1.81	1.78
	2	17.6	8.6	3.3	499.99	890	1.78	
	3	17.6	8.6	3.3	499.99	890	1.76	
C	1	17.5	8.6	3.3	496.65	820	1.65	1.65
	2	17.5	8.6	3.3	496.65	830	1.64	
	3	17.6	8.6	3.4	514.63	820	1.66	
D	1	17.6	8.6	3.3	499.49	770	1.54	1.49
	2	17.6	8.6	3.3	499.40	750	1.50	
	3	17.6	8.6	3.4	514.63	740	1.44	
E	1,2,3	0	0	0	0	0	0	0

From the table 1, we can see that the more cow manure used, the density mass of bricks more decreases. Density of brick based on SNI 15-2094-2000 standard is between 1.60 gr/cm^3 - 2.00 gr/cm^3. If compared to SNI, the bricks that qualified are the sample A, B, and C, where the average density of that samples within the allowable range. In sample D the density calculation is under SNI, while sample E is not carried out density test, because during the combustion process the bricks break into pieces. The bricks are broken into pieces due to the mixture too much cow manure that makes the bricks brittle. From the experimental data can be seen that the more cow manure,the lighter the bricks produced. Whereas egg shells and rice husks which is used for strengthen bricks.

C. The Water Absorbtion Test

Water absorption test is needed to measure the brick ability to absorb water. To large absorption of water making they are not firmly attached when installation. The water absorption test begins by calculating the dry mass of each sample then soak the sample for 24 hours in water and calculate the mass wet for each sample. After obtaining the wet mass and dry mass of the bricks, entered into equation 2. Experimental results and calculations can be seen in the table 2.

Table 2. Water absorbtion test of Brick

Sample		*Mw* (gr)	*Md* (gr)	*S* (%)	Average *S* (%)
A	1	940	1128	20	20
	2	950	1150	21	
	3	940	1117	19	
B	1	900	1066	18.44	18.33
	2	890	1050	18.01	
	3	890	1055	18.54	
C	1	820	960	17.50	16.82
	2	830	976	17.07	
	3	820	950	15.90	
D	1	770	850	10.40	11.07
	2	750	840	12.00	
	3	740	820	10.81	
E	1,2,3	0	0	0	0

From the table 2 we can see that more cow manure is used, the lower the water absorption. Water absorption based on SK SNI 03-0691-1996 is a maximum of 20%. All samples meet the SNI criteria in the power test absorb water where the average calculation results show the water absorption capacity below 20%. While sample E was not tested for water absorption due to the shape of the bricks that are not intact, broken into pieces during burning process.

D. Additional test

An additional test is in the form of a drop test where the bricks will be dropped from the1 m height and scratch test on each sample. In sample A at time carried out a slamming test the bricks only broke slightly at the edges, Likewise, samples B and C showed results that were not much different, however for sample D when the slamming test was carried out the bricks broke into two parts. For the scratch test, samples A, B and C showed results that were almos tthe same where bricks when scratched using pieces of glass leave scratch marks without falling bricks, while in sample D suffered scratches and a little bit of falling off the bricks. The next step of research is submit the research results to the village head for further action.

4. CONCLUSIONS

In Summary, we finally succeeded in making BCMEHC from the waste of live stock and some natural material that strenghten the product. Density test result that the maximum mixture of cow manure in making bricks in accordance with the SNI SK is a maximum of 20%. Additional tests were carried out with a drop test and scratch test, samples A, B, C passed in the drop test and scratch test, while sample D failed because it broke at during the drop test and fall off during the scratch test. Sample E is not tested anything because it breaks into pieces during combustion.

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