Research Article

Utilization of Solid Waste Pulp Green Liquor Dregs and Slaker Grits for Rooftile Production Application

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Abstract.
This study aims to utilize solid waste pulp green liquor dregs and slaker grits by analyzing the effect of adding solid waste green liquor dregs and slaker grits on water absorption and tile compressive strength, analyzing the chemical content of solid waste green liquor pulp dregs and slaker grits and concrete tile products and chemical morphology of the samples. The method used in this research is pressing. The results of the water absorption test for concrete roof tiles with the addition of 0%, 5%, 10%, and 15% solid waste green liquor pulp and slaker grits were 8.4%, 6.4%, 7.5%, and 9.4%. Testing the compressive strength of concrete tiles with the addition of 0%, 5%, 10%, and 15% solid waste green liquor pulp and slaker grits was 19.0 MPa, 19.7 MPa, 18.6 MPa, and 18.3 MPa. The chemical content of solid waste pulp before and after the finished concrete tile product is in accordance with the building blocks of the tile which consists of compounds Al_2O_3, SiO_2, Fe_2O_3, and CaO. From the above test, it can be concluded that the addition of solid waste pulp can produce quality concrete roof tiles with reference to the value of SNI 0096-2007, that the maximum water absorption value of tile is 10% and the compressive strength of roof tiles is at least 6.0 MPa.

Keywords: solid waste, green liquor, slaker grits, rooftile

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Published: 27 March 2024

Publishing services provided by Knowledge E

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Selection and Peer-review under the responsibility of the ICMScE Conference Committee.

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1. INTRODUCTION

Pulp green liquor solid waste dregs and slaker grits are taken from PT. Indah Kiat Pulp and Paper is located in Tualang District, District Siak. This waste is studied as alternative products in agriculture and construction sector. Solid waste pulp green liquor dregs and slaker grits is the residue from the pulp and paper that is usually only stockpiled [1]. This residue can cause negative impact soil contamination and leaching toxic compounds [2]. Solid waste pulp drags contain heavy metals harmful to the environment, such as Cd, Cu and Zn [3]. Green liquor dregs and slaker waste grits can have a negative impact on environment because it is a type of B3 waste (hazardous materials and toxic) which has easy properties flammable, explosive, reactive and corrosive [4].

Green liquor dregs and waste slaker grits need to be handled further to become a new material which is positive for improve the community's economy [5]. Concrete tile production with the addition of solid waste pulp green liquor dregs and slaker grits physical characterization test and chemical characterization of concrete roof tiles, namely compressive strength test of concrete roof tile and test water absorption of appropriate concrete tile with SNI 0096-2007 [6].

Characterization concrete tile chemistry, namely the test chemical content with x-instrument ray fluorescence [7]. Waste use solid pulp green liquor dregs and slaker grits is expected to be additional materials in construction building, namely in the manufacture of concrete roof tiles [8].

2. RESEARCH METHOD

2.1. Material and Instruments

Tools used in This research is a 200 mesh sieve, oven (memmert), analytical balance (ABJ-320-4NM), mold pressing device (press hydraulic) UTM (Universal Tensile Machine), X-Ray Fluorence (XRF) PANalytical Epsilon 3, Scanning Electron Microscopy (SEM) and Frourier Transform-Infra Red Spectroscopy (FT-IR) Shimadzu Corp., Japan Brand IR-Prestige-21 dan other glassware. Ingredients used in this study is waste solid pulp green liquor dregs and slaker grits (PT Indah Kiat Pulp dan West Perawang Paper, Siak, Riau), cement (Jakarta cement), lime mill (the king of the tigers), water, sand, filter paper whatman 42 and aquades.

2.2. Preparation and Characterization

Pulp green Solid Waste Sample liquor dregs and slaker grits Green pulp solid waste sample liquor dregs and slaker grits dried in the sun for +7 days, then in the oven for 24 hours, aiming to remove the remaining water stick to the waste to get constant results. Sample sieved with a 200 mesh sieve. Pulp dregs . solid waste sample and grits that have been prepared chemical composition test was carried out with X-Ray Fluorescence (XRF) instrumentbefore the production process concrete roof tile.

2.3. Concrete Roof Tile Production Process

Concrete roof tile building materials consists of cement, aggregate (sand + waste), lime mill, water with composition comparison used is 1 Portland cement: 3 Waste + Sand : 2 Lime : 1 Water. Dregs and grits waste added with 4 variations, namely 0%, 5%, 10% and 15%. All samples mixed in dry use a fork until mixed to be homogeneous, i.e. if the color is the same and even. Then mix blended and stirred until homogeneous.

2.4. Sample Printing Process

The homogeneous mixture, printing process. Printtile smeared with lubricant first and poured into concrete roof tile mold to the brim. Then pressed with a printer until smooth and neat, after that the tile has been lifted to the place maintenance or aerated in 3 days. This step is done repeatedly until the number of tiles concrete reaches the desired amount to be tested. The finished tile printed, chemical content test is done tile products, tile compressive strength test, water absorption test on concrete tile and tile product morphology test concrete.

3. RESULTS AND DISCUSSION

3.1. Waste Chemical Content Analysis Solid Dregs and Grits

Solid waste pulp drgs and grits in this study works as an additive in building construction objects namely concrete roof tiles. In Table 1 shows the chemical content of solid waste pulp drgs and grits. Results the tested solid waste has a large amount of CaO i.e 58.10% dregs 59.76% waste grits. CaO compounds function as binder/adhesive in the production process concrete tile. Compounds SiO_2, Al_2O_3 with a chemical composition of 11.31% at dregs and 12.38% on grits work as a filler that canimprove the quality of concrete roof tiles, due to the reaction that occurs between silica and lime in the mix concrete so that the concrete roof tile will harden. Fe_2O_3 compounds function as a stabilizing agent to form tougher concrete tile, perfect and strong [8].

3.2. Chemical Content Analysis Concrete Roof Tile Products

Product chemical content analysis concrete roof tile works for compare chemical composition solid waste pulp green liquor dregs and slaker grits without a mixture of ingredients other and solid waste pulp green liquor dregs and slaker grits after done

Table 1: Chemical composition of solid waste pulp dregs and grits and concrete roof tile products.

No	Chemical Composition (%)			
	Parameter	Dregs	Grits	Roof product
1	Al_2O_3	27.95	25.31	5.207
2	SiO_2	11.31	12.38	13.929
3	Na_2O	0.20	0.39	-
4	K_2O	0.47	1.40	0.725
5	MgO	0.50	0.54	-
6	CaO	58.10	59.76	65.573
7	Fe_2O_3	0.33	0.57	7.841
8	TiO_2	1.01	0.39	1.111
9	P_2O_5	-	-	1.715
10	SO_3	-	-	2.163

mixing with other ingredients roof tile compiler to become concrete tile products. Chemical composition contained in roof tile products concrete is CaO which is 65.573%, SiO_2 13.929%, Fe_2O_3 7.841%, Al_2O_3 5.207%, SO_3 2.163%, P_2O_5 1.715%, K_2O 0.725% and TiO_2 1.111%.

SNI standards regarding roof tiles concrete does not include requirements especially the content of contaminants in concrete tile that uses B3 waste raw material. This problem is necessary studied more deeply by means of carry out usage research B3 waste (heavy metal processing) as a raw material for manufacturing concrete roof tiles according to SNI and goverment regulations.

3.3. Water Absorption Test (Water Absorption) Concrete Roof Tile

The size of the water absorption in the sample is strongly influenced by the pores or cavities in the sample. The more pores contained in the sample then water absorption is getting bigger so that resistance will be reduced. Cavities (pores) contained in the sample happened because of poor quality and the composition of the constituent materials. The effect of a ratio that is too large can cause cavities, because there is water who didn't react and then evaporates and leaves a cavity thus causing the tile to become easy to crack [9].

Based on Figure 1 can it can be seen that the increase in variation composition of solid waste pulp grits and dregs cause water absorption the concrete tile is also getting bigger, thing This is due to solid waste pulp grits and dregs have good absorption greater than power absorb sand, solid waste pulp grits and dregs will also fill the

cavities 5 between the grains of sand so that absorption water in the sample is getting bigger. The results of the water absorption value on concrete tile that can be obtained in variations composition 5%, 10%, 15% and tile consecutive normal are: 6.4%, 7.5%, 9.4% and 8.4%. The four variations addition of solid waste pulp dregs and the grits are in accordance with SNI 0096-2007, namely water absorption on the tile does not exceed 10%,thus the concrete roof tile with addition of solid waste pulp drgs and grits can be used as materials roof covering on the building.

3.4. Compressive Strength Test of Concrete Roof Tile

Compressive strength of concrete tile generally produced from a mixture of low-phase concrete, however if the manufacturing process is lacking perfect will cause tile concrete becomes porous which can reduce the strength value. Increased green pulp solid waste liquor dregs and slaker grits compared upside down with compressive strength of the tile construction, the more waste dense pulp grits and compressive strength dregs will get smaller. This is because in the process of making tiles construction materials are stirred so that solid waste pulp mixed with binder (cement). Solid waste pulp green liquor dregs and slaker grits has a fine grain size so that the pulp solid waste will mix with cement, on concrete tile production process, a mixture of solid waste and cement will bind the grains of sand and when drying is complete solid waste with cement will dry and then bind the grains of sand [10].

Greater cement adhesion compared to the adhesiveness of the waste solid pulp green liquor dregs and slaker grits, that's what causes the increase in pulp solid waste will reduce the affinity for the granules sand. The result of the compressive strength of the tile concrete at various compositions of 5%, 10%, 15% and normal tile in a row are 19.7 MPa, 18.6 MPa, 18.2 MPa and 19.0 MPa is in accordance with SNI compressive strength test of concrete tile minimum 6.0 Mpa.

4. CONCLUSION

Based on this research can it was concluded that the addition of solid waste pulp green liquor dregs and Slaker grits produce tiles higher quality concrete, saving cost and more environmentally friendly. Thing This is proven from the chemical content test waste and tile products as well as physical tests concrete tile, namely the compressive strength and water absorption of concrete tile. Test chemical content of waste and products concrete

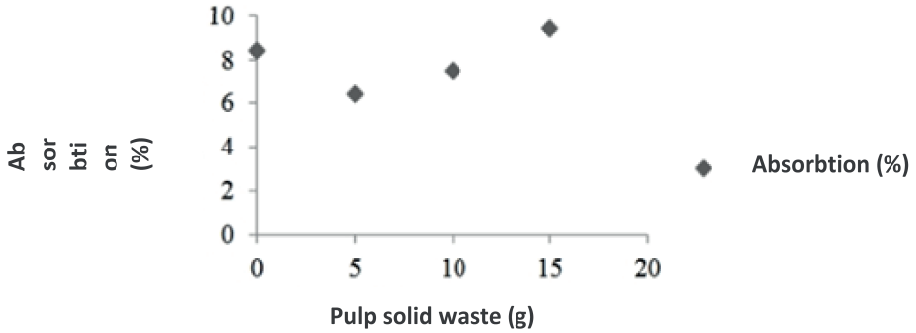

Figure 1: Effect of waste weight composition (g) on the ability of concrete roof tiles absorb water (water absorption versus solid waste pulp sample).

tile produces compounds building construction compounds, such as CaO, SiO_2, Al_2O_3 and Fe_2O_3.

Effect of adding variation waste composition in manufacturing tile will cause compressive strength the tile is getting smaller and absorption the water on the tile becomes larger. Test compressive strength resulting from the addition of 5% waste, the resulting value good compressive strength of 19.78 MPa, with refers to SNI 0096-2007 strong value compress the tile at least 6.0 MPa. Test water absorption in concrete roof tiles generated from the addition of 5% waste, good water absorption value is produced namely 6.4% with reference to SNI 0096-2007 tile water absorption value maximum 10% [6].

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