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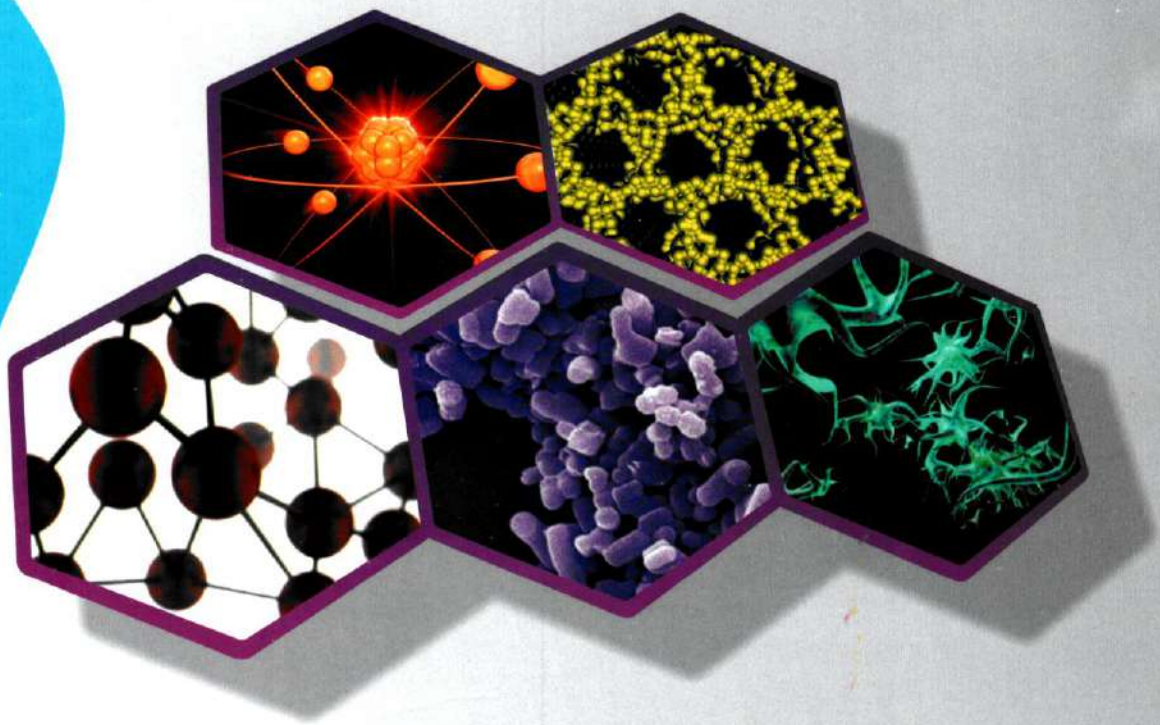
PROCEEDINGS

6th Kentingan Physics Forum
International Conference on Physics and Its Applications (ICOPIA)

The Future of Advance Materials, Nanoscience and Nanotechnology



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The Influence of Bamboo Leaf Ash as Fly Ash on Physical Property of Concrete Cement

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ABSTRACT

The bamboo leaf ash is used as fly ash in cement, for the environmental reason. The bamboo leaf ash (blash) is added to base material of cement (clinker, gypsum, trash and lime stone). Percentage of blash is 0%, 3%, 4%, and 6% in weight with base material. The x-rays fluorescence (XRF) is used to determine its chemical composition. The physical properties of sample are measure by automatic Blaine, Vicat and Autoclave. Its physical properties match with Indonesia National Standard (SNI). The physical properties of the best sample are made from composition of 3 % in weight of bash as addition material.

Keywords :cement, bamboo leaf ash, clinker, gypsum, trash, lime stone

INTRODUCTION

Cement is a complex product, depend on its composition. The base material of cement is clinker, gypsum, trash and lime stone. Fly ash a commonly use as substitute material in concrete cement. Fly ashes are finely divided residue resulting from the combustion of ground or powdered coal. They are generally finer than cement and consist mainly of glassy-spherical particles as well as residues of hematite and magnetite, char, and some crystalline phase formed during cooling. In addition to economic and ecological benefits, the use of fly ash in concrete improves its workability, reduces segregation, bleeding, heat evolution and permeability, inhibits alkali-aggregate reaction, and enhances sulfate resistance [1,2,3]. Bamboo leaf as a waste material has a silica compound. The calcinations at certain temperature, bamboo leaf will inform ash. The results show that this kind of ash is formed by silica with a completely amorphous nature and a high pozzolanic activity [4]. Bamboo leaf ash as fly ash can be used as additive of base material for cement. It gives an economic value.

METHODOLOGY

The mix of clinker, gypsum, trash and lime stone is a base material of cement. Bamboo leaf ash (blash) is used as additive material of cement.

Bamboo leaf ash (blash) was obtained by calcinations bamboo leaves at 800 °C for 1.5 h in a laboratory electric furnace. There are 4 types mixture of clinker, gypsum, trash, lime stone, and bamboo leaf ash, see table 1. Each composition of material is determined its chemical composition by x–ray fluorescence. The physical properties of sample are determined by automatic Blaine, Vicat and Autoclave.

Table 1.Composition of base materials with total mass 2500 grams

MATERIAL	Sample I (g)	Sample II (g)	Sample III (g)	Sample IV (g)
Clinker	1875	1900	1950	2000
Gypsum	125	125	125	125
Trash	250	150	150	150
Limes stone	250	150	150	150
Bamboo leaf ash	0	150	100	75

RESULT AND DISCUSSION

Clinker, gypsum, trash, lime stone, bamboo leaf ash and samples are determined its chemical composition by x-ray fluorescence. The x-ray fluores-

cence showed the bamboo leaf ash has high SiO_2, which is higher than clinker, gypsum and lime stone.

Table 2. Chemical composition of material in weight percentage by XRF

Material	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	SO_3
Clinker	21.41	5.78	3.89	66.37	0.74	0.3	0.39
Gypsum	30.22	5.57	0.28	30.22	0.03	0.12	42.89
Trash	64.49	14.68	1.22	2.52	0.91	5.27	1.20
Lime stone	0.57	0.38	0.02	53.65	0.50	0.02	0.03
Bamboo leaf ash	55.70	6.54	1.84	4.48	2.21	2.37	1.86
Sample I	24.17	5.95	3.25	60.7	0.61	0.73	3.21
Sample II	22.43	4.14	2.53	62.3	5.52	5.57	3.01
Sample III	22.76	4.45	2.72	63.54	0.52	0.68	2.56
Sample IV	23.53	4.72	2.60	64.66	0.57	0.70	2.21

Gypsum, trash and bamboo leaf ash have high SiO_2 but low concentration of CaO. The source of CaO come from clinker and lime stone. The mix of base material gives a good composition of cement, which has a high composition of CaO and SiO_2. It will play a role of a hardness of concrete cement.

The sample I – IV, which is a mixture of base material (clinker, gypsum, trash and lime stone) and the additive material (bamboo leaf ash), have weight percentage of SO_3 less than 4.0 % as recommended in SNI-15-2049-2004.

Table 3 Physical property of concrete cement

Property	Unite	S I	S II	S III	S IV	Standard [5]
Fineness	m^2/kg	494.5	403.5	435.6	473.1	Min. 280
Expansion	%	0.08	0.09	0.02	0.06	Max. 0.8
Setting Time						
Initial	Minutes	125	120	115	100	Min.45
Final	Minutes	370	330	280	230	Max. 375
False Set	%	58.33	71.88	73.53	80.00	Min. 50
Hardness						
3 Days	N/m^2	147.8	139.7	152.5	157.6	Min. 125
7 Days	N/m^2	244.8	256.8	253.5	266.1	Min.200
28 Days	N/m^2	297.2	286.7	300.7	311.8	Min. 250

The fineness of cement was measured by Automatic Blaine, with 119.5 grams of sample. The sample II – IV have fineness less than sample I, but all samples are higher than recommended for Portland composite cement ($280m^2/kg$) [5].

Autoclave is using to measure the expansion of concrete cement. The 650 grams sample mix with water to get a 25 cm long of testing material. The percentage quantity of bamboo leaf ash in cement (sample II- IV) does not make any different of the expansion percentage. Sample I – IV have less than 0.8% as recommended for Portland composite cement.

Vicar automatic is used to measure the cement pasta. The pasta makes of 650 grams cement with water. The amount of water depends of its NC (normal consistent of form). All samples have initial setting time more than 45 minutes and its final time less than 375 minutes. The setting time is increasing as amount of bamboo leaf ash increasing.

False set was measured by Vicat automatic, using pasta of 500 grams cement (sample I-IV) and water. The samples have false set more than 50% which indicate good cement. The addition of bamboo leaf ash is increase the false set.

The hardness of concrete cement was measured on 3, 7, and 28 days. The testing material made of cement, Ottawa sand, and water. The samples have hardness higher than the standard for cement Portland. The present of additive material (bamboo leaf ash) could increase the hardness. Thus, it's promise material for composite cement.

Bamboo leaf ash give a higher hardness compare the used of fly ash and shell fish as an addition material on cement [6].

CONCLUSION

The additive of bamboo leaf ash as additive or substitution in base material of cement gives a good result on physical property of concrete cement, by measured its fineness, expansion, setting time, false set, and hardness. The best composition of bamboo leaf ash as additive material in cement was 3 % in weight of the total weight. The most important as concrete cement is hardness which is better than the standard for testing a 3 days, 7 days and 28 days.

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