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Effect of Rice Husk and Rice Husk Ash to Properties of Bricks

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Abstract

This research has aims to study effect between rice husk and rice husk ash to properties of bricks. Comparative adding between rice husk and rice husk ash were varied by 0 -10% by weight. The results showed that more adding rice husk less compressive strength and density of specimens. Otherwise the porosity increases when adding rice husk. By adding 2 % of rice husk ash by weight is the best of bricks properties which 6.20 MPa of compressive strength, 1.68 g/cm³ of density, and 15.20% of water absorption.

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1. Introduction

The term brick refers to small units of building material, often made from fired clay and secured with mortar, a bonding agent comprising of cement, sand, and water. Long a popular material, brick retains heat, with-stands corrosion, and resists fire. All of bricks in Thailand made from combination between clay and rice husk or saw dust. This combination material sinter with brick kiln for rigidity and strengthen. The brick is the main material in construction due to strengthen, durability, loading, compactness and light weight. The Brick's utility in construction of Thailand had been used since long time ago. Most of old constructions can confirm the popularity of brick. The brick is well-known and widespread due to durability and local production which by local composition and labor. General

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properties of brick easily allow heat transfer and keep the heat inside for long time which means high heat capacity. Then, the brick is appropriate for construction material. The product of brick in Thailand produces all regions from cottage industry until large industrial plants. The common problem which is processing and procedure occurs in production. For example, the inconsistency ratio of composition and low efficiency of knowledge in raw resource cause low brick's quality. Many researchers studied the effect of rice husk to product. The result performs that addition of rice husk in composition effect to decrease compressive strength and to get more porosity. The proper temperature of sintering is 1100 degree Celsius. The study effect of rice husk ash to increase compressive strength of concrete [1-3], and effect of rice husk ash to deduct temperature of whiteware [4]. For this research we study effect of rice husk and rice husk ash with determine the varied addition of rice husk or rice husk ash to properties of bricks.

2. Experiment procedures

The clay, rich husk ash and rice husk form Bang Ban district Ayutthaya province. Fluoresce X-ray equipment is analyzed the combination of raw material which is clay and rice husk ash and finding the proper combination of raw material. The percentages of rice husk or rice husk ash in the brick combination are varied from 2, 4, 6, 8, and 10 by weight. The product is examined by Thai industrial standard of brick TIS.77-2545.[5] The experiment properties has compressive resistibility, water absorbency, contractibility and density. The sampling combinations are extruded and sintered by local kiln in Bang Ban district, Ayutthaya province. All of samples are transported to Science and Technology Research Instruments Center for analysis as scheme show in Fig. 1.

Fig. 1 performs the schematic diagram of brick manufacturing. After the raw material procured by clay, the main component is cured for three days. The rice husk or rice husk ash is added in the curing component which varies percentage of weight from 0, 2, 4, 6, 8, and 10, respectively. Next, the component is mixed and molding by casting, the bricks are cast in sizing of $10 \times 15 \times 30$ cm and. Then, the specimen is sintered in kiln-fired bricks at about 700 degree Celsius for 7 days. The local kiln-fired brick uses the rice husk as combustible. Later, the raw brick is analyzed for industrial standard as compressive strength by universal Testing machine dartec model 1000/RF-2, density, percentage of water absorption by Archimedes, heat transfer of clay by thermal differential analysis and structure analysis by Scanning Electron Microscope (SEM) model jsm-5410 lv.

3. Results and Discussion

3.1. The composition of raw material

The composition of element in raw material for brick is analyzed and shows that the most of raw material clay compose of Silicon Dioxide, Aluminium Dioxide and Iron oxide subsequently. The Silicon Dioxide make more brick's strength. For Aluminium Dioxide and Iron, they change the brick pigment to red after sintering [6]. The main component of rice husk ash is Silicon Dioxide. Table 1. show major composition of raw material.

3.2. Differential thermal analysis, DTA

Differential thermal analysis of soil with main of raw materials show in Fig. 2. At 80 °C soil moisture evaporates after that at temperature approximate 145 °C because endothermic reaction in soil with soil moisture evaporates and water loss in lactic structure. At about 573 °C structure of silicon dioxide inversion by Infrastructure expansion [6].

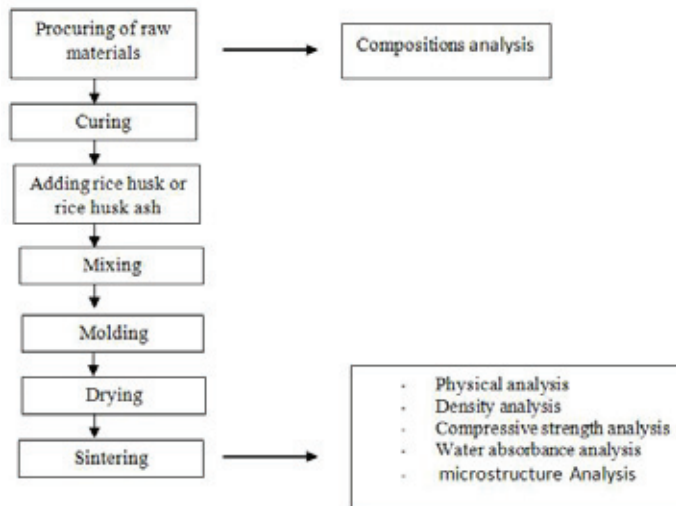


Fig. 1. Schematic Diagram of experiment

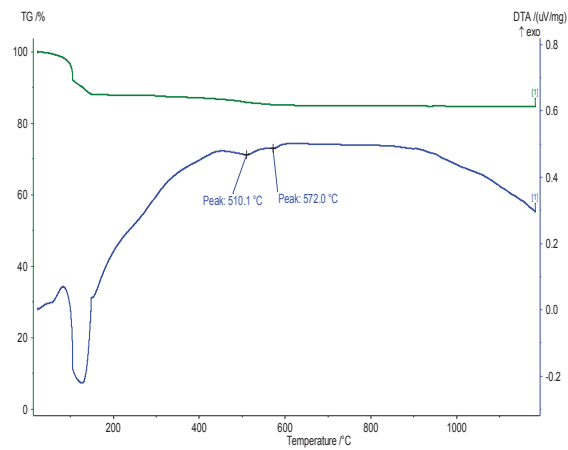


Fig. 2. Differential analysis of soil

Table 1. Composition of law materials

Substance	Clay	Rice husk Ash
SiO ₂	60.67	93.59
Al ₂ O ₃	15.18	0.54
Fe ₂ O ₃	7.61	0.82
K ₂ O	3.12	1.94
MgO	1.15	0.15
TiO ₂	1.18	0.07
CaO	0.79	1.45
Na ₂ O	0.56	0.01
SO ₂	0.55	1.94
MnO ₂	0.22	0.19
BaO	0.11	0.01
ZnO	0.01	0.04
ZrO	0.01	0.01

3.3. Bulk density

The bulk densities of sintered specimen are given in Fig. 3. Compare between specimen with add rice husk and rice husk ash, the brick specimen with add rice husk has bulk density less than with add rice husk ash, Bulk density decrease with increase rice husk addition because the large the rice husk organic matter content, the greater the porosity and shorter the past among particles for gas diffusion. The Therefore, a higher rice husk addition ratio increases the porosity volume and decrease bulk density of sintered spacemen.[1] The bulk density were high maximum 1.68 g/cm³ with 2% addition of rice husk ash, and decrease when rice husk ash addition more than 2%.

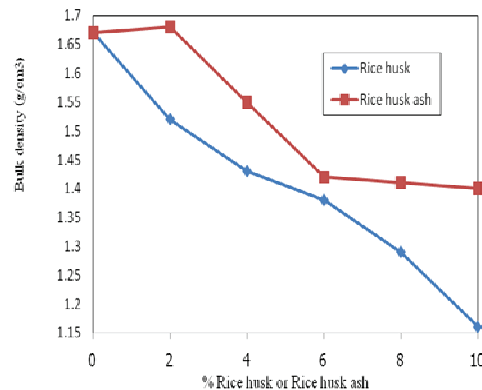


Fig. 3. Bulk density of brick specimen with addition rice husk and rice husk ash

3.4. Compressive strength

The compressive strength of brick specimen sintered as the function for different rice husk and rice husk ash show in Fig. 4. The compressive strength decrease with increase rice husk addition, because higher porosity and low bulk density, for rice husk ash addition were 2% by weight show height maximum of compress strength are 6.20 MPa. Because it is a pozzolanic material which has silica dioxide about 90%. When it is grinded neatly, it helps about the combination in brick more and infiltrates in clay's blank.

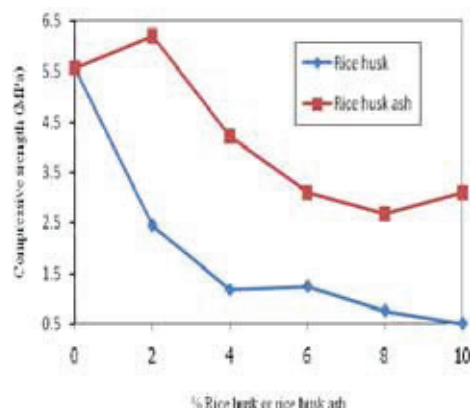


Fig. 4. Compressive strength of brick specimens with difference addition of rice husk and rice husk ash

3.5. Water absorption

The effect of rice husk and rice husk ash to water absorption is show in Fig. 5. The water absorption increase whit increase addition of rice husk because high porosity spacemans with evaporate of rice husk when burned. The addition of rice husk ash are 2% by weight show maximum of water absorption were 15.20 % because at composition their high maximum of density properties.

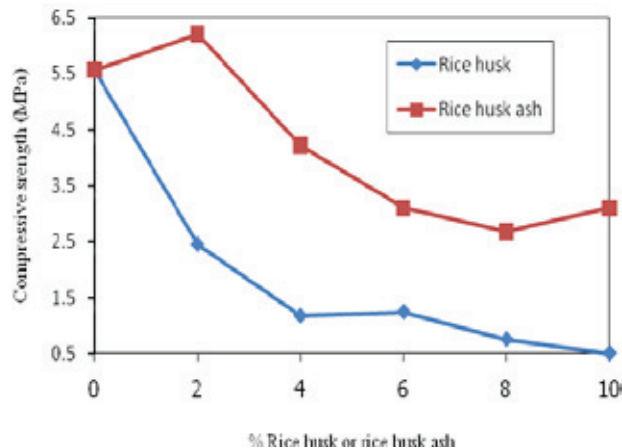


Fig. 5. Water absorption of brick specimen with differential addition of rice husk and rice husk ash

3.6 Micro structure

Effect of rice husk and rice husk ash to micro structure of brick specimens are show in Fig. 6-7.

The Fig. 5 reveals the comparative of micro construction that the traditional brick has porosity less than modified brick. More rice husk adds in component, more porosity increase in the brick matter. The more porosity is acquired by decomposed rice husk in sintering. Unfortunately, the more porosity affects the less product strength. At 10 percents rice husk by weight, the brittle brick decline the compressive strength and decrease the density. Accordingly, the water absorption mounts up.

In term of comparing between modified brick by adding the rice husk ash and traditional brick (Fig. 6), the rice husk ash left at the brick surface. In addition, the porosity of brick is minor change. More rice husk ash adds in component, more ash left on cross section surface because 700 degree Celsius cannot combust the ash.

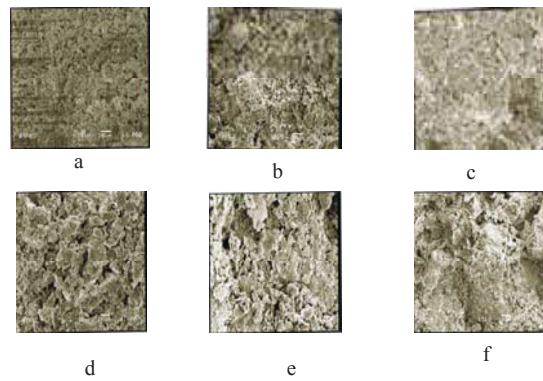


Fig. 6. Micro structures of modified component brick which vary rice husk ash: (a) 0; (b) 2; (c) 4; (d) 6; (e) 8; (f) 10 percent by weight

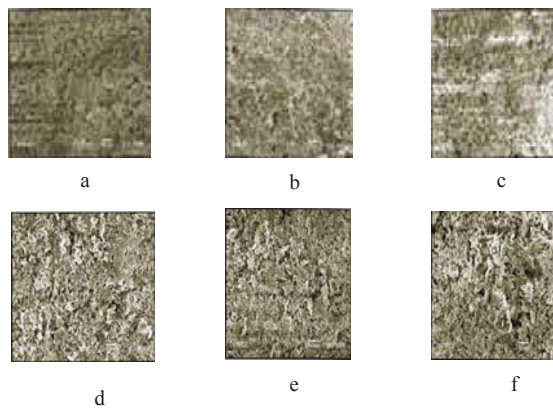


Fig. 7. Micro structures of modified component brick which vary rice husk: (a) 0; (b) 2; (c) 4; (d) 6; (e) 8; (f) 10 percent by weight

4. Conclusions

The increasing rice husk in product decline the compressive strength because the combusted rice husk replace with the space in the product which effect the density and compressive strength. The 2 percent of rice husk ash by weight increase the compressive strength and density. The other percentages decrease the compressive strength and density. Thus, the best composition of brick is 2 percent of rice husk ash by weight. The 2 percent of rice husk ash by weight obtain 6.20 MPa of compressive loading and 15.2 percent of water absorption.

This ratio component is the proper properties of brick. The main component of rice husk ash is Silicon Dioxide which effect of increasing interaction. The interaction is that heated ash in quartz form rises up due to solid state sintering. This cause effects strength of brick [7-8].

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