



KEMENTERIAN PENGAJIAN TINGGI



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UNIT PENYELIDIKAN DAN INOVASI

**TAJUK PROJEK: PERFORMANCE OF CEMENT SAND BRICKS CONTAINING
RECYCLE CLAY ROOF TILES AS ADDITIONAL MATERIAL**

JABATAN: JABATAN KEJURUTERAAN AWAM

NAMA PELAJAR & NO MATRIK	1. NADZWA THALHAH BINTI MOHAMAD HATTA (08DKA18F1040) 2. YOLANDA DONATTELA ANAK PAIT (08DKA18F1047) 3. LIM MEI QI (08DKA18F1059) 4. ALYSSA VANEZSA ANAK ALVIN WAYNE (08DKA18F1062)
NAMA PENYELIA	1. PUAN SALIZAWATI BINTI KAMARUZZAMAN

PERFORMANCE OF CEMENT SAND BRICKS CONTAINING RECYCLE CLAY ROOF TILES AS ADDITIONAL MATERIAL

PROBLEM STATEMENT

- i. High waste of clay roof tiles
- ii. Existing cement sand brick has low strength
- iii. High water absorption in cement sand brick

There are some clay roof tiles that is wasted and defected quality from the company's manufacturer or demolished building area which could not be used in the future then will be consider as waste. The sample of clay roof tiles waste that is rejected due to defected or broken condition are collected for free at Premium Rooftop Sdn. Bhd. as this project focuses on the usage of solid waste from concrete demolition waste (CDW) which is located at No. 9, Jalan BK 1/19, Kinara Industrial Park, 47180 Puchong, Selangor Darul Ehsan, Malaysia.

Cement sand bricks are a type of brick made from a mixture of cement and sand, moulded under pressure and cured under steam. These days, various studies are more focusing on incorporates solid waste and organic waste into cement-sand brick sample to analyze the new strength and the ratio of water absorption that shows varied final result thus proves the possibility of using other existing solid waste. Therefore, this study aims to identify the strength and water absorption ratio using clay roof tiles waste as additional material.

LITERATURE REVIEW

Clay roof tiles are one of the oldest types of roofing materials, dating back hundreds of years. They are made from natural clay that is baked to remove excess moisture, and they may be glazed or unglazed. Clay roof tiles is known for its rich red colouring and its high level of strength and durability.

Lianyang Zhang (2013) in his paper based on the review of the various studies on production of bricks from waste materials. A wide variety of waste materials have been studied for production of bricks. The different methods studied for producing bricks from waste materials can be divided into three general categories: firing, cementing and geopolymerization. Although much research has been conducted, the commercial production of bricks from waste materials is still very limited.

Recycling of wasted roof tile is an environmentally friendly means of disposing of them I.Milicevic et al (2015). During their production and transport, some bricks and roof tiles are broken in the factory and are immediately crushed in the factory. One way to reuse crushed bricks and roof tiles is by using them as admixture for cement sand bricks. Therefore, recycle roof clay pantiles is added as admixture of sand cement brick. Admixtures are ingredients that are added to the cement sand immediately before or during mixing. They confer certain beneficial effects to cement sand bricks, including controlled setting and hardening, improved workability, increased strength, reduce water absorption and etc.

METHODOLOGY

This describe the material used, test preparation procedures and the properties and chemical compositions of materials included. Use of waste material in construction is a green approach. It provides the value addition to the waste materials and helps to achieve the sustainability goals in the construction. In order to achieve the stated objectives, this study was carried out in few stages. In the initial stage, all the materials and equipment needed are gathered and checked for availability. After that, the mixture and casting process are carried out.

DESIGN MIX PROPOTION

In this project, water cement ratio prepared with 1:6 which 1 part was representing cement and the 6, represent sand.

Material	Control Sample	2% replacement	4% replacement	6% replacement	Total
Cement	3.89	3.89	3.89	3.89	15.56
Sand	26.54	26.01	25.48	24.95	102.98
Clay Roof Tiles	0	0.53	1.06	1.59	3.18
Water	1.95	1.95	1.95	1.95	7.80

MATERIAL PREPARATION

The material that had been use in this research were cement, sand and clay roof tiles.

TYPES OF MATERIAL	FEATURE
 <p data-bbox="444 743 548 772">Cement</p>	<p data-bbox="764 520 1369 716">The research was using the Ordinary Portland Cement. This is because it can form a compact mass of the brick instead to be used to fill the void in between sand and coarse aggregate particles.</p>
 <p data-bbox="464 1094 526 1123">Sand</p>	<p data-bbox="764 863 1369 1058">This research was using the local river sand. The grain size of sand was 0.0625 until 2 mm. The sand helps to prevent the mortar shrinkage and cracking.</p>
 <p data-bbox="409 1619 583 1648">Clay roof tiles</p>	<p data-bbox="764 1192 1369 1604">The clay roof tiles must go through a process before it can be used because it was found in a large size. The clay roof tiles were crushed into a grain size so it can be mixed well with the other materials. The size of the grain also affects the strength of the brick. Thus, by reducing the particles sizes down to 0.0625 until 2 mm was a good measure.</p>

PROCESS



Obtain wasted clay roof tiles.



Crushing the clay roof tiles into grain size particles.



Pour all the materials into concrete mixer.



Put the mixture into the mould and tamped using tamping rod



Bricks were taken out for each percentage



Curing the bricks into water tank



After 24 hours, the brick is taken out from the mould.



Levelled the mixture surface.



The bricks weight was recorded to obtain water absorption



Compressive strength test was conducted.

SOLUTION

From the study, the percentage of additional material used should be more than 6%. For instance, 8%, 10% and 12% of clay roof tiles added into the mixture to achieve higher strength than the control sample 0%. The strength of the compression test must be exceeding 7N/mm^2 .

The product also needs an effort to be compacted. By using the tamping rod, the amount of honeycomb and the air void can probably be reduced. The honeycomb occurred when the bricks are not tamping equally throughout the mould. These bricks will be rejected during the quality control due to the defective such as honeycomb. So, the tamping rod is the most important apparatus during the moulding process. So, the compressive strength will be higher than the usual standard brick.

The brick also must have an equal size so that it is easy to lay the brick. It also affects the compressive strength of the brick because of the difference volume of each bricks. The bricks need to be in the same size, so that, it is easy to lay the brick without having a problem with the length, breadth and the height of the bricks.

ADVANTAGES

The clay roof tiles usually rejected by the industrial due to the defectives of the products or it is rejected during the quality control. By using this waste clay roof tiles, it can reduce the amount of waste at the construction site. This material also can reduce the land pollution if it is used.

These products also creating an environmentally-friendly bricks. This is because the clay roof tiles are made from the natural resources and it do not cause any bad impact toward the environment.

Furthermore, bricks are low maintenance. Bricks do not need paint or other treatments to maintain aesthetics value and durability. Even after 50 years, they are still strong, reliable and relatively maintenance free. It also saving the cost and the time required to upkeep the house, compared to the lighter weight materials.

IMPLEMENTATION AND APPLICATION METHOD

As this study focus on the new cement sand brick with additional material mix in the mixture which is recycle clay rooftiles it helps to reduce the amount of the industrial and construction waste. Since bricks are versatile and building and construction material, the cement sand brick can be uses in masonry work such as brick wall with thick mortar bed method, fences, temporary structure using bricklaying method. Bricklaying method is whereas the bricks are laid flat in rows, exposing either their sides and held together by mortar consist of sand and binding agent usually cement and water then mixed to a thick paste. The implementation of the cement-sand brick is according to the strength and size of bricks.



Figure 1: Cement-sand brick wall and plastering

SUMMARY

To summarize, the new cement-sand brick produced with recycle clay rooftiles able to reduce the amount of construction and demolition waste as in this study uses the clay rooftiles obtained for free from Premium Rooftop. Furthermore, the new cement-sand bricks achieve the highest strength with 6% additional material in the mixture. This shows that the higher percentage of recycle crushed clay rooftiles in the mixture, the higher the strength meanwhile, the water absorption by weight shows that the longer the brick cured in the water tank (more than 7 days) the bricks shows an increasement of water absorption percentage resulting in the declining of compressive strength of the new cement-sand bricks.

APPANDIX**i. Costing**

No.	MATERIAL	QUANTITY	PRICE (RM)	TOTAL (Q×P)
1.	YTL Cement 50kg	1	RM 18	RM 18
2.	Sand 12kg	9	RM 6	RM 54
3.	Clay rooftile	FREE	FREE	FREE
4.	Plywood 4'×6'(5.2mm)	2	RM 30	RM 60
5.	¾" Wood Nails	1	RM 2	RM 2
6.	Compressive strength test	3	RM 43	RM 129
Overall Total Cost (RM)				RM 263.00