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Use of Sawdust as Admixture in Cement-Sand Brick

Rosnani Ahmad*, Rohaidah Md Nor and Siti Azliya Ismail

Department of Civil Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah, 40150 Shah Alam, Malaysia

ABSTRACT

Sawdust is considered a waste material and a number of innovative ways are being taken to mitigate its effects on the environment. The use of sawdust as additional admixture in cement-sand brick production is an alternative option to mitigate the problem. In this study, three different types of cement-sand brick mixture in proportion of 1%, 2% and 3% of sawdust added to the normal mixture are prepared. Compression test was conducted on the brick mixture and results indicated 1% sawdust satisfy the Class 1 loadbearing brick whilst the 2% sawdust is slightly above the minimum required strength of 5.2 MN/m^2 for an ordinary quality brick set by the Standards MS 76:1972. Thus, the use of sawdust as admixture in cement-sand brick should not exceed 3%.

Keywords: Cement-sand brick, compressive strength, sawdust brick

INTRODUCTION

Sawdust is a by-product of wood-based processing mills or workshops. It is of little use and usually dumped with detriment to the environment. Recycling unmanaged industrial wastes is one way this problem can be overcome (Turgut & Algin, 2007).

Many researches have considered sawdust in building materials such as in concrete and bricks. Sawdust up to 25% can be used as replacement for sand in concrete (Joseph et al., 2014). Raheem (2012) reported that sawdust ash in concrete reduces the slump and compacting factor thus indicating reduction of workability. For optimum strength the percentage of sawdust ash should be at 5% replacement (Raheem et al., 2012). Saeed (2013) studied the use of pre-treated sawdust in sawdust concrete and found its compressive and flexural strength improved while at the same time maintaining basic advantages such as lightness of weight, saw-ability and nail-ability. It was also found that with the increase in the amount of

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E-mail addresses:
nani_psa@yahoo.com (Rosnani Ahmad),
zurida5267@gmail.com (Rohaidah Md Nor),
adamono2006@gmail.com (Siti Azliya Ismail)
*Corresponding Author

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sawdust, the workability and density of concrete decreased; however, the water absorption capacity of concrete increased with the volume whilst its strength and the modulus of elasticity decreased (Hossain, 2016). In the case of bricks, Turgut and Algin (2007) reported that limestone dust in combination with wood sawdust in high quantities resulted in less unit weight, smooth surface and ductile fracture. Chemani (2013) studied the effect of adding sawdust to ceramic clay brick by drying and firing shrinkage, water absorption, porosity, bulk density and compressive strength. They concluded that up to 9% sawdust of particle size 1.6 mm can be used in the mixture for better results. (Chemani & Chemani, 2013). Mageed (2012) reported that the combination of limestone dust and cement can be used in the production of masonry building bricks with acceptable mechanical properties. Studies of sawdust in sand blocks showed that not more than 10% replacement will maintain the compressive strength but will reduce the weight and cost of the sandcrete blocks (Adebakin & Adeyemi, 2012). The objective of this study is to determine the compressive strength of cement-sand brick mixed with different proportion of sawdust to the normal mixture.

MATERIALS AND METHODS

Methodology of the study is prepared based on the chart shown below:

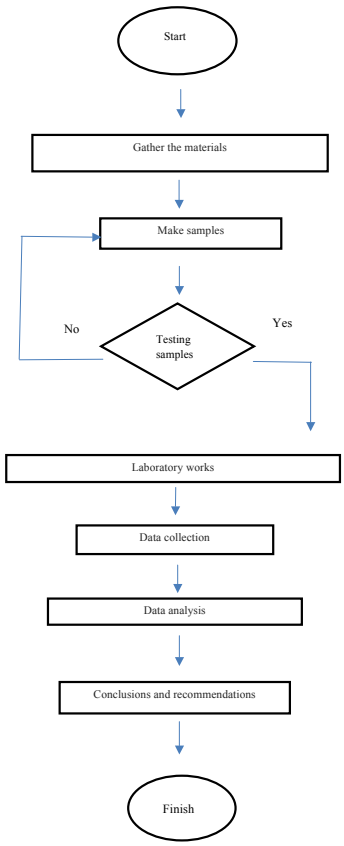

Figure 1. Methodology flow chart for sawdust bricks

Laboratory experiments was done to determine the compressive strength different quantities of sawdust in the 1%, 2% and 3% range respectively. Malaysian Standard, MS 76:1972 states that the compressive strength of ordinary brick must pass 5.2 MN/m². Bricks with a compressive strength of 5.2 MN/m² can be used for the construction of single and two-storey buildings.

Process of cement sand bricks from sawdust.

The sawdust used was filtered and surpassed 600 micrometer in size, the percentage of sawdust used is 1%, 2% and 3% of the total weight of sawdust bricks that were made.

Table 1
Proportion of sawdust for cement bricks

The Average Weight of a Brick	2700g
Weight 1% sawdust in a brick	27g
Weight 2% sawdust in a brick	54g
Weight 3% sawdust in a brick	81g

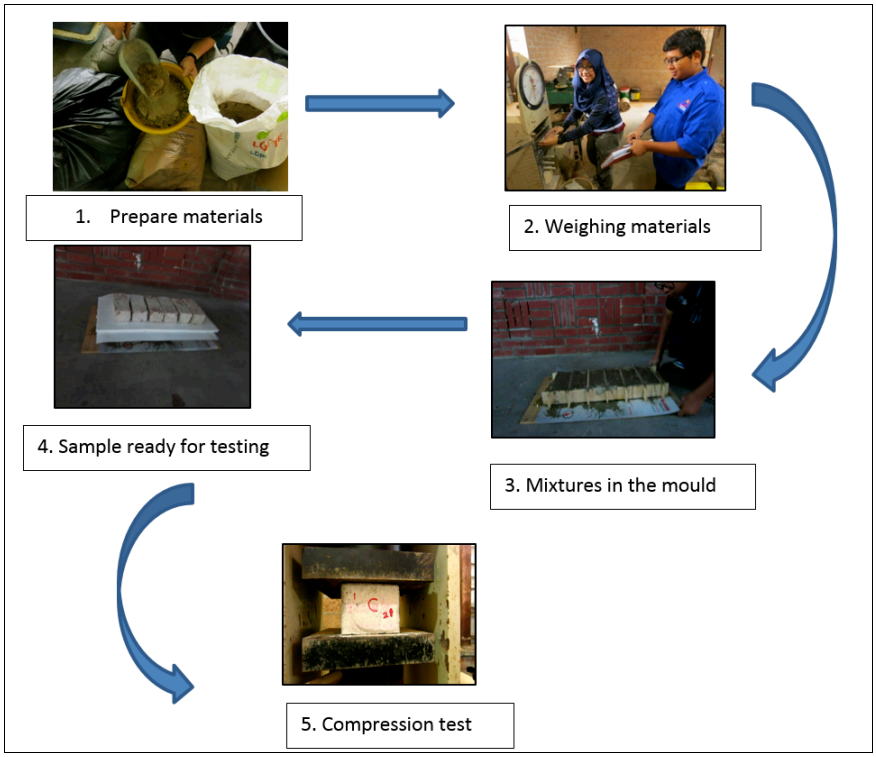

Figure 2. Selecting materials until testing of compression strength

RESULTS AND DISCUSSION

The compressive strength test for sawdust bricks was carried out at intervals of i.e. 7, 14 and 28 days. The results of the compressive strength is tabulated below:

Table 2
Compressive strength of sawdust bricks at different ages

Sample mixture	7 days	14days	28 days	Average	Difference
Sawdust bricks (1%)	7.32 MN/m^2	8.54 MN/m^2	8.67 MN/m^2	8.18 MN/m^2	2.98 MN/m^2
Sawdust bricks (2%)	6.08 MN/m^2	7.18 MN/m^2	7.29 MN/m^2	6.85 MN/m^2	1.65 MN/m^2
Sawdust bricks (3%)	3.87 MN/m2	4.68 MN/m^2	5.25 MN/m^2	4.60 MN/m^2	-0.6 MN/m^2

Table 2 shows that, the average compressive strength for sawdust bricks with 1% addition saw dust is 8.18 MN/m^2, 2% sawdust is 6.85 MN/m^2 whilst 3% sawdust is 4.60 MN/m^2. It means, the when the proportion of sawdust is increased the compressive strength of the bricks decreases. This leads to an average difference of 2.98MN/m^2, 1.65MN/m^2 and (-0.6 MN/m^2) for 1%, 2% and 3% respectively as compared to standard bricks.

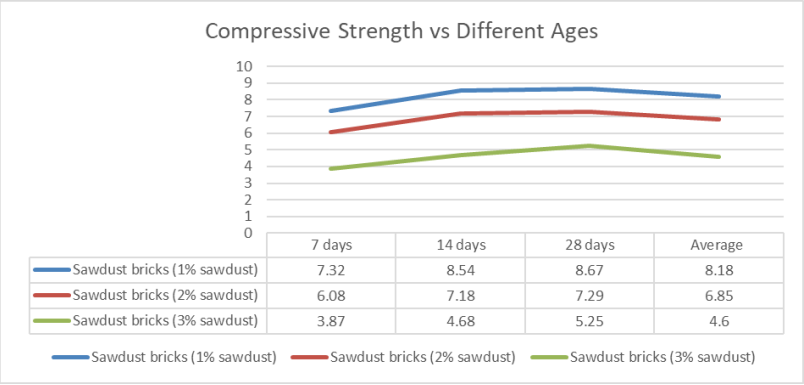

Figure 3. Compressive strength vs different ages

The data shown in Figure 3 shows that the compressive strength of 1% sawdust bricks is 8.18 MN/m² meets the requirement of Class 1 for load bearing bricks. While the compressive strength of 2 % sawdust bricks is 6.85 MN/m² fulfils the criteria stated in Clauses 12, 17 & 22 as stated in MS 76: 1972 as a load bearing brick. Therefore, it can be deduced that sawdust has the potential to be an additive in the manufacture of cement bricks although the amount used as additive it should not exceed 2%.

CONCLUSION

This study was carried out to determine the potential of waste sawdust from work based workshop as an additive in cement bricks. The tests prove that sawdust can be used in the manufacture of cement bricks. However, the percentage of sawdust that has to be added in cement bricks cannot exceed 2%.

ACKNOWLEDGEMENT

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