

Experimental Study of Bricks Prepared by Blending Clay with Cigarette Butts

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Abstract— In environment, various wastes are disposed-off without any suitable treatment which causes nuisance and may pollute the land or soil, water and air; cigarette butts (CBs) are one of them. Cigarette butts are basically a filter used while smoking, it is 30% of the total length of cigarette and made up with cellulose acetate, rayon and paper. CBs are largely produce and consumed by U.S.A., single handedly it produces 5.5 trillion cigarette butts in 2004 study and it is estimated to be increase by 40% in 2025. On large scale, CBs are majorly consumed by U.S.A., India, Australia, México, Brazil. CBs are basically a litter to the environment and poses serious environment risk. In this study, bricks manufactured using CBs has been manufactured and studied. Properties including water absorption, compressive strength, flexural strength, efflorescence, size and shape, hardness and soundness of clay bricks are reported and discussed. The result shows that density of bricks decreased approx. by 18% to 29% with varying percentage of cigarette butts incorporating in it. Compressive strength of bricks comes out as 8.34, 6.59, 5.07, 3.91 MPa for 5%, 10%, 15% and 20% CBs content respectively. Water absorption of such kind of bricks comes out in within the limits of 20%.

Key words: Cigarette Butts, Clay Brick, Re-Using Litter

I. INTRODUCTION

Worldwide, cigarette litters are most hazardous element for environment. There is a strong demand for safe disposal and reusage of cigarette litters because they are non-biodegradable in nature. In India, National Green Tribunal (NGT) and union ministry of environment and forest (MOEF) estimates that 100 billion of non-biodegradable cigarette butts (CBs) are disposed off into environment every year and MOEF also estimates that by 2025, cigarette butts litter shall increase by 50%, which make this problem very serious while india is working on Swachh Bharat Abhiyan. so, proper disposal of these hazardous litter should be done.

There are several methods of disposal of cigarette butts i.e. land filling, incineration and reusage. Land filling is one of the disposal method but as it contain high amount of organic content and toxic substances, which may pollute the underground water and may leak pollutants into the soil and surrounding environment. Second method of disposal is incineration, it does not look a sustainable solution as burning waste may contain various hazardous substances. Third method is reusage, which we have adopted in this study. The alternative disposal of cigarette butts can be accomplished by using it as an engineering construction material.

Possible solution of cigarette litters is to re-use it as a building material by incorporating cigarette butts in a sustainable composite building material such as clay bricks.

Brick is one of the most accommodating masonry unit as a building material due to its properties. Various practices has been done in the past to incorporate waste in the production of bricks such as use of wood sawdust, rubber and limestone dust, sludge, polystyrene, processed waste tea and flyash. By recycling such wastes by incorporating them into building material, is one of the practical solution to the pollution problem. In addition, adding carbonaceous waste has also determined to be reducing fuel cost for brick manufacturing.

In this study we investigate the re-usage of cigarette butt by using it in the manufacturing of light weight clay brick.

II. MATERIALS AND METHODOLOGY

The cigarette butts used in this study are bought up from different paan shops near the locality. After collecting butts from dry receptacles. Upon delivery these butts are disinfected at 105°C for 24 hours. The soil used in brick manufacturing is silty sandy clay and taken from the manufacturer site. Lime has been bought from the shops.



Fig. 1: manufacturing of brick with varying percentage of cigarette butt



Fig. 2: Brick sample shape and size after moulding

s. no.	Mixture identification	Percentage of cigarette butts by weight (%)	Percentage Of Cigarette Butt Compacted By

			Volume (%)
1.	SAMPLE -1	5	10
2.	SAMPLE-2	10	20
3.	SAMPLE-3	15	30
4.	SAMPLE-4	20	40

Table 1: Mixes Used in This Study

first of all cubic bricks (of size 190mm x 90mm x 90mm) are prepared using a steel mould and bricks are manufactured using different amount of cigarette butts i.e. 5%, 10%, 15% and 20 % by weight incorporating in brick manufacturing material. Other materials used are silty sandy clay , lime and water.

materials used in brick manufacturing is prepared and mixed together in sealed bucket, then water is added in it according to the optimum moisture content then by giving vertical motion through rod mixed material is poured in the mould.

Prepared wet bricks are left out to dry for 24 hours at room temperature, it should be done carefully then the sun drying is done for 5 days period so that required strength can be achieved.

Then it is burnt in kiln at non controlled temperature of around 700^oc to 1300^oc.

III. RESULTS & DISCUSSION

The density of the manufactured bricks decreased almost linearly from 2176 kg/m³ for the control samples (0 % CBs) to 1269kg/m³ for bricks with 20% CB content (Fig. 3). The density of bricks decreased by 32.3 %, 36.02 % , 39.79 % and 41.68% when 5 % , 10 % , 15% and 20% CBs was incorporated into the raw materials (Table II). The bricks became more porous as CB content increased (Figs. 4 and 5). Low-density or light-weight bricks have high advantage in construction which includes easier handling. Lower structural dead load, transportation cost reduces and number of bricks production per tones of raw material has been increased. Such kind of bricks can be substituted in place of standard bricks except in case of high strength bricks needed.

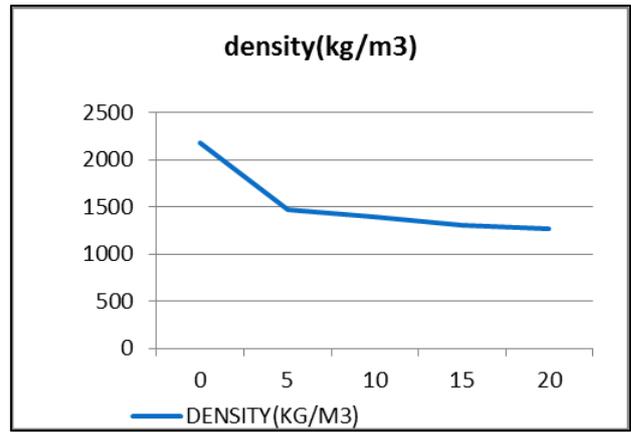


Fig. 3: Graph Between Density And Cigarette Butts (%)

The light weight brick produced by incorporating 5% to 20% CBs by weight equalizes approximately to 10 % to 40% by volume of compacted CBs.

The compressive strength of bricks increased remarkably from 3.5 MPa(for 0% CB) to 8.34Mpa and then decreases to 3.91MPa for 5%,10%, 15% and 20% CBs content respectively.

Compressive strength plays an important role in determining load bearing capability of brick. Studies shows that high rate of mixing speed and longer duration of mixing leads to the high compressive strength bricks and other studies also shows that higher temperature burnt bricks also leads to higher compressive strength brick. This is currently under investigation.



Fig. 4: compression testing of brick

s.no.	Specimen name	Avg. dry weight (kg)	Avg. wet weight (kg)	Water absorption (%)	Avg. field density (kg/m ³)	Avg. compressive strength (MPa)	Efflorescence
1	Sample 1	2.268	2.68	18.43	1473	8.34	nil
2	Sample 2	2.143	2.55	19.12	1392	6.59	nil
3	Sample 3	2.017	2.41	19.63	1310	5.07	nil
4	Sample 4	1.953	2.35	20.32	1269	3.91	nil

Average result of 3 specimen per sample

Table 2: Experimental result of control mix containing CB

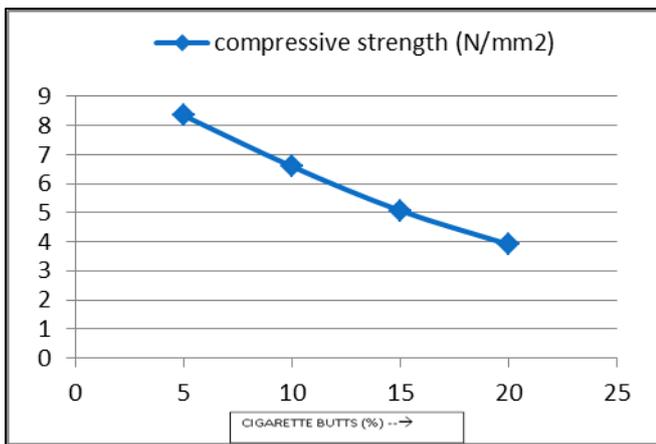


Fig. 5: graph between compressive strength and varying CB percentage



Fig. 6: cross section of brick having different percentage of cigarette butt content i.e.5%,10%, 15% and 20%

From The Table-II, it is clearly seen that flexural strength also got improved which is very negligible. i.e. 6.082 Mpa (for 0% CBs) to 6.329 Mpa for 5%,10%,15% and 20% CBs content respectively.

Efflorescence test has been conducted and test results shows that there will be no efflorescence detected in it.

Shape and size are found to be perfect with sharp edges .

In soundness test it produces a clear ringing sound.

IV. CONCLUSION

In this study, possibility of incorporation of cigarette butts in clay brick has been investigated. Cigarette butts which produces litter and affect the swachh bharat abhiyan (which is a initiative of India) has been used in these bricks.

Mix of cigarette butts-clay with 5%, 10%, 15% and 20% mixes by weight, and 10%, 20%, 30% and 40% by volume had been used in manufacturing brick samples. Certain tests are performed and the following conclusions have been made.

Density of bricks has been reduced by 17.50% to 28.98% in comparison to standard bricks , 32.3% to 41.70% in comparison to ordinary clay bricks and 35.2% to 44.2% for fly ash bricks. Compressive strength of bricks in comparison to standard brick first increases by 35.6% and then decreases by 36.42%. while in comparison to fly ash brick it increases first by 51.63% and then decreases by 28.90%.While in cost comparison, it is cheaper than fired clay bricks and standard bricks and little bit costly than fly ash brick by 14.44%.Due to the low density of these bricks, it also reduces the dead load of the structure. By incorporating, such kind of litter in the bricks we can save the environment and health of human beings. While

studying it is also seen that by incorporating cigarette butts in the bricks 60% of fuel cost can be saved by incorporating 5% by weight to the raw clay soil.

These type of bricks does not required any skilled labour in manufacturing of bricks. Size and shape of these bricks are similar to the required conventional bricks. These bricks can be provided as a conventional alternative to standard bricks. These kinds of bricks can be used in partition walls, low cost housing and refractory linings.

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