International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 03 , March 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

REUSE OF CIGARETTE BUTT FOR MANUFACTURING BRICKS

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ABSTRACT

Cigarette butts accumulate in the environment mainly due to the poor biodegradability of the cellulose acetate filters. CB filters release a range of toxic chemicals as they deteriorate. CBs are carried by storm water into watercourses and ultimately the ocean where the chemicals they contain pose a risk to the organisms of both freshwater and marine environments. A large amount of CBs are produced worldwide yearly. The insufficient collection & inappropriate disposal of wastes poses risks to human health & environment. Over the next few decades, globalization, rapid urbanization & economic growth in the world are tending to further deteriorate to this situation. This paper presents some of the results from a continuing study on recycling CBs into fly ash bricks. Tests including flexure strength, water absorption & compressive strength.

Keywords: Bricks, Cigarette Butts, Clay, Environment

I. INTRODUCTION

CBs accumulate in the environment mainly due to the poor biodegradability of the cellulose acetate filters. CB filters release a range of toxic chemicals as they deteriorate. CBs are carried by storm water into watercourses and ultimately the ocean where the chemicals they contain pose a risk to the organisms of both freshwater and marine environments. Land filling and incineration of CB waste are not, universally, environmentally sustainable nor economically feasible disposal methods. Even when correctly binned and sent to landfill far from natural waterways, CBs remain an environmental hazard. Also, land filling of waste with high organic content and toxic substances is in general becoming increasingly costly and difficult. Incineration of CBs is also a seemingly unsustainable solution as emissions from the burning waste contain various hazardous substances. Recycling CBs is problematic because there are no easy mechanisms or procedures to assure efficient and economical separation and recycling of the entrapped chemicals. An alternative could be to incorporate CBs in a sustainable composite building material such as fired bricks. Brick is one of the most accommodating masonry units as a building material due to its properties. Attempts have been made to incorporate waste in the production of bricks; for instance, the use of rubber, limestone dust and wood sawdust, processed waste tea, fly ash, polystyrene and sludge. Recycling of such wastes by incorporating them into building materials is a

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

practical solution to the pollution problem. In addition, adding carbonaceous industrial wastes has also been demonstrated to be an efficient and environmentally advantageous way of reducing fuel use for brick-making.

II MATERIALS

2.1 Cigarette Butts:-

Worldwide, cigarette butts (CBs) are the most common type of litter. The United States Department of Agriculture estimates that in 2004 over 5.5 trillion cigarettes were produced in the world [1]. This is equivalent to an estimated 1.2 million tonnes of cigarette butt waste per year. These figures are expected to increase by more than 50% by 2025, mainly due to an increase in world population. CBs accumulate in the environment mainly due to the poor biodegradability of the cellulose acetate filters. CB filters release a range of toxic chemicals as they deteriorate. CBs are carried by storm water into watercourses and ultimately the ocean where the chemicals they contain pose a risk to the organisms of both freshwater and marine environments.

Fig.no.2.1.Cigarette Butts

The filter of cigarette contains a sponge like material which is not decomposed and therefore they can be utilized in manufacturing of bricks. We can test various properties of bricks including CBs. Land filling and incineration of CB waste are not, universally, environmentally sustainable nor economically feasible disposal methods. Even when correctly binned and sent to landfill far from natural waterways, CBs remain an environmental hazard. Also, land filling of waste with high organic content and toxic substances is in general becoming increasingly costly and difficult. Incineration of CBs is also a seemingly unsustainable solution as emissions from the burning waste contain various hazardous substances. The butts are collected from dry receptacles. Upon delivery, the CBs are disinfected at 105 Degree Celsius for 24 hours and then stored in sealed plastic bags.

2.2 Clay

In brick-making terms, clay covers a range of naturally occurring raw materials which are used to make a product. The clays vary considerably in physical properties, colour, hardness etc, and mineralogical content. They do, however, have certain properties in common. They have the ability to be crushed and mixed with water to form a plastic material which can be moulded into various shapes. This can then be fired to a high temperature during which process it attains a hard, weather resistant characteristic. The key, in geological terms, is the mineral content of the raw material. This is common to all clay types. Pure clay mineral is formed from

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ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

the erosion and weathering of primary igneous rocks. The clay mineral is transported away by the action of water, wind, ice etc., and re-deposited elsewhere. In the process it picks up a number of impurities, Quartz, mica, Calcium Carbonate (lime), Iron Oxide etc, etc. The subsequent deposit becomes a sedimentary rock. Due to variances in the age of the deposit, the conditions of its deposition and the impurities involved there will be variations between different clay types and even on occasions within the same deposit. These variations may affect the brick making process and the properties of the finished product.

Fig.no.2.2. Clay

2.3 Water

Water used for making bricks should be potable. The water should be free from all organic impurities, dirt and dust. Sea water should not be used in manufacturing of bricks as it contains high quantity of salt which will finally result into efflorescence in bricks.

III. MANUFACTURING PROCESS

1. After storage, clay is further crushed and mixed with water, in an operation designated as tempering. In the early times, the mixing was carried out by hand, in a crude and often ineffective manner; but, later, horse-driven heavy rollers or wheels in a ring-pit were used.
2. The amount of water used depends on the type of element being produced and, usually, smaller and thinner clay elements would require a greater amount of water.
3. The resulting mix must be characterized by enough plasticity to facilitate the moulding, but not "too plastic", as it can lead to severe shrinkage during the drying phase, resulting in warping, twisting of early brick makers often used a mix of about 30% of sand and 70% of plastic clay.

Sr.no.	CLAY (in %)	CBs (in %)	CLAY(in kgs)	CBs (in kgs)
1	99.8	0.2	2.495	0.005
2	99.6	0.4	2.490	0.010
3	99.4	0.6	2.485	0.015
4	99.2	0.8	2.480	0.020
5	99.0	1.0	2.475	0.025

Table.no.3.1. Table Showing Proportions of Clay & CBs

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ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

3.1 Moulding

Then this plastic mass of clay and water is moulded into a steel mould. The mould is 9 x 4 x 3 inches in size. Mould contains an impression of frog in it so that the brick moulded will contain a frog. After inserting the plastic mass the mould is slightly banged for 2-3 times on the ground for compaction. Then the excess mass is wiped by hand or by a metal strip. Then the mould is inverted and the clay gets shaped into a brick.

Fig.no.3.1.1. Brick Mould

3.2 Drying

Before the bricks can be fired, as much moisture as possible must be removed or they will explode in the kilns. Drying involves the removal of water from the wet brick in such a way as to dry them out evenly from inside out. If the outer skin of the brick dries first it becomes impossible for the moisture inside to escape. Generally the drying of bricks is done in open atmosphere as it not requires any brick dryer equipment. Drying schedules vary but between 18 to 40 hours is typical for an automated plant. Special shapes and large units can take up to a week or more. The dry bricks are then set onto kiln cars ready to be fired.

Fig.no.3.1.2. Drying of Bricks

3.3 Firing

Firing temperatures vary considerably between different clay types and are often quite critical. During firing, bricks undergo a physical change. Clay particles and impurities are fused together to produce a hard durable and weather resistant product. This is called vitrification. This is usually accompanied by further shrinkage and a colour change. Temperatures vary greatly depending on clay type but are generally in the range of 900 – 1200 degrees centigrade.

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ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

IV. TESTS & RESULTS

4.1 Compression Test (Conforming to IS 3495 (PART 1) 1992)

It is very important to test the compression strength of bricks as it is very important factor to be considered for the brick to be used in construction. For this test the compression testing machine is used which is generally hand operated.

Following is the How Compression Strength of Bricks is carried out:

1. Firstly the brick is properly placed on to the load frame.
2. Then gradually the load is applied on the brick through the pumping unit.
3. The needles on the dial gauge indicate the load which is applied onto the bricks.
4. The load at which the brick breaks is noted down.

Sr.No.	Proportion (CL+CBs)%		C1	C2	C3	C4	C5	AVG.
	Clay	CBs	KN	KN	KN	KN	KN	KN
1	100%	0%	50	55	65	50	55	55
2	99.8%	0.2%	55	53	54	55	56	55
3	99.6%	0.4%	50	52	51	50	50	50
4	99.4%	0.6%	45	46	42	42	38	43
5	99.2%	0.8%	40	37	41	38	40	40
6	99.0%	1.0%	35	34	34	36	35	35

Table no 4.1. Table showing Compressive Strength of Bricks in KN.

4.2 Water Absorption

Water absorption of the bricks is also tested. The brick should not absorb more than 20 % of water of its weight.

Following Is The Procedure For The Water Absorption Test:

1. The sample of 25 bricks is first dried at the site for one day for 24 hours. Then each weighed on the electronic balance to an accuracy of 0.1%. Ensure there is space between the bricks. (NB Do not put bricks in a cold oven)
2. Each specimen in turn is then placed in the water bath allowing water freely to circulate on all sides, with at least 10mm space between the brick and the side of the bath at least for 24 hours.
3. After 24 hours the bricks are taken out from water bath and then it is dried for 24 hours under the normal condition (sunlight).
4. Weighing should be completed within 2 minutes from their removal from the bath.
5. The water absorption is calculated using the formula.

    i. A = 100 x (wet mass - dry mass)/dry mass

    And the average of the ten specimens also calculated and reported to the nearest 0.1%.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

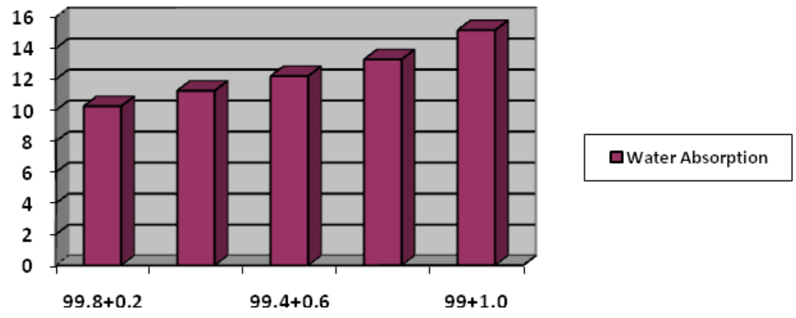

Fig.no.4.2.1. Chart showing Water Absorption of Bricks

4.3. Flexure Test (Conforming To Is 9399-1979 Or On Request Is 516)

Following Is The Procedure For The Flexure Test:-

1. Firstly the brick is placed on the scale and it is tightly fixed on to the scale with the help of two nuts.
2. Then several small iron balls are poured into the cylinder up to the level.
3. The cock is released to pass iron balls into weighing bucket until the brick is breaked, then cock is again fixed so that no any more balls will enter into weighing bucket.
4. Then balls due to which the brick breaks is taken in a tray and the tray is weighed.
5. Then the weight obtained in KGs is considered as the flexural strength of bricks.

Proportion	Flexure Strength in KGs					Avg. Flexure Strength in KGs
	C1	C2	C3	C4	C5	
0.2	9.8	10	9.9	10.3	10.1	10.02
0.4	8.5	8.3	8.6	8.8	8.2	8.4
0.6	9.6	9.7	9.5	9.2	9.5	9.5
0.8	11.5	11	11.3	11.1	10.9	11.1
1	7.8	7.5	7.6	7.3	7.5	7.5

Table.No.4.3.2. Table showing Flexure Strength of Bricks

V. CONCLUSION

The project was carried on by using cigarette butts for manufacturing of bricks. CBs were used in this project because they cause a severe damage to the environment. Also CBs are not disposable therefore they are used in manufacturing of bricks. Through different tests carried on bricks, these bricks proved a very good alternative to the conventional clay bricks. The Compressive Strength, Water Absorption and Flexure Strength of the CB bricks were approximately same as compared to conventional clay bricks. In this way full study of manufacturing of bricks is done by us and we manufactured bricks by CBs in various proportions.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

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