PROBING OF ECOBRICKS FROM INDUSTRIAL WASTE USING "ALKALI ACTIVATION TECHNOLOGY"

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ABSTRACT

This research incorporates waste boiler ash into masonry construction materials using alkali activation. Utilization of industrial waste Boiler ash is derived from paper mills. The process of Eco bricks is mixing with clay, lime, Boiler ash and NaOH and then dried with oven and direct sun light is termed as Alkali Activation Method. It reduces the CO2 emission and serious hazards to human health. A brick formulation is boiler ash, clay, lime and NaoH to produces bricks. An economic and environmental analysis indicates that these bricks can be produced for similar cost as clay brick with reduced environmental impact making them a viable alternative in the market.

I. INTRODUCTION

House is a basic need, Owning a house is a problem for majority of people in India due to expenses cost of construction.To Address this situation attention has been focused on low cost alternative buildings.In India,Fired clay bricks are being used extensively and it consumes about 20,000million bricks and 27% of total natural energy consumption for their production.So that we have to use alkali activation technology to reducing serious hazards to both environment and human health.

II. MIX PROPORTION

- **GENERAL**

The manufacturing of clay brick is done by manual and mechanical, processes like mixing, casting is also manual and mechanical work. The composition of proportion of materials in each brick is depends on weight of than brick. Each brick having 4000gm materials required.

The approximately, the weight of one wet brick is 4 kg.

- **MOULDS**

Moulds are prepared as modular brick size of 215mm x 100mm x70mm. For the purpose of comparison of brick test results into codes.

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- **MIX PROPORTION**

Clay (kg)	Lime(kg)	NaOH (M)	Boiler Ash(kg)
2	2	2	0
2	1.5	2	0.5
2	1	2	1
2	0.5	2	1.5
2	0	2	2
2	0.5	2	1.5
2	1	2	1
2	1.5	2	0.5

RESULTS

1.Compressive strength test

A compressive testing machine, the compression plate of which shall have a ball seating in the form of portion of a sphere the centre of which coincides with the centre of the plate, shall be used.

Table no 1 Compressive strength of CB

Weight of boiler ash (kg)	Load at failure (kN)	Area (mm^2)	Compressive Strength (N/mm^2)	Average (N/mm^2)
0	80	215 X 100	3.72	3.50
	75		3.50	
	70		3.30	
0.5	100	215 X 100	4.65	4.57
	105		4.88	
	90		4.18	
1	140	215 X 100	6.52	6.44
	135		6.27	
	140		6.52	
1.5	130	215 X 100	6.04	6.04
	125		5.81	
	135		6.27	

Compressive strength = (load at which the specimen fails/area of specimen) = (100 X 1000/ 215 X 100)

= 4.65 N/mm^2

On the addition of waste materials such as boiler ash in the brick material is observed that the compressive strength is increase from the compressive strength of conventional bricks. From the above results the optimum compressive strength value is achieved on addition of 0.5kg of Boiler ash i.e., 4,57 N/mm^2

Table 2 Compression test of CLB brick

Weight of boilerash and lime (kg)	Load at failure (kN)	Area (mm^2)	Compressive strength (N/mm^2)
0	80	215 X 100	3.72
	75		3.50
	70		3.30
0.5	110	215 X 100	5.10
	100		4.65
	100		4.65
1	160	215 X 100	7.44
	155		7.20
	150		6.97
1.5	85	215 X 100	3.77
	90		4.00
	85		3.77

Compressive strength = (Load at which the specimen fails/Area of thespecimen)

= (110 X 1000/ 215 X 100)

= 5.10 N/mm

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On the addition of waste materials such as boiler ash in the brick material is observed that the compressive strength is increase from the compressive strength of conventional bricks. From the above results the optimum compressive strength value is achieved on addition of 1.5kg of Boiler as i.e.,3.84N/m.

Water absorption test

Water absorption is a key parameter that establishes the durability of the brick. It is an indicator of sustainability of the brick against moist environment. Lower the absorption indicates presence of pores and hence reduces the weight.

Water absorption test after 24 hours

Table 6.3 Combination of clay and boiler ash

Weight of boiler ash (kg)	Weight of dry bricks W1 (kg)	Weight of wet bricks W2 (kg)	Amount of water absorbed (%)	Average (%)
0	3.322	3.614	8.78	8.42
	3.325	3.598	8.21	
	3.332	3.607	8.25	
0.5	3.296	3.614	9.65	9.75
	3.294	3.618	9.83	
	3.287	3.609	9.79	
1	3.330	3.700	11.11	11.60
	3.326	3.712	11.60	
	3.317	3.723	12.23	
1.5	3.238	3.794	11.85	11.94
	3.247	3.792	11.94	
	3.262	3.783	12.04	

Amount of water absorbed = {(W2 – W1)/W1} X 100Where,W1 = weight of dry bricksW2 = weight of wet bricks = {(3.614 – 3.322)/3.322} X 100= 8.42%

As per weight of boiler ash and lime added increases, the water of the bricks also increases gradually due to the presence of pores in the waste material. But with the waste addition from the results of graph, the percentage of absorption for boiler ash bricks is less than 1.5kg as specified in IS 1077-1976.

Table 3 Combination of clay, lime and boiler ash

Weight of boiler ash and lime (kg)	Weight of dry bricks W1(kg)	Weight of wet bricks W2(kg)	Amountof water absorbed (%)
0	3.322	3.614	8.78
	3.325	3.598	8.21
	3.332	3.607	8.25
0.5	3.252	3.722	14.45
	3.261	3.734	14.29
	3.278	3.744	14.22
1	3.228	3.746	16.04
	3.236	3.749	15.85
	3.239	3.755	15.93
1.5	3.219	3.752	16.55
	3.212	3.761	17.09
	3.206	3.758	17.21

Amount of water absorbed = {(W2 – W1)/W1} X 100 Where, W1 = weight of dry bricks W2 = weight of wet bricks

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= {(3.722 – 3.252)/3.252} X 100 = 14.45%

As per weight of boiler ash and lime added increases, the water of the bricks also increases gradually due to the presence of pores in the waste material. But with the waste addition from the results of graph, the percentage of absorption for boiler ash bricks is less than 1kgas specified in IS 1077-1976.

SHAPE AND SIZE TEST

The shape and size of bricks are very important consideration. All bricks used for construction should be a same size. The shape and size of bricks should be purely rectangular with sharp edges. Standard brick size consists length x breadth x height as 23cm x10cm x 7cm**.**To perform this test, select 10 bricks randomly from brick group and stack them along it length, breadth and stack them along its length and compare. So if all bricks similar size then they are qualified for construction work.

HARDNESS TEST

In this test, brick is scratched using finger nail. If there are no visiblescratches made on the brick surface, it is said to be sufficiently hard.

EFFLORESCENCE TEST

The water has been absorbed and bricks appear to be dry, place a similar quantity of water in the dish and allow it to evaporate as before. Examine the bricks for efflorescence after the second evaporation and report the results. Results of efflorescence test shall be reported as nil, slight, moderate, heavy or serious. Results of efflorescence test shall be reported as nil. If there is no noticeable deposit of efflorescence.

STRUCTURE TEST

A brick is broken and its structure is examined. It should be homogeneous, compact and free from any defects such as holes, lumps etc.

CONCLUSION

Boiler ash is available in large amount throughout the year. As the productionof boiler ash in large quantity, can be utilized for the manufacture of constructionmaterial like brick, etc.,

It is known from the graph that the maximum compressive strength of the brick is obtain in 1kg of boiler ash and lime used with clay when it dried with oven and direct sunlight.

From the results of water absorption graph obtained from the additional of waste materials, the percentage of water absorption for boiler ash is less than 20% as specified in IS 1077-1976. Similarly, the percentage of water absorption for boiler ash, clay and lime used bricks is less than 20% as specified in IS 1077- 1976.

Environmental effects of waste and disposal problem of waste can be reduced through this brick manufacturing process. This study helps in converting boiler ash into bricks and make it valuable.

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From this research maximum compressive strength of correct proportion by alkali activation method is obtained.

The main conclusion is that compressive strength our eco brick is more when compared to conventional brick.

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