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# A Review : Study the Possibilities of using Coal Bottom Ash in Concrete as a Cement

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## ABSTRACT

The Coal Bottom Ash is obtained from the Thermal Power Plant. In India about 35 million tons of Coal Bottom Ash is produced the study was to investigate their use in concrete to replace cement with coal bottom ash as a waste with a main focus on the properties such that Physical and Chemical. In Physical such as specific gravity, particle size analysis, moisture content, bulk density. In chemical property content the XRF test and SEM test also included. This test value compare with IS Code 3812[Pulverized Fuel Ash – Specification]. The value match the XRF and SEM test with IS code 3812, then the possibilities of using Coal Bottom Ash in concrete as a Cement.

## I. INTRODUCTION

The ash is obtained from the thermal power station. In India about 190 to 200 million tons of coal ash as waste which is comprises of bottom ash and fly ash. Large quantity (35 million tons) of coal bottom ash is produced by thermal power plants in india. The present method of disposal of coal bottom ash on open land is the main cause of an environment hazard for the surrounding community. As utilization of coal bottom ash can help in alleviating environmental problems, Hence the aim of this research study was to investigate their use in concrete to replace cement with bottom ash as a waste. Bottom ash is part of the non-combustible residue of combustion in a furnace or incinerator. In an industrial context, it has traditionally referred to coal combustion and comprises traces of combustibles embedded in forming clinkers and sticking to hot side walls of a coal-burning furnace during its operation.The portion of the ash that escapes up the chimney or stack is, however, referred to as fly ash.The clinkers fall by themselves into the bottom hopper of a coal-burning furnace and are cooled. The above portion of the ash is referred to as bottom ash too Additionally, modern municipal waste incinerators try in reducing the production of dioxins by incinerating at 850 to 950 (degrees Celsius) for at least two seconds forming bottom ash as byproduct. Bottom ash also makes a useful construction material. In Indian coal combustion products association estimates the use of bottom ash in the construction industry at 46% and the use of fly ash at 43%. Bottom ash applications include filler material for structural applications and embankments, aggregate in road bases, sub – bases, pavement, and lightweight concrete products, as feed stock in the production of cement. The chemical makeup of fiy and bottom ash varies significantly and is dependent on the source and composition of the coal being burned . This can include a wide variety of toxic substances from trace amounts to percent levels. In order to protect the environment or the quality and safety of any products it is added to, the composition of the ash product needs to be accurately analyzed before it can be recycled or disposed .

## II. METHODS AND MATERIAL

**Materials:**

We have collected the Coal Bottom Ash from different power plant

1) Khaperkheda Thermal Power Plant
2) Koradi Thermal Power Plant
3) Butibori Relience Power Plant

**Figure 1.** Coal Bottom Ash of Butibori Relience Power Plant

**Figrue 2.** Coal Bottom Ash of Khaperkheda Power Plant

**Figrue 1.** Coal Bottom Ash of Koradi Power Plant

**Methods:**

**1) Sieve analysis:**Take adequate quantity of the representative sample and thoroughly break up the lump by means of a rubber pestle in mortar bur not breaking the individual grains. Then dry in air or sun. In wet weather, use sample maintained at 70$^{o}$C weight the sample and record its weight correct to 0.1% of the weight of the sample. Separate the sample by sieving into two parts,

**1. Retaining on 75μ sieve**

**2. Passing through 4.75mm sieve.**

Here analysis is done for the fraction above 2mm only. Record the weight of fraction retained 0.2mm sieve accurate to 0.1% of its total weight.

Separate the various fractions by successive sieving through sieve of 100mm, 63mm, 20mm, 6.3mm, 4.75mm and 2mm. while sieving, agitate the sieves so that the material rolls in irregular motion.

Record the weight of material retained on each sieve correct to the 0.1% of its total weight. Then calculate the percentage of each fraction of the weight of total sample taken initially analysis.

**2) Moisture Content:** Clean and dry container with lid or dish . Weight accurately and determine the weight of the empty container provided along with lids. Let it be W1.

1) Take about 20 to 25 gm. Of the given weight of coal bottom ash in a container and determine the weight again. Let it be W2.
2) Keeps the containing the wet coal bottom ash in an oven. Set at 105$^{o}$C The drying should be done

in constant weight. The container should be open, but the lid also be kept along with container.

3) After complete drying, cool it in desiccators to room temperature and weight let it be W3.

**4) Specific Gravity**:

1) Sieve the dry field sample through 4.75mm sieve.Oven dry the soil to constant weight at 105°C to 110°C and cool it I desiccators. Record the weight of empty pycnometer used (W1).
2) Weight the pycnometer with oven dry soil (W2).
3) Fill Kerosene to half full level in the pycnometer and mix the thoroughly with glass rod. Add more kerosene and stir it. Replace the screw top and fill the pycnometer flush with hole in the conical cap. Dry the pycnometer from outside, and find the weight(W3).
4) Empty the pycnometer, clean it thoroughly and fill it with distilled water, to hole of the conical cap and find the weight(W1).
5) Repeat above steps for the two more determination of specific gravity.

5) **Bulk Density:** Sieve about 40g of the material through 250. Micron IS sieve on to a tared glazed paper and weigh it accurately. Slip the powder gently and smoothly into the measuring cylinder which should be held at 45° to the vertical, without knocking or squeezing. Assemble the apparatus With the thumb and four fingers of one hand, gently grasp the upper part of the cylinder, and within one second lift it about 25 mm and let it drop. Note the volume after dropping it once. Continue lifting and dropping until 50 complete drops have been given to the cylinder. During this operation give a gentle turn of about 10° in the clockwise direction to the cylinder after every two drops. As soon as 50 drops are completed, raise the cylinder to eye level and read the volume of the material.

**6) Loss on Ignition**: Heat 1.00g of the sample for 15 minutes in a weighed and covered platinum crucible (a porcelain crucible may also be used) of 20 to 25 ml capacity by placing it in a muffle furnace at temperature between 900° and 1000°C; cool and weigh. Check the loss in weight by a secong heating for 5 minutes and re-weigh.

**7) XRF Test:**

**Table 1.** Comparison between Cement and CBA (Butibori Reliance Power Plant)

| Chemical Composition | Cement | CBA |
|---|---|---|
| $SiO_2+Al_2O_3+Fe_2O_3$ | 70 | 58.72 |
| $SiO_2$ (min) | 35 | 56.32 |
| MgO (max) | 5 | 0.38 |
| $Na_2O$ (max) | 1.5 | 0.053 |
| $K_2O$ (maX) | 0.83 | 0.060 |
| CaO | 63.72 | 7.3 |
| LOI | 5 | 1.02 |

**Table 2.** Comparison between Cement and CBA (Khaperkheda Power Plant)

| Chemical Composition | Cement | CBA |
|---|---|---|
| $SiO_2+Al_2O_3+Fe_2O_3$ | 70 | 69.54 |
| $SiO_2$ (min) | 35 | 67.42 |
| MgO (max) | 5 | 0.29 |
| $Na_2O$ (max) | 1.5 | 0.034 |
| $K_2O$ (max) | 0.83 | 0.060 |
| CaO | 63.72 | 7.3 |
| LOI | 5 | 7.33 |

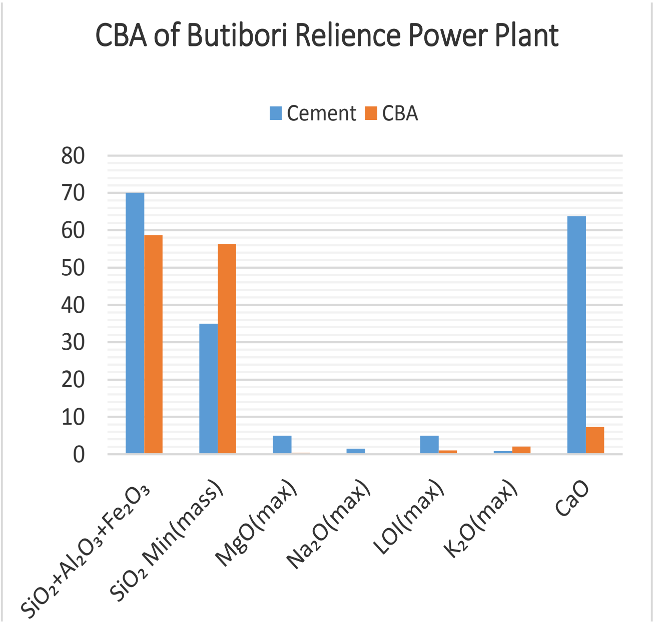
**Table 3.** Comparison between Cement and CBA (Koradi Power Plant)

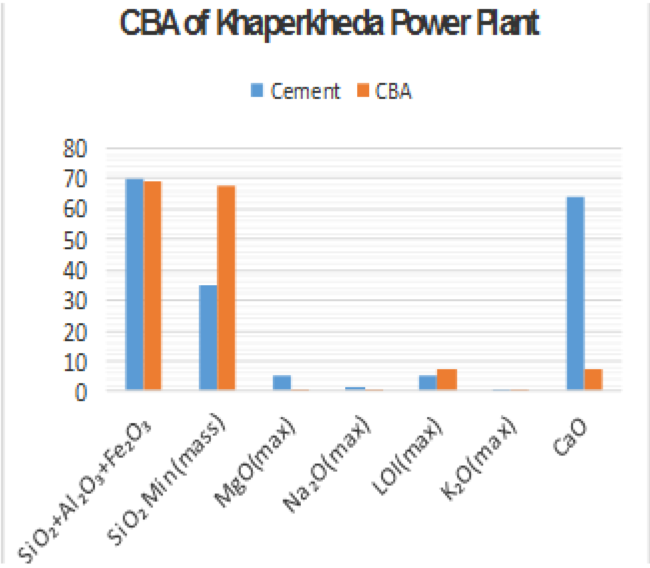
| Chemical Composition | Cement | CBA |
|---|---|---|
| $SiO_2+Al_2O_3+Fe_2O_3$ | 70 | 60.75 |
| $SiO_2$ (min) | 35 | 58.96 |
| MgO (max) | 5 | 0.10 |
| $Na_2O$ (max) | 1.5 | 0.060 |
| $K_2O$ (maX) | 0.83 | 0.060 |

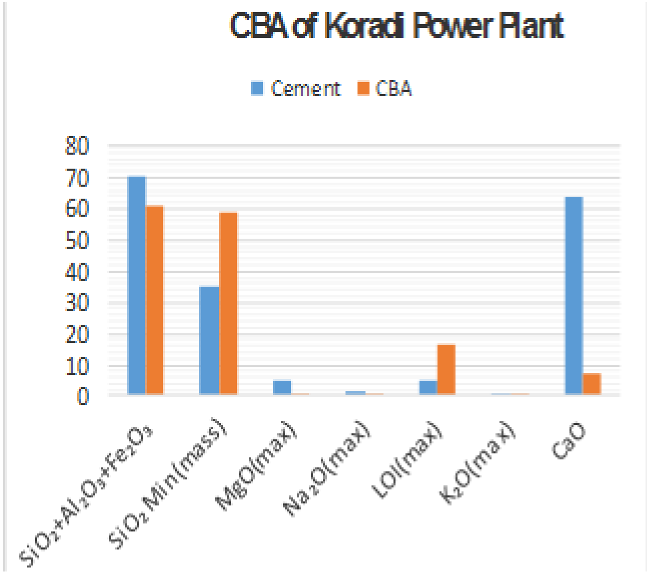
| | | |
|---|---|---|
| CaO | 63.72 | 7.3 |
| LOI | 5 | 16.23 |

## III. RESULTS AND DISCUSSION

### Comparison of cement and Coal Bottom Ash




## IV. CONCLUSION

This paper was prepared by reviewing the different on thermal Power Plant grinding time of CBA. From the review, the properties of Cement is compare with CBA were improved by decreasing the particle size of CBA. Furthermore, SEM analysis shows that the particle size of the CBA and scanning the p.article of CBA Generally, pozzolanic reaction of CBA was directly related to its fineness. The SEM result will be positive as possible . From the literature review, by increasing the fineness of CBA. Then the conclusion is Positive as possibilities using the Coal Bottom Ash as a Cement.

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