Experimental Investigation using Bottom Ash as a Partial Replacement of Fine Aggregate with Addition of Humic Acid

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ABSTRACT

This study presents the test results of fresh and hardened properties of bottom ash concrete incorporating bottom ash as partial replacement of normal sand at 0%, 10%, 20%, 30% by weight. The fly ash and bottom ash are the slag from coal combustion process for power generation. 80% fly ash and 20% bottom ash, and are classified as waste in utility disposal sites. In construction large volumes of materials are consumed, such as highway. Embankment construction, it is an economic alternative to the use of traditional materials. This paper presents the bottom ash concrete. The sample of bottom ash were collected Neyveil lignite plant. For evaluation of compressive strength, flexural strength, split tensile strength. The bottom ash was added as partial replacement of fine aggregate in 10%, 20%, 30%. In addition humic acid an organic water soluble humic substance derived from lignite was also added in 1%, 1.5%, 2% based on the percentage of water added. In split tensile strength of the cylinder and beam flexural strength the maximum tensile strength is achieved in 10% of Bottom ash and 1% of Humic acid then the normal conventional concrete

Keywords---- Fiber, Leonardite, Ash

II. LITERATURE REVIEW

Daniel D et al:

A process for the preparation of water soluble products from humic acids, lignites and pre oxidized coals which are reached with a sulfonating agent to form a sulphate or a bisulphate in situ, in an alkaline medium. The water soluble product is useable as a well drilling fluid.

Hayes James R:

A drilling fluid or mud additive having several components, including leonardite (humic acid), potassium acetate, partially hydrolyzed polyacrylamide, polyionic cellulose polymer, sulfonated asphalt, sulfalkylated tannin, polystyrene maleic anhydride copolymer, micronized cellulose fiber, and calcium carbonate. These components are premixed in a dry formulation as a powder or as pellets, and shipped to the construction site.

OBJECTIVE

The main objective of this project is to study the flexural behavior of concrete beam.

To study the compressive strength of concrete cubes at 7, 28 days.

To study the split tensile strength of concrete cylinder at 7, 28 days

To study the flexural behavior of Bottom ash concrete beams.

To study the deflection of the beams according to loading condition.

III. METHODOLOGY

The methodology has been followed in this experimental investigation,

• Mix design for M25 concrete.
• Mix proportion for concrete by using the Bottom ash and humic acid.
• Determination of compressive strength of design mixes.
• Casting of cubes with replacement of Bottom ash with addition of humic acid in normal concrete.

Fig 1 shows flow chart of Flow chart of the raw material,
Fig 2 shows Flow chart of concrete mixing process

IV. EXPERIMENTAL INVESTIGATION

**Natural sand:**
The Natural sand obtained from local resource from cauvery river bed confirming to IS Standard was used in concrete to cast test cubes and beams.

**BOTTOM ASH**
Bottom ash with size less than 2.36mm was used in this work

**PROPERTIES OF HUMIC ACID**
- $pH = 8.0$ to 9.5
- CEC = 100 TO 130 meq/100 gms
- Total potassium 7.64%
Carbon and Oxygen = 90% to 95%
Nitrogen and hydrogen = 3% to 5%
Its also contains plant nutrients nitrogen, potassium, sulphur, iron(0.10 -6.0%) and copper, zinc, magnesium, boron(20-200ppm)

COARSE AGGREGATE
Locally available coarse aggregates having the maximum size of 10 to 20mm confirming to IS Standard was used in this present work. The results of test conducted on coarse aggregate are given in table.

Cement
The cement used in this study is 43 grade OPC with specific gravity 3.15

WATER
The portable water available in the college campus has been used.

MIX PROPORTION
The Indian standard method of mix design is used for the design of concrete mix of grade M25 with mix proportion 1:1.5:2.7

DETAILS OF TEST SPECIMENS
S1 - 10% Bottom ash +1% humic acid + Fine aggregate + Coarse aggregate.
S1- 10% Bottom ash+1.5% humic acid +Fine aggregate + Coarse aggregate.
S1-10% Bottom ash + 2% humic acid + Fine aggregate + Coarse aggregate.
S2 -20% Bottom ash + 1% humic acid + Fine aggregate + Coarse aggregate.
S2-20% Bottom ash+1.5% humic acid +Fine aggregate + Coarse aggregate.
S2-20% Bottom ash + 2% humic acid + Fine aggregate + Coarse aggregate.
S3-30% Bottom ash + 1% humic acid + Fine aggregate + Coarse aggregate.
S3-30% Bottom ash+1.5% humic acid +Fine aggregate + Coarse aggregate.
S3-30% Bottom ash + 2% humic acid + Fine aggregate + Coarse aggregate.

TABLE 1 COMPRRESSIVE STRENGTH RESULT

<table>
<thead>
<tr>
<th>Humic acid</th>
<th>10% bottom ash</th>
<th>20% bottom ash</th>
<th>30% bottom ash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 days</td>
<td>28 days</td>
<td>7 days</td>
</tr>
<tr>
<td>1% humic acid</td>
<td>40.5</td>
<td>38.0</td>
<td>40.0</td>
</tr>
<tr>
<td>1.5% humic acid</td>
<td>30.6</td>
<td>35.0</td>
<td>29.3</td>
</tr>
<tr>
<td>2% humic acid</td>
<td>30.5</td>
<td>36.2</td>
<td>29.5</td>
</tr>
</tbody>
</table>

SPLIT TENSILE STRENGTH OF CYLINDERS
The Split Tensile Strength Results of Concrete Cylinder Specimens for 28 days are presented in the Table.2 .Strength variations between 7& 28 days of the all mixes little bit decreasing of strength up to 30%

<table>
<thead>
<tr>
<th>Humic acid</th>
<th>10% bottom ash</th>
<th>20% bottom ash</th>
<th>30% bottom ash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 days</td>
<td>28 days</td>
<td>7 days</td>
</tr>
<tr>
<td>1% humic acid</td>
<td>2.42</td>
<td>2.48</td>
<td>2.35</td>
</tr>
<tr>
<td>1.5% humic acid</td>
<td>2.38</td>
<td>2.44</td>
<td>2.33</td>
</tr>
<tr>
<td>2% humic acid</td>
<td>2.38</td>
<td>2.4</td>
<td>2.34</td>
</tr>
</tbody>
</table>

FLEXURAL STRENGTH OF BEAMS
The Flexural Test Results for the Beams Specimens are presented in the Table 3

RESULT FOR DEFLECTIONS FOR BEAMS

V. RESULT AND DISCUSSION

COMPRESSIVE STRENGTH OF CUBES
The Compressive Strength Results of control mixes and bottom ash concrete strength results for 7 and 28 days are presented in the Table 1. The percentage decreases with increase of bottom ash replacement with increase age of concrete. Strength variations between 7& 28 days of the all mixes little bit decreasing of strength up to 30% replacement of bottom ash. When compare to control mix it was observed that it has good compressive strength quality. The maximum strength attained in 10% bottom ash replacement with 1% humic acid and minimum strength in 30% replacement with 2% humic acid.
VI. CONCLUSION

From the test results obtain the following conclusions:

Bottom ash used as fine aggregate and large utilization of waste product in addition with humic acid it increases strength in 7 days and decreases gradually with age of curing of concrete. Due to the less weight of bottom ash it reduces the transportation cost, equalize the ecological balance and the conservation of natural sources etc.

From the result the optimum compressive strength of cubes Using Bottom ash 10,20,30% Replacement of Fine aggregate with addition of 1,1.5,2% of hum acid.

From the experimental survey 10% of bottom ash with 1% of humic acid gives better compressive strength and Split tensile strength when compared to the conventional mix proportion and is taken as optimum.

For further studies, flexural members are to be casted and their behaviours will be studied.

REFERENCES


