4-1-2019

Use of Biomass Waste in the Construction Industry

Harish Konduru  
*Clemson University*

Prasad Rangaraju  
*Clemson University*

Follow this and additional works at: https://tigerprints.clemson.edu/grads_symposium

Recommended Citation
https://tigerprints.clemson.edu/grads_symposium/294

This Poster is brought to you for free and open access by the Student Works at TigerPrints. It has been accepted for inclusion in Graduate Research and Discovery Symposium (GRADS) by an authorized administrator of TigerPrints. For more information, please contact kokeefe@clemson.edu.
Objectives

- To reduce the emissions of Carbon dioxide from cement manufacturing industries which contribute to 8% (40,000 million tons of CO₂) of the total emissions every year.
- Show proof-in principle that incorporation of biomass ash as a cement replacement material will produce High strength & more Durable concrete.

Methods used:

- X-ray Diffraction, Thermo-gravimetric analysis, Strength activity index, Calorimetric analysis, Consistency, Setting time, Compressive strength, Flow, Shrinkage test, Alkali-Silica reaction, Sulfate attack, Water absorption and sorptivity.

For this research, we used Rice Husk (RHA) as one of the biomass wastes and tested for its reaction with cement.

Motive: About 1100 million tons of Biomass waste is being produced every year in the USA alone that ends up being dumped as landfills. So, why not use a waste material, that can very well enhance the properties of a concrete mixture thereby helping in the reduction of waste as well.

Results

<table>
<thead>
<tr>
<th>STRENGTH TEST - Designation</th>
<th>Avg. Compressive strength (psi)</th>
<th>% strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement samples</td>
<td>5079</td>
<td>100%</td>
</tr>
<tr>
<td>(Cement + Partially ground Biomass waste) samples</td>
<td>5425</td>
<td>106.8%</td>
</tr>
<tr>
<td>(Cement + Fairly ground Biomass waste) samples</td>
<td>5876</td>
<td>115.6%</td>
</tr>
<tr>
<td>(Cement + Heavily ground Biomass waste) samples</td>
<td>6541</td>
<td>128.8%</td>
</tr>
</tbody>
</table>

Table 1: Strength Activity Test

Table 2: Thermo-Gravimetric Analysis (TGA)

<table>
<thead>
<tr>
<th>TGA TEST - Designation</th>
<th>Ca(OH)₂% 28 days</th>
<th>Ca(OH)₂% 56 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement samples</td>
<td>13.69</td>
<td>15.60</td>
</tr>
<tr>
<td>(Cement + Partially ground Biomass waste) samples</td>
<td>11.23</td>
<td>13.56</td>
</tr>
<tr>
<td>(Cement + Fairly ground Biomass waste) samples</td>
<td>9.54</td>
<td>11.41</td>
</tr>
<tr>
<td>(Cement + Heavily ground Biomass waste) samples</td>
<td>5.97</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Outcomes

- The strength of the mixture (biomass + cement) was 130% of its control (cement alone)
- The mixture with biomass was so durable and exceeded the performance with that of a mixture with only cement.

Future studies: Use of biowaste for Ultra High Strength concrete structures.

Proposed collaborations:

With agriculture department to work on other bio-wastes and save planet earth by reducing the emissions of harmful gases from the cement manufacturing industries.

Cement production:

- DON’T LANDFILL YOUR BIOMASS WASTE, PRODUCE CEMENT WITH IT!!

Conclusions

References:


Harish, K.V and Rangaraju, P.R. “Decoupling the effects of Chemical Composition and Fineness of Fly Ash in Mitigating Alkali-Silica Reaction”, Cement and Concrete Composites, Vol 43, 2013, pp. 54-68