ABSTRACT

The waste glass powder may be replaced partially to the cement in the concrete and may investigate its strength and other characteristics of the concrete. Disposal of waste glass is one of the problematic issues. Different methods are used in disposal of waste and unusable glasses. But they are not much effective. One of the disposing or reusing of glass is grinding it into a respective range of size and used, instead of cement on concrete for the construction purposes. Here the glass is powdered to the size of 90 micron. Because of presence of silica content on the glass, it shows some pozzolanic properties, when it is powdered. The glass powder is mixed at different proportions instead of cement at 10%, 20%, 30% and 40% of range. This experimentation carried out for wide range of curing ages 7 and 28 days. It observes that the glass powder contributes much in increasing the strength properties of the concrete.

I. INTRODUCTION

Concrete is the most widely used construction material. There were different materials are added on the concrete to improve its quality; like that the addition of glass powder at certain size is also another idea. The glass may have the silica content and the silica plays the vital role on the day-to-day life. The glass took part on all aspects of life. The major sources of the glass are construction, automobiles, utensils, windows screen; tube light, bulbs, etc.. The improper disposal of glass creates lots of problems to human; to avoid this problem mixing of glass powder on the concrete instead of concrete is the one of the best possible ways. It was proved that the introduction of waste glass in cement production increased the alkali content in cement which could result in flash setting due to the high alkali content and the formation of CaSO4.

The glass powder was obtained by crushing waste glass pieces in a cone crusher mill. The 425-micron passing fraction was used for the experimentation. Few studies have investigated the potential of finely ground waste glass powder as pozzolanic material. It was demonstrated that the properties which influence the pozzolanic behavior of waste glass, and most Pozzolana in general, are fineness, composition and pore solution present for reaction. Recently, Glasses and its powder have been used as a construction material to reduce the environmental problems. Therefore, glass is used as a replacement of supplementary cementitious materials.

II. MATERIALS AND METHODS

a. Materials

Cement

Cement is the important materials which may play an important role on the concrete properties are listed in table 1. Here by the Pozzolana Portland cement is used. Specific gravity cement is 3.15.

Aggregate

Aggregate is another important material which gives strength to concrete.

The fine aggregate of Zone II with specific gravity is 2.62 is used in the present work.

The coarse aggregate used is 20 mm with specific gravity 2.74

Waste Glass Powder (WGP)

Properties of glass powder are the used in this work are listed in table 1. The glass powder was obtained by crushing waste glass pieces in a cone crusher mill. The glass is powdered at the size of 90-micron. The glass may have number of metallic silicates. The property of the glass which was used his amorphous, transparent and brittle in nature. Glass does not contain the internal subdivisions associated with grain boundaries in polycrystals. It may give good bonding to the concrete.
b. Methods

Mix Design

Mix design carried out to form M25 grade of concrete by IS 10262: 2009 yielded a mix proportion of 1:1.7:3.72 with water cement ratio of 0.50. Different mixes were prepared using cement replaced by waste glass powder (WGP) at varying percentages of 0, 10, 20, 30 and 40. Chemical admixtures are not used in experimental work.

Compressive, Tensile and Flexure test:
Cement was partially replaced with glass powder and cubes, cylinder and beam were cast and cured under normal condition as per IS recommendation and were tested at 7 days and 28 days for determining the compressive, Tensile and flexural strengthened and compared with the test results of conventional concrete are shown in table 2.

III. TEST RESULTS

Table 2: Show the various results of tested concrete specimen with glass powder in Cement with different proportions over 7 and 28 days.

<table>
<thead>
<tr>
<th>MIX NOTATION</th>
<th>Replacement of GLP By Cement %</th>
<th>Avg Compressive Strength (N/mm²)</th>
<th>Avg Flexural Strength (N/mm²)</th>
<th>Avg Tensile Strength (N/mm²)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>7 days</td>
<td>28 days</td>
<td>7 days</td>
</tr>
<tr>
<td>M1</td>
<td>0</td>
<td>16.23</td>
<td>26.11</td>
<td>2.51</td>
</tr>
<tr>
<td>M2</td>
<td>10</td>
<td>16.71</td>
<td>27.13</td>
<td>2.62</td>
</tr>
<tr>
<td>M3</td>
<td>20</td>
<td>16.90</td>
<td>27.90</td>
<td>2.70</td>
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</tbody>
</table>
Figure 1: Comparative Compressive strength of Concrete with Cement replacement with Glass Powder for 7 days and 28 days.

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<tbody>
<tr>
<td>M4</td>
<td>30</td>
<td>17.45</td>
<td>28.31</td>
<td>2.95</td>
<td>3.98</td>
<td>2.34</td>
</tr>
<tr>
<td>M5</td>
<td>40</td>
<td>16.16</td>
<td>26.24</td>
<td>2.60</td>
<td>3.67</td>
<td>1.88</td>
</tr>
</tbody>
</table>

Figure 2: Flexure strength of Concrete with Cement replacement with Glass Powder for 7 days and 28 days.
IV. TEST RESULT DISCUSSION

The result is variation of compressive strength of concrete produced by replacing cement with glass powder for 7, 28 days. Fig 1, fig 2, fig 3 shows the strength result for glass powder replaced concrete for curing period of 7, 28 days respectively. Unit weight of concrete without waste glass is higher than partially replaced glass based concrete. The specific gravity of waste glass is 2.58 which are much lower than the specific gravity of cement which is 3.15.

V. CONCLUSIONS

From the experimental work, it is clear that glass can be used as a partial replacement of cement in concrete because of its increased workability, strength parameters like compressive strength, flexural strength and split tensile strength has shown good results. As disposal of waste products is a major problem in today’s world due to limited landfill space as well as its escalating prices for disposal, utilization of waste glass in concrete is cost effective, reduces the serious disposal problems. Higher strength was obtained when 30% cement was replaced by waste glass powder. Workability decreases as percentage of glass powder increases. From strength point of view, replacement of glass powder shows positive results and it is eco friendly.

REFERENCES