

Utilization of Coconut Shell Charcoal in Mortar Samples

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ABSTRACT: Coconut shells which are agricultural waste are mostly left unutilised. In this paper an attempt has been done to analyse the prospects of the utilization of coconut shell in mortar samples. CSC (Coconut shell Charcoal) is added in mix while preparing the mortar samples in the 0%,5%,10%,15%,20%,30% of the cement. Compressive strength of the mortar sample is found out. Apart from that abrasion resistance of the sample and durability samples in NaCl and MgSO₄ solution is also found out. It is found that the addition of coconut shell charcoal in the mortar cubes improves the abrasion resistance of the sample without affecting its strength up to some extent. Due to its good abrasion resistance it is proposed that CSC can be used on pavements and highways and in other structures where degradation is due to abrasion or some other causes.

KEYWORDS: Coconut shell charcoal, CSC, NaCl,

I. INTRODUCTION

Concrete pavements in highways, airport runways and hangers and in industrials surfaces subjected to heavy abrasion and degradation under various circumstances. These structures are made up with lots of money and efforts have done to make these structures more durable. Coconut shell charcoal can be used to make these structures more durable. There are lots of agricultural wastes produced which left unutilised. There is a problem for their disposal sometimes they are utilised in some ways and sometimes left unused. Coconut shell charcoal is a processed material from coconut shell. In this paper an attempt has been done to find the utilisation of coconut shell charcoal in concrete.

II. MATERIALS AND METHODS



Fig no: 1 Coconut shell charcoal



Fig no:2 Coconut shell charcoal powder

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Coconut shell is waste materials and it is available in abundance. Lots of experimental work done has been done to analyse the effect coconut various coconut waste materials in different form. Concrete made with coconut shell aggregates exhibit higher compressive strength and there is reduction in the total cost of the concrete [1] Studies on the bond strength coconut fibre with the concrete is also conducted.[2] Effects due to different types of curing on the coconut shell aggregate concrete were also studied and by SEM analysis it is concluded that bond between the coconut shell aggregate improves with the passage of the times.[3].Coconut shell charcoal is purchased from the manufacturer where it is prepared by burning the coconut shell in the controlled condition in the industry. Cement and sand used for preparing the mortar mix are in accordance with standard codes.

Compressive strength:

Plain mortar cubes were prepared with coconut shell charcoal Size of the mortar cubes were 70.6mm X 70.6mm X 70.6 mm. Coconut shell charcoal is added in the mortar mix in the 0%, 5%, 10%, 15%, 20%, and 30% of the total volume of the cement. Samples prepared from coconut shell charcoal is put under the curing tank for 3,7,28 and 56 days. After the curing period samples were taken out and dried in environment. After that compressive strength test were conducted to find out the compressive strength of the sample.

Abrasion resistance:

The abrasion resistance test is performed in accordance with the IS: 1237(2012) and IS: 9284 on the samples of size $70.7 \times 70.7 \times 70.7$ mm after the curing of samples for 28, 56 and 112 days.[8][9] The abrasive powder used on the grinding path with >95% aluminum oxide whose shape is round and whose specific gravity is of 3.9 and on Mohrs Scale its hardness is 9.Abrasion resistance is measured in terms of wear loss.

NaCl and MgSO₄ Solution Durability test:

For testing the durability of the Coconut shell charcoal mortar NaCl and MgSO₄ solutions are used. CSC mortar samples were put in a tank for 56 days which contains 5% NaCl and 5%MgSO₄.After removing from the curing tank the samples were weighed and test for compressive strength were done.

III. EXPERIMENTAL TEST RESULTS AND DISCUSSION:



Fig no: 3 Curing of CSC mortar cubes



Fig no: 4 Abrasion test setup

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Fig no 5: Abrasive Powder on the rotating disc



Fig no 6: Mortar samples in the mould

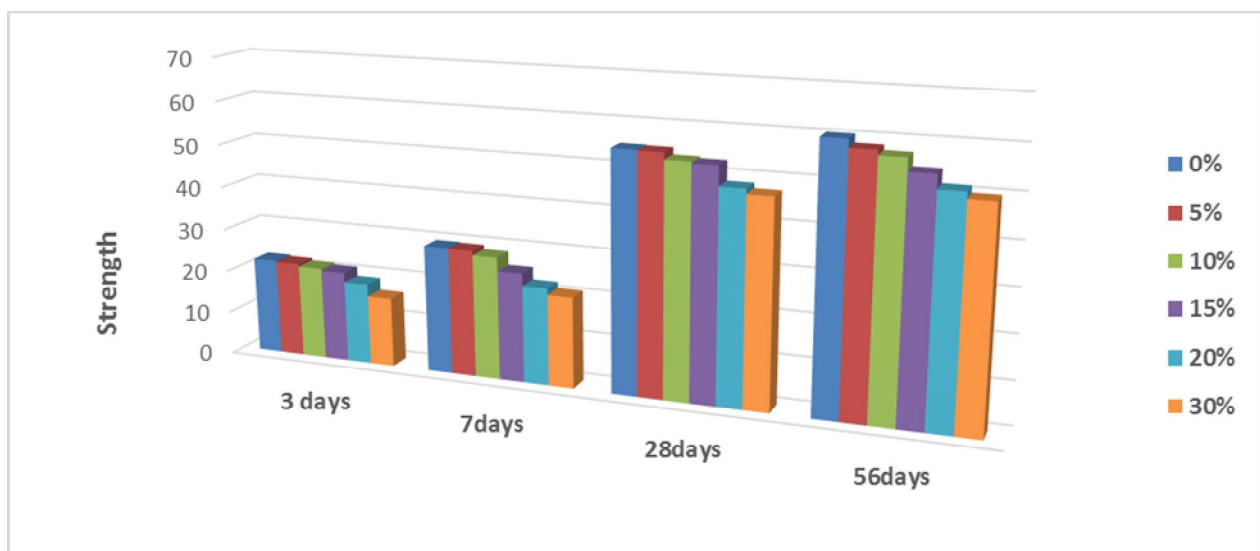


Fig no 7: Compressive strength of CSC mortar

CSC is added in the percentage of 5%, 10%, 15%, 20%, and 30% in mortar cubes. Samples were cured in the curing tank for 3, 7, 28, and 56 day. In the control mix the strength of the sample is 22.28 N/mm^2 , 29.48 N/mm^2 , 54.89 N/mm^2 and 60.23 N/mm^2 at 3, 7, 28 and 56 days of curing respectively while with 5 % addition of CSC the strength is 22.01 N/mm^2 , 29.35 N/mm^2 , 54.75 N/mm^2 and 58.35 N/mm^2 at 3, 7, 28 and 56 days of curing respectively. It is found that compressive strength of the sample did not change much with the addition of coconut shell charcoal however compressive strength goes on decreasing more with addition of more than 15% of coconut shell charcoal.

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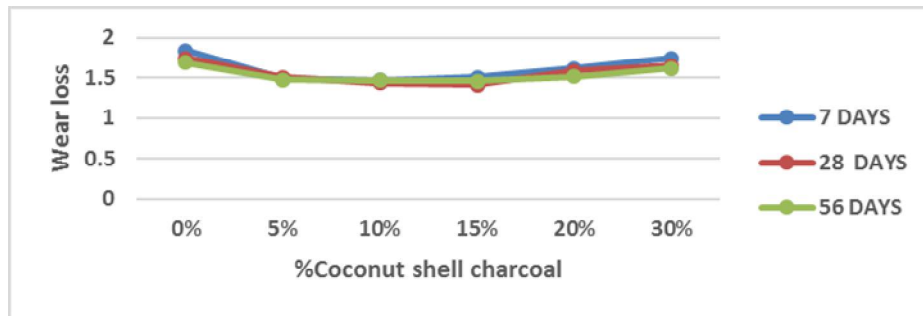


Fig no 8: Abrasion resistance of coconut shell charcoal in terms of wear loss

In the abrasion test the lesser the wear loss means more abrasive resistance of the sample. Coconut shell charcoal in the mortar gives a very good result in abrasion test the wear loss in control mix is 1.84,1.75 and 1.69 for 7,28 and 56 days while at 10 % addition of CSC the wear loss values are 1.47,1.44 and 1.47 for 7,28 and 56 days respectively. Wear loss decreases as the percentage addition of coconut shell charcoal increases while after 15% of CSC addition wear loss increases means the sample abrasion is more.

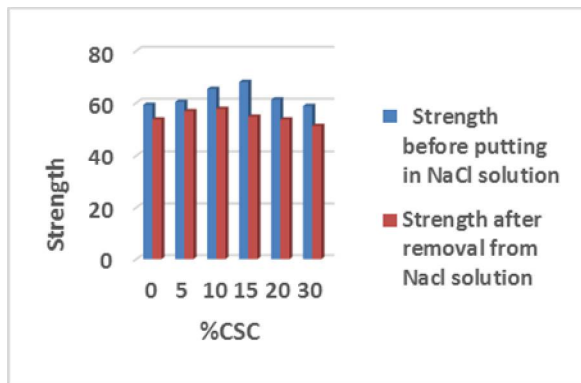


Fig no 9: Strength loss in CSC mortar in NaCl solution

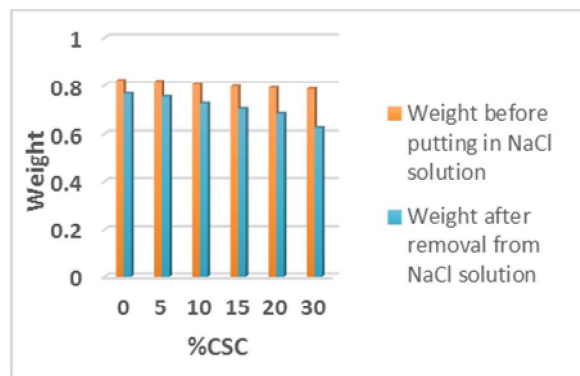


Fig no 10: Weight loss in CSC mortar in NaCl solution

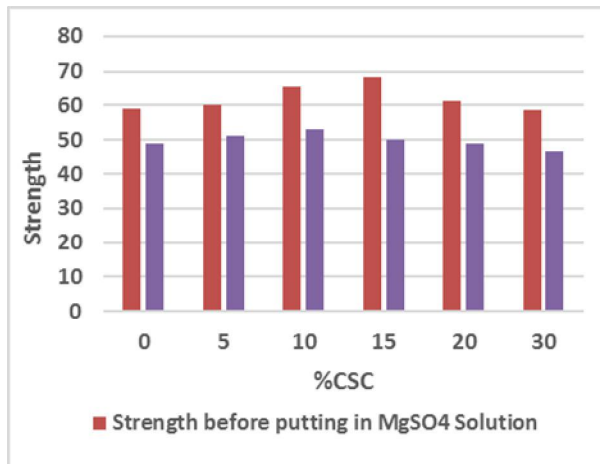


Fig no 11: Strength loss in CSC mortar in MgSO₄ solution

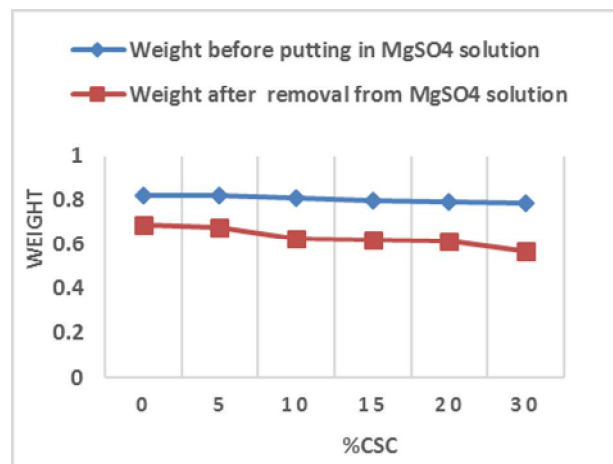


Fig no 12: Weight loss in CSC mortar in MgSO₄ solution

Coconut shell charcoal mortar samples also shows good resistance to degradation in durability test. Samples were put in the NaCl and MgSO₄ solution for 56 days and after that it is dried and tested for compressive strength and weight loss. Strength loss and weight loss before putting in the solution were compared with the same after removing it from the solution. Weight loss and strength loss is less in samples which have less than 15% of CSC however after 15% addition of CSC strength decreases so as weight also decreases.

IV.CONCLUSION

From the experimental test it is concluded that the coconut shell charcoal can be added in mortar mixture. Strength of the mortar mixture did not increase with addition of the coconut shell charcoal. However up to the 15% addition of coconut shell charcoal strength did not decrease much but with addition of CSC above 15% strength of the samples decreases marginally. Coconut shell mortar sample shows very good abrasion resistance in the abrasion test and also shows good resistance to the solution in the durability test. It is concluded that coconut shell charcoal can be added up to 15% for improving the abrasion resistance of the sample however more research is needed to find the more application of the coconut shell charcoal.

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