A REVIEW ON CHARACTERIZATION OF ECO-FRIENDLY REINFORCED CONCRETE AS AGGREGATE COCONUT SHELL REPLACEMENT

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ABSTRACT

In the analysis, the compression strength of concrete with the use of coconut shells for rigid paving in different percentages increased to 15% and the value of compressive resistance decreased after 15%. The addition of coconut shell to 15 percent therefore gives the higher value of concrete compressive strength for rigid flooring. For flexible pavement the value of los abrasion test is approximately 29.5 when we add 15% coconut shell and it is suitable for bituminous roads and after that its value increases above 30% which is suitable for different type of roads such as bituminous bound macadam, water bound macadam, water bound macadam surfacing course, bituminous surface dressing and water bound macadam base course with bituminous surfacing. The total value of the effect is high and the total value of the crushing is less than 30 percent.

Keywords— *Coconut shell aggregate, Aggregate Impact Value, Aggregate crushing Value, Aggregate Impact Value and Compressive Strength;*

INTRODUCTION

In another view, the improper and inadequate management of waste is bound to encounter biohazards, in some cases, it might cause loss of life. All of these issues should be mentioned as the guideline toward the government's efforts to attain sustainable development approach for vision 2020. There is an increasing trend of recyclable materials as single time use materials are getting depleted. Just because Malaysia, our neighboring country, has announced that more than 23,000 tons of waste are produced every day and is expected to reach 30,000 tons, a large number of wastes created are sadly unprocessed and disposed of. These are some serious warning and should be acted in time. Recycling is also a potential alternative to land filling, but there is very little public knowledge and appreciation of recycling, and future outcomes are not being considered. Similarly, it also observed that on an average of 0.8 kilogram of waste is being produced by a person per day for which a cost of the cost of recycling is Rs 14 per kg. Subsequently, it has reduced the life of landfills and caused an enormous blow to our country economy. Waste management is an important agenda that needs the effective solutions and recycling should be always viewed as a vital aspect of an effective and efficient solid waste management system.

PROBLEM STATEMENT

- Coconut shell spirits to be disposed of in large quantities without being treated, and this could lead to a requirement for a larger area at the site for the dumping of environmental waste materials.
- The coconut shell hold disposable problem as the shells are very sluggish to biodegrade due to the occurrence of high absorptions of lignocelluloses in them.
- The scorching of the coconut shell is creating air pollution leading to environmental degradation and distresses the well-being of the community residing in near villages and causing abundant diseases to them.

- Coconut shell causes a cumulative disposal of all non-biodegradable waste as well as a risk to the environment where contaminated and harmful gasses are proclaimed from landfill sites and harm to human health.
- Coconut shells are a serious environmental waste disposal problem, with around 60 per cent of the local waste capacity left in the environment.

WORLD COCONUT PRODUCTION

Coconut is widely farmed all over the world. According to reports by FAO in 2009 over 92 countries are farming coconut over a total landmass of 11.8 million hectares producing a yield of 61.7 million tons that an average of 5.2 tons per hectare. In Table 1.1 below are the Top Ten producer countries

Country	**Production (tons) 2009**	**% of World Production**	**Acreage under Production (ha)**	**Yield/ha (tons)**
Indonesia	21,565,700	34.9	3,231,710	6.67
Philippines	15,667,600	25.4	3,401,500	4.61
India	10,148,000	16.4	1,903,000	5.33
Sri Lanka	2,099,000	3.4	394,840	5.32
Brazil	1,973,370	3.2	284,058	6.95
Thailand	1,380,980	2.2	237,882	5.80
Vietnam	1,128,500	1.8	121,500	9.29
Mexico	1,004,710	1.6	155,713	6.45
Papua New Guinea	930,000	0.7	166,400	2.76
Tanzania	577,099	1.5	216,000	4.30
WORLD	**61,708,358**		**11,864,344**	**5.20**

LITERATURE REVIEW

K. Gunasekaran et al in 2016 published a paper that deals with the comparative study of the concrete pipe with shell replaced aggregates concrete pipes. There were numerous test performed on both the specimen specified by IS 458:2003. Both of them were having load bearing capacity with the acceptable limits as prescribed by the code mentioned earlier. The hydro-static pressure didn't form beads of water on the pipe surface by application of test pressure of 0.07 N/mm2 . Absorption properties of shell replaced aggregates pipes and conventional pipes were also within limits acceptable by code. Since the performance was of shell replaced aggregates of pipes were satisfactory, the paper concludes that it can be used as an alternative material for conventional aggregates.

Sarfraj Jahagirdar et al in 2016 published a paper in which study was conducted to compare the standard M20 cube strength with coconut shell aggregates as partial replacement for the quarry aggregates. The study has casted cubes of 10-12mm coconut aggregates along with same size quarry aggregates. The partial replacement of 20%,30%,40%,50% and 60% were performed respectively. A total of 36 cubes were casted and the 7 days compressive strength (in Mpa) were 20.89,16.89,16,14.74,10.67 and 9.19 for the respective percentage of replacement mentioned previously and 28 days strength (in Mpa) of 24.89, 19.85, 18.07, 16.37, 13.78, 12.74 respectively.

A.Anbuvel et al in 2016 published a paper that examines the variety of properties of coconut shells as aggregate replacement. A concrete sample with Natural aggregate replacement of 0-20% was provided. There were two design

mix i.e. fly ash and coconut shell that were investigated for properties such as water absorption, compressive strength, moisture content and split tensile strength. It was reported that as % shell increases density decreases. Workability also decreases. Both the compressive strength and spilt tensile strength also decreases. The permeable voids and absorption were recorded more than the sample with conventional aggregate. Fly-ash replacement had no notable effect.

Kulkarni Parag Pramod et al in 2016 published a paper that emphasizes that the cost of conventional building material is too high this paper reflects that there is a huge expense that has to be paid why using conventional building materials. The work focuses mainly on casting M30 grade concrete while using the coconut shell as a partial replacement material for the conventional rough aggregate. Hymns were cast and tested on the basis of their flexural strength and compressive strength, and the results were reported. It was found that as we increase the percentage coconut shell the density, compressive strength and flexural strength decreases.

Apeksha Kanojia et al in 2015 published a paper that reviews a variety of waste material such as silica fumes, copper slag, fly ash etc. These are mainly used as primary ingredients to make plywood, flush door etc. For the concrete the main ingredients is aggregate which covers 70%-80% as its constituents. The growth on construction industry is greatly reducing the available natural resources, hence the papers shows that by applying these waste material to the main constituents of the concrete as partial replacement in order to economize the whole project cost.

Amrita Agnihotri et al in 2015 published a paper that reflects concerns towards the increasing prices of building materials and its effect on increasing prices of house in the world. The paper deals with comparative study of conventional aggregate and granular coconut as partial replacement for aggregate in casted beams with respect to their flexural and compressive strength for M20 grade of concrete. There were little difference in the properties but huge difference in the cost and hence it suggested the developers to encourage the alternative materials.

Miss. Anjali S. Kattire et al in 2015 published a paper where they studied a total of 16 specimen casted 8 cubes and 8 cylinders and their compressive and tensile strength were measured after 28 days. Coconut shell was used as a partial replacement and the percentage at which it was replaced were 0%, 10%, 15% and 20% respectively. Although with increasing replacement the above mentioned mechanical properties started to show decrement, some of them were still good for construction of light weight members.

Lopa M. Shinde et al in 2015 published a paper that reviews the practical application of the agricultural waste as replacements for construction materials in order to lower down the cost of construction. It is also recommended to promote sustainable development of the structure in order to lower the impact on the environment. It highly issues the concern about recycling the material in order to lower the burden on natural resources. The papers describes how increasing utility of agricultural waste not only decreases pollution but also decreases the cost of construction. This has been shown by testing coconut shell as aggregate partial replacement from a wide range literature review.

Chandraul Kirti et al in 2015 published a paper that deals with researching the concrete for a design mix of 1:1.51:3.06 as a control sample and crushed coconut shells were used as replacement for crushed granite aggregates. Overall 36 cubes were casted with water / cement ratio as 0.5. The coconut replacement that was used in study were 10%, 20%, 40%, 60%, 80% and 100%. The density decreases as we increase the percentage of coconut shell. There is a bright side that the 20% replacement can be used widely in construction and can be a viable replacement for natural sourced aggregates thereby decreasing the cost of construction and burden on natural resources.

NOTEWORTHY CONTRIBUTION IN THE FIELD OF PROPOSED WORK

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CONCLUSION

1, As in the case of rigid pavement the compressive strength value goes on increasing upto 15% of usage of coconut shell in coarse aggregates. The compressive strength value upto 15% usage of coconut shell in coarse aggregates at 7 days and 28 days is about 25.75MPa and 34.8Mpa respectively and according to IRC the minimum value of compressive strength at 28 days is about 30MPa for low volume roads and for other roads it is upto 40 MPa. Therefore for rigid pavements we can use coconut shell in coarse aggregate upto 15%.

2, In the water absorption test the value goes on increasing if we increase the amount of coconut shell in coarse aggregates. As per IRC water absorption value ranges from 0.1 to about 2% for aggregate normally used in road surfacing. Stones with water absorption upto 4% have been used in base course. In the water absorption test the resultant value is 1.7 in case of usage of 10%of coconut shell in coarse aggregate. Therefore it used for road surfacing. Above 10% usage of coconut shell in coarse aggregate, the value lies between 2-4% which is suitable for base course.

3, In the specific gravity test the value goes on decreasing if we increase the amount of coconut shell in coarse aggregates. As per IRC the specific gravity of coarse aggregate normally used in road construction ranges about 2.5 to 3.0, though high specific gravity of an aggregate is considered as an indication of high strength. In our case the resultant value is 2.49 in case of usage of 5% usage of coconut shell in coarse aggregate. Therefore it is used for road surfacing upto 5% replacement.

References:

[1] A. A. Ramezanianpour, M. M. Khani, and G. Ahmadibeni, "The effect of rice husk ash on mechanical properties and durability of sustainable concretes," International Journal of Civil Engineering, vol. 7, no. 2, pp. 83–91, Jun. 2009.

[2] M. Ali, "Coconut fibre: a versatile material and its applicationsin engineering," Journal of Civil Engineering and Construction Technology, vol. 2, no. 9, pp. 189–97, Sep. 2011.

[3] K. H. Mo, T. S. Chin, U. J. Alengaram, and M. Z. Jumaat, "Material and structural properties of waste-oil palm shell concrete incorporating ground granulated blast-furnace slag reinforced with low-volumesteel fibres," Journal of Cleaner Production, vol.133, pp. 414–426, Oct. 2016.

[4] Ministry of Agriculture and Farmer's Welfare. Coconut development board. Accessed Nov. 15, 2018. [Online]. Available: http://www. coconutboard.nic.in

[5] C. Meyer, "The greening of the concrete industry," Cement and Concrete Composites, vol. 31, no. 8, pp. 601–605, Sep. 2019.

[6] L. M. Federico and S. E. Chidiac, "Waste glass as a supplementary cementitious material in concrete – critical review of treatment methods," Cement and Concrete Composites, vol. 31, no. 8, pp. 606–610, Sep. 2019.

[7] U. J. Alengaram, B. A. A. Muhit, and M. Z. B. Jumaat, "Utilization of oil palm kernel shell as lightweight aggregate in concrete – a review," Construction and Building Materials, vol. 38, pp. 161–172, Jan. 2013.

[8] R. Prakash, R. Thenmozhi, and S. N. Raman. (2019, April 29) Mechanical characterization and flexural performance of eco-friendly concrete produced with fly ash as cement replacement and coconut shell coarse aggregate. [Online]. Available: https: //www.inderscience.com/info/inarticle.php?artid=99491

[9] K. Gunasekaran, P. Kumar, and M. Lakshmipathy, "Mechanical and bond properties of coconut shell concrete," Construction and Building Materials, vol. 25, no. 1, pp. 92–98, Jan. 2011.

[10] H. B. Basri, M. A. Mannan, and M. F. M. Zain, "Concrete using waste oil palm shells as aggregate," Cement and Concrete Research,vol. 29, no. 4, pp. 619–622, 1999.

[11] K. Gunasekaran, R. Annadurai, and S. Kumar, "A study on some durability properties of coconut shell aggregate concrete," Materials and Structures, vol. 48, no. 5, pp. 1253–1264, May 2013.

[12] K. Gunasekaran, R. Ramasubramani, R. Annadurai, and S. P. Chandar, "Study on reinforced lightweight coconut shell concrete beam behavior under torsion," Materials Design, vol. 57, pp. 374–382, May 2014.