

# A Review on Consumption of Agricultural Waste Material (Coconut Shell) As Aggregate in Design Mix Concrete

Lopa M. Shinde

M. Tech (Str.Engg)

Civil Engineering Department

B.D.C.E, Sevagram

P. L. Naktode

Professor

Civil Engineering Department

B.D.C.E, Sevagram

P. P. Saklecha, PhD

Professor

Civil Engineering Department

B.D.C.E, Sevagram

## ABSTRACT

This paper reviews the possible use of agricultural wastes as aggregate in the concrete industry. Large volumes of natural resources and raw materials are being used for concrete production around the world in laboratory. To reduce or minimize the undesirable environmental effect of the concrete industry and promote environmental sustainability of the industry, the use of wastes from industry as materials for concrete construction is considered as an alternative solution for preventing the excessive usage of raw materials. It aims to support the notion of using these wastes by explaining their engineering properties. This review of existing knowledge about the successful use of agricultural wastes in the concrete industry helps to identify other existing waste products for use in concrete manufacturing. Recycling of such wastes and using them in construction materials appears to be feasible solution not only to the pollution problem but also an economical option in construction. In this constructed environment, the intensifying cost of building construction materials is the factor of immense concern. In this paper, the use of coconut shell as a coarse aggregate has been discussed based on the results obtained from wide-ranging review of literature. The coconut shell is a material which can be a replacement of aggregates. The intension of this paper is to increase knowledge about the use of coconut shell as a construction material in civil engineering.

## Keywords

Agricultural waste, Coconut shell, Design mix concrete, etc.

## 1. INTRODUCTION

In the world there are many countries in which coconut is cultivated at a big level. Here some data is provided according to production of coconut an area under the coconut cultivation. The coconut industry in India accounts for over a quarter of the world's total coconut oil output and is set to grow further with the global increase in demand. However, it is also the main contributor to the nation's pollution problem as a solid waste in the form of shells,

which involves an annual production of approximately 3.18 million tones. Coconut shell represents more than 60% of the native waste volume. Coconut Shell, which presents serious disposal problems for local environment, is an large quantities available agricultural waste from local coconut industries. In developing countries where large quantities agricultural and industrial wastes are discharged, these wastes can be used as potential material or replacement material in the construction industry.

This will have the double advantage of reduction in the cost of construction material and also as a means of disposal of wastes. The concrete obtained using Coconut Shell aggregates satisfies the minimum requirements of concrete. Concrete using Coconut Shell aggregates resulted in

acceptable strength required for structural concrete. Coconut Shell may offer itself as a coarse aggregate as well as a potential construction material in the field of construction industries and this would solve the environmental problem of reducing the generation of solid wastes simultaneously. The Coconut Shell-cement composite is compatible and no pre-treatment is required. Coconut Shell concrete has better workability because of the smooth surface on one side of the shells. The impact resistance of Coconut Shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of Coconut Shell are more Compared to conventional aggregate. The amount of cement content may be more when Coconut Shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. There is presence of sugar in the Coconut shell as long as it is not in a free form; it will not affect the setting and strength of concrete. It is found that being hard and of organic origin, will not pollute or leak to produce toxic substances once they are bound in concrete matrix. Coconut shell needs no pre treatment, except for water absorption. Use of coconut shell aggregate in concrete as structural lightweight concrete is recommended. Coconut shell aggregate is a possible construction material and concurrently reduces the environmental problem of solid waste.



Fig 1: Coconut Shell



Fig 2: Coconut Shell as aggregates

## 2. REVIEW OF LITERATURE

Vishwas P. Kukarni, Sanjay kumar B. Gaikwad(2013)

<sup>[1]</sup>In this paper three different concrete mixes with different the combination of natural material content namely 0%, 10%, 20%, 30%.Three sample specimen will be

prepared for each concrete mixes. The aim behind this is to use low cost material like coconut shell and thus taking close to the concept of low cost housing. There is no need to treat the coconut shell before use as an aggregate except for water absorption. Coconut shell is compatible with the cement. All precaution is taken to maintain serviceability, strength of the members. Thus it will be helpful for civil engineers and society to adopt this concept to fulfill the basic need of human that is housing. Coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate. Coconut shell can be grouped under lightweight aggregate.

**Parag S. Kambli, Sandhya R. Mathapati (2014)**<sup>[2]</sup> In this paper coarse aggregate namely gravel and fine aggregate is sand in concrete will be used as control. While natural material is coconut shell as coarse aggregate will be investigate to replace the aggregate in concrete. In this study, three different concrete mixes namely M20, M35 & M50 grade with different combination of natural material CS content in the proportion 0%, 10%, 20%, 30% and 40% will be replaced. The parameters will be tested are compressive strength behavior of cube specimens for 7 & 28 days. the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production. The main objective is to encourage the use of these waste products as construction materials in low-cost housing.

**ManinderKaur, ManpreetKaur(2012)**<sup>[3]</sup>

In this paper, the utilization of coconut shell as a coarse aggregate has been discussed based on the results obtained from comprehensive review of literature. Every construction industry totally relies on cement, sand and aggregates for the production of concrete. Nowadays, most of the researchers are doing the research on the material which can reduce the cost of construction as well as increase the strength. Use of coconut shells in cement concrete can help in waste reduction and pollution reduction. The construction industries have identified many artificial and natural lightweight aggregates that have replaced conventional aggregates thereby reducing the size of structural members. This has brought immense change in the development of high rise structures using Light weight concrete.

**Daniel Yaw Osei (2013)**<sup>[4]</sup>

In this paper, a concrete mix of 1:2:4 was used as control, while coconut shells were used to replace crushed granite by volume. The density and compressive strength of concrete reduced as the percentage replacement increased. The results of the study showed that concrete produced by replacing 18.5% of the crushed granite by coconut shells can be used in reinforced concrete construction. A potential exists for the use of coconut shells as replacement of conventional aggregate in both conventional reinforced concrete and lightweight reinforced concrete construction.

**Siti Aminah Bt Tukiman and Sabarudin Bin Mohd (2009)**<sup>[5]</sup>

In this studies, five different concrete mixes with different the combination of natural material content namely 0%, 25%, 50%, 75% and 100%. The parameters will be tested are flexural strength, compressive strength, tensile strength, modulus of elasticity and deflection crack behavior. The combination of coconut shell and grained palm kernel shell has potential as lightweight aggregate in concrete. Also using the combination of coconut shell and grained palm kernel shell as aggregate in concrete can reduce the material cost in

construction because of the low cost and abundant agricultural waste. The effect of aggregate content to workability will also examine. The expected outcome of the study is the combination of coconut shell and grained palm kernel shell has potential as lightweight aggregate in concrete.

**Kabiru Usman Rogo, Saleh Abubakar (2010)**<sup>[6]</sup>

This paper contains a research conducted to explore the use of coconut shell as a coarse aggregate in concrete. Experimental approach was adopted to determine the suitability of coconut shell as full replacement for coarse aggregate in concrete work. The physical and mechanical properties of coconut shell and crushed granite rock were determine and compared. Since the concrete strength of coconut shell with mix ratio 1:1 1/2 :3 attained 16.5N/mm<sup>2</sup> at 28 days it can be used as plain concrete. Hence cost reduction of 48% was obtained.

### 3. CONCLUSION

From the discussion, The Coconut Shell-cement composite is compatible and no pre-treatment is required. the coconut shell has potential as lightweight aggregate in concrete. Also, using the coconut shell as aggregate in concrete can reduce the material cost in construction because of the low cost and abundant agricultural waste. Coconut Shell Concrete can be used in rural areas and places where coconut is abundant and may also be used where the conventional aggregates are costly. Coconut shell concrete is also classified as structural lightweight concrete. It is concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

### 4. REFERENCES

- [1] Vishwas P. Kukarni, Sanjay kumar B. Gaikwad "Comparative Study on Coconut Shell Aggregate with Conventional Concrete" International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 12, June 2013.
- [2] Parag S. Kambli, Sandhya R. Mathapati "Compressive Strength of Concrete by Using Coconut Shell" IOSR Journal of Engineering (IOSRJEN) ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 04 (April, 2014).
- [3] ManinderKaur, ManpreetKaur "A Review on Utilization of Coconut Shell as Coarse Aggregates in Mass Concrete" International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 7 No.11 (2012).
- [4] Daniel Yaw Osei "Experimental assessment on coconut shells as aggregate in concrete." International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 Volume 2 Issue 5 | May, 2013 | PP.07-11.
- [5] Siti Aminah Bt Tukiman and Sabarudin Bin Mohd "Investigate the combination of coconut shell and grained palm kernel to replace aggregate in concrete: A technical review" National Conference on Postgraduate Research