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Review Article

# Concrete using agro-waste as fine aggregate for sustainable built environment – A review

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## Abstract

High demand of natural resources due to rapid urbanization and the disposal problem of agricultural wastes in developed countries have created opportunities for use of agro-waste in the construction industry. Many agricultural waste materials are already used in concrete as replacement alternatives for cement, fine aggregate, coarse aggregate and reinforcing materials. This paper reviews some of the agro-waste materials, which are used as a partial replacement of fine aggregate in concrete. Different properties of fresh and hardened concrete, their durability and thermal conductivity when admixed with agro-wastes are reviewed. Agro-waste used in self-compacting concrete and mortar are also reviewed and their properties are compared. It has been seen that the agro-waste concrete containing groundnut shell, oyster shell, cork, rice husk ash and tobacco waste showed better workability than their counterparts did. Agro-waste concrete containing bagasse ash, sawdust ash and oyster shell achieved their required strength by 20% of replacement as fine aggregate, which were maximum among all agro-waste type concrete. Close relations were predicted among compressive strength, flexural strength, tensile strength, ultrasonic pulse velocity and elastic modulus of agro-waste concrete. Addition of bagasse ash as fine aggregate in mortar increased the resistance of chloride penetration whereas inclusion of cork in mortar showed better thermal resistance and improved cyclic performance. After the review, it is of considerable finding that more research is deserved on all fine aggregates replacing agro-waste materials, which can give more certainty on their utilization in concrete.

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*Keywords:* Agro-waste concrete; Agricultural waste; Fine aggregate; Sustainable concrete

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## 1. Introduction

Concrete is a mixture of cement, fine aggregate and coarse aggregate, which is mainly derived from natural resources. Increasing population, expanding urbanization, climbing way of life due to technological innovations has demanded a huge amount of natural resources in the construction industry, which has resulted in scarcity of resources. This scarcity motivates the researchers to use solid wastes generated by industrial, mining, domestic and agricultural activities. It is observed that in India more than 600 MT wastes have been generated from agricultural

waste, which is seriously leading to a disposal problem. Reuse of such wastes as sustainable construction materials take care of the issue of contamination, as well as the issue of area filling and the expense of building materials (Madurwar et al., 2013). The Major quantity of solid wastes generated in India is reported in Fig. 1. Shafiqh et al. (2014) expressed that research on the utilization of agricultural waste, as an aggregate substitution is generally new and more research is needed for long-term durability properties of concrete. They also studied the relationship between the concrete made using this type of materials; environmentally friendly concrete and green building rating systems.

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