International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

USE OF RICE HUSK ASH (RHA) IN CONCRETE FOR FUTURE SUSTAINABLE DEVELOPMENT

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I. ABSTRACT: *The presented paper is a literature review on the use of mineral admixture in concrete for the sustainable development of consumption of natural resources. Rapid increase in construction activities has resulted in shortage of conventional construction materials. In the present scenario, the high cost of conventional building materials is a major factor affecting housing delivery in the world. This has necessitated research into alternative materials of construction. The use of industrial and agricultural by-product waste as a mineral admixture in concrete for partial replacement of cement shall reduce waste landfill sites and pollution as well as minimize the consumption of natural resources. The main focus of this literature review is to study the effect of partial replacement of cement with minerals on the properties of concrete and its durability particularly RHA (RICE HUSK ASH). Review of literatures shows that the utilization of (FA) fly ash, (RHA) rice husk ash in concrete will enhance the strength and durability of concrete. Hence it is a necessity considering the present environmental problems to encourage its use in the local construction industry for sustainable development free of environmental concerns as far as possible.*

KEYWORDS: ***RHA, CONCRETE.***

II. INTRODUCTION

In current worldwide scenarios of markets and highly increasing demand on quality, requirement for concrete having high strength with affordable cost has increased up to a valuable extent. The construction industry relies heavily on conventional materials such as cement, sand and granite for production of concrete. Concrete is the basic civil engineering composite material. The quality of concrete is determined by the quality of paste/mix. It is the world's most consumed man made material. Its great versatility and relative economy in satisfying wide range of needs has made it a competitive building component. The demand for concrete for today's infrastructural development is rising day-by -day in the global market. In correspondence to this, the non-availability of natural resources to future generation has also been realized over the past decades, research on concrete has entered broad based fields of activities to enhance the performance concrete. The reason behind this is not only to the vast range of applications that concrete offers, but it is also due to its great affordability, durability, strength, and versatility.

Many methods have been applied and different kinds of concrete have been introduced like, Self -Compacting Concrete (SCC) that enhances the durability of the concrete, high strength concrete (HSS) was introduced that provide ultra-high strength. But such concrete is rarely available and the cost is high. The need to reduce the high cost of Ordinary Portland Cement (OPC) with the desirable characteristics some materials have to be modified. From the detailed research into naturally available products and cutting in cost, partial replacement of the OPC with rice husk ash is proven to be considerably effective. Rice husk Ash is an agricultural product on which rice husk is totally burnt into ashes. RHA is found to be friendly material which satisfies the physical characteristics and chemical composition of mineral admixtures. A small amount added of RHA (lesser than two to three by weight of the cement), to a given water cement ratio, is adequate and handy to improve the stability, durability as well as the workability tends to elevate the compressive strength and durability of the concrete. RHA is one of the largest agricultural waste easily available in almost every corner of India. The review of literatures on RHA shows improvement in mechanical properties of concrete. The RHA is also used in various industrial works as absorbent, building construction etc.

The rice husk can also be used in concrete due to the following points:-

(i)Large scale production of rice in the coastal states of India and also in other countries of Asia.

(ii)It is the most popular food type in majority of the countries of the world and thus generation of the husk is in Mega-tonnes per year.

(iii)Some percentage of husk is used as eatables for the domestic animals, while majority are being wasted so it can be used as partial replacement in concrete without extra cost.

(vi)Essential in cost effective housing and low-rise buildings. With the quest for affordable housing system for both the rural and urban population of India and also other developing countries

(vi)Serves as an environment-friendly construction material. Finding a substitute for the aggregate used today is a subject that is worth studying considering the current ecological and environmental problems around the globe, it helps in preserving conventional materials for future developments.

III. THE EFFECT OF RHA ON PROPERTIES OF CONCRETE:

In the year 1978 P. K. Mehta obtained a patent for the production of RHA, which could be used as pozzolanic material. After that, a few studies have been worked out on the production of RHA [1]. Silica content in the RHA reacts with calcium hydroxide to generate additional cementations gel compound calcium-silicate-hydrate which holds the concrete ingredients and improves the strength of concrete.

(a)Workability:

The highlighted property of freshly made concrete is workability which is also an important factor while considering its quality. The workability of concrete including RHA decreases at the higher replacement levels compared to that of the control mixture due to the pore structure of RHA [2]. The increment in particle size or content of RHA enhances plastic viscosity and yield stress of concrete [3].

(b)Strength:

The water binder ratio with 0.30, 0.33, 0.36 and 0.44 the partial replacement of RHA the result shows that the mixtures gained strength comparable to that of respective reference mixtures and up to 30% of ordinary Portland concrete can be replaced with RHA without affecting its strength and durability properties [1]. M30 grade of concrete mix partial replacement of cement by 3% RHA, 20% FA and only 20% FA the result shows that the compressive strength, split tensile strength and flexural strength test of rice husk ash concrete by 5.3%, 8.9% and 11.1% strength than the fly ash concrete [4]. The strength of the concrete increased 7.70% with the levels of percentage of replacement of 10% RHA at 90 days compared to normal concrete. In the case of M60 grade concrete the compressive strength enhances with the involvement of super plasticizer [5].

(c) Durability:

The RHA up to 30% could be advantageously blended with cement without compromising the strength and permeability properties of concrete [6]. The Concrete mixed with RHA had considerable resistance to sulphate attack [7]. The self-compacting concrete (SCC) mixes made with RHA decreased the chloride ion penetrability and increase in replacement decreased the charge passed. Very poor permeability was attained by the 15% RHA replacement to cement and moderate permeability was obtained for the control mix [8]. The best resistance to chloride ion penetration is gained with 15% replacement of Portland cement by RHA and helpful in reducing the alkali silica reaction (ASR) [9].

IV. CONCLUSIONS

The workability of rice husk ash decreased with increase in percentage of rice husk ash. The compaction factor has been decreased with increase in percentage of rice husk ash.

The compressive strength of the concrete with partial replacement of rice husk ash increases with increase the percentage of rice husk ash at some extent.

The literatures discussed in the present study shows that the industrial and agricultural by-product has the potential to reduce the use of natural resources by partial replacement of cement in concrete construction. From the literature it is clearly shown that these mineral admixtures has improved the mechanical properties of concrete and its durability, however the performance of this should be taken up to encourage the use of these SCM in local construction industry for environmental friendly and low cost construction which makes the local constructs sustainable.

Hence the developing country demands large quantity of natural resources. Hence for sustainable development it is most important to preserve available natural resources and consume waste materials from industrial and agricultural production such as RHA.

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