Literature Review on Different Waste Materials Use in Concrete

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***Abstract*—Availability of raw material is very less due to higher use of concrete. Normal practice of concreting is batching of all raw materials, mixing (all raw materials), transporting, compaction at site, finishing and curing is followed by industry. In developed country like India use of concrete is higher quantity and availability of raw material is very less. Total replacement of concrete is not possible due to no material plays the role of concrete in terms of strength, durability, and workability. We have to partial replace all the material to achieve desire properties of concrete in terms of workability, strength and durability. This paper includes survey of different waste material used in the concrete from this survey we can understand the effect of different waste materials on the properties of concrete.**

***Index Terms*— Partial replacement, Cement, Fly Ash, Concrete, Waste material, Role of concrete.**

I. INTRODUCTION [1]

Concrete is a mixture of different waste material like binder (cement), fine aggregate, coarse aggregate and water. Normal practice of concreting is batching of this common raw material, mixing of raw material, transporting of concrete (mixture of all raw materials) , compaction of concrete, finishing and finally curing of concrete is followed by industries. Use of concrete is very large so availability of natural material is reduced and there is no material which plays the role of this ideal material (concrete) so to full fill the requirement of industries we have to replace fully or partially all the materials. In India numbers of waste materials are produced by different manufacturing companies, thermal power plant, municipal solid wastes and other wastes. Solid as well as liquid waste management is one of the biggest problems of the whole world. With disposal of waste in to the land causes serious impact on environment. It spoils the land. This paper is based on the review of literature which gives the idea about different waste available and possibility of use of this waste material in concrete.

II. LITERATURE REVIEW

Chandana Sukesh et al.[2] They have studied about the partial replacement of cement in concrete by use of waste materials like cement kiln dust (CKD), ceramic waste, palm oil fuel ash (POFA) and plastic. All of these materials are industrial waste materials and termed as hazardous waste to environment. They have found that the addition of up to 15% CKD as a cement replacement has a negligible effect on the strength of the block. Several concrete mixes possessing a target mean compressive strength of 30 MPa were prepared with 20% cement replacement by ceramic powder (W/B = 0.6). A concrete mix with ceramic sand and granite aggregates had also prepared as well as a concrete mix with natural sand and coarse ceramic aggregates (W/B = 0.5). Results show that concrete with partial cement replacement by ceramic powder although it has minor strength loss possess increase durability performance. Experiments have been conducted by replacing 10%, 20%, 30%, 40% and 50% of POFA by weight of Ordinary Portland Cement. The properties of concrete, such as setting time, compressive strength, and expansion due to magnesium sulfate attack were investigated. The results revealed that the use of POFA in concretes caused delay in both initial and final setting times, depended on the fineness and degree of replacement of POFA. They have observed that they hav added 5% plastic by weight, the strength and found to be two times greater than the plain cement concrete. With these results it is very clear that we can effectively use these eco-friendly materials in partial replacement of cement.

A.V.S.Sai. Kumar and Krishna Rao B[3] They have investigated the effect of strength of concrete with partial replacement of cement with quarry dust and Metakaolin. They have stated that concrete is a composite material made from cement, water, fine aggregate and coarse aggregate. But present researchers are in interest of finding new cement materials by waste materials or waste products produced from industries which are harmful to environment. The paper is deals with partial replacement of cement with quarry dust and metakaolin which are having silica used as admixture for making concrete. They have investigated first quarry dust is made partial replacement of cement and found that 25% of partial replacement is beneficial to concrete without loss of standard strength of cement. They have made 25% partial replacement of cement with quarry dust as constant, 2.5%, 5.0%, 7.5%, 10.0%, 12.5% metakaolin was made in partial replacement of cement and they had founded that quarry dust and metakaolin can be used as a partial replacement of cement.

P.S.Kothai and Dr.R.Malathy[4] They have investigated about the partial replacement of cement in concrete by use of waste materials Steel Slag. Slag is a byproduct of metal smelting and hundreds of tons of it are produced every year all over the world in the process of refining metals and making alloys. Like other industrial byproducts, slag actually had many uses, and rarely goes to waste. It appears in concrete, aggregate road materials, as ballast, and is sometimes used as a component of phosphate fertilizer. In appearance, slag looks like a loose collection of aggregate, with lumps of varying sizes. It is also sometimes referred to as clinker, in a reference to its sometimes dark and crumbly appearance. They have studied that aggregates occupy 70-80 percent of the volume

of concrete, their impact on various characteristics and properties of concrete is undoubtedly considerable. All along in India, we have been using natural sand and gravel in concrete manufacturing. Availability of natural aggregates is getting depleted and also it becoming costly. Hence, they have to be an importance on the use of wastes and by-products in all areas including construction industry. As 75% of concrete is composed of aggregates it is imperative that we look to maximize the use of waste as aggregate input in concrete making. They have investigated to determines the effect of partial replacement of fine aggregates by steel slag on the mechanical properties of concrete.

Amarnath Yerramala[5] They have investigated to use of poultry waste in concrete through the development of concrete incorporating eggshell powder (ESP). Different eggshell powder (ESP) concretes had developed by replacing 5-15% of ESP for cement. The results indicated that eggshell powder (ESP) can successfully be used as partial replacement of cement in concrete production. The data presented cover strength development and transport properties. With respect to the results, at 5% eggshell powder (ESP) replacement the strengths were higher than control concrete and indicate that 5% ESP is an optimum content for maximum strength. They have studied performance of eggshell powder (ESP) concretes was comparable up to 10% ESP replacement in terms of transport properties with control concrete. They have resulted that addition of fly ash along with ESP was beneficial for improved performance of concretes.

R. Kamal and B. Krishna Rao[6] They have studied about seek to greener environment since it seeks to develop recycle waste material for construction. The use of recycle aggregates and solid wastes from construction and demolition waste is showing a prospective application in construction and as alternative to primary and natural aggregate. It conserves natural resources and reduces the space required for land fill disposal. In the laboratory the crushed tile aggregate has been tried as partial replacement substitute to convectional coarse aggregate in concrete making of cubes, cylinders, beams. They have been cast and tested for compressive strength, split tensile and flexural strength after a curing period of 7, 28, 56 days. The results indicate effectiveness of crushed ceramic waste as partial replacement of conventional coarse aggregate up to 40 percent, without affecting the design strength.

A.M. Mustafa Al Bakri1 et al.[7] They have investigated the strength of concrete with ceramic waste as replacement of coarse aggregate in concrete. The sources of ceramic waste are obtained from the industrial in Malaysia. Presently, in ceramics industries the production goes as waste, which is not undergoing the recycle process yet. The potential of recycled ceramic waste as a substitute for coarse aggregates in concrete has been investigated. The recycle ceramic waste as aggregate was used. Concrete mixes with a 28 days characteristic strength of 20 MPa had prepared using water/cement ratio of 0.4, 0.5 and 0.7. The strength development of the concrete mixes containing recycled ceramic waste aggregates was compared to that of conventional concrete. They have resulted that the concrete mixes containing recycled ceramic waste aggregates achieve strength levels between 80 to 95 % compared to the conventional concrete. They have concluded that ceramic waste can be effectively replaced partially by cement in concrete.

M. Iqbal Malik et al.[8] They have studied on the issues of environmental and economic concern had addressed by the use of waste glass as partial replacement of fine aggregates in concrete. Fine aggregates had replaced by waste glass powder as 10%, 20%, 30% and 40% by weight for M-25 mix. The concrete specimens had tested for compressive strength, splitting tensile strength, durability (water absorption) and density at 28 days of age and the results obtained had compared with those of normal concrete. They have resulted permissibility of using waste glass powder as partial replacement of fine aggregates up to 30% by weight for particle size of range 0-1.18mm.

Amitkumar D. Raval et al.[9] They have studied about the (OPC) cement has been replaced by ceramic waste powder accordingly in the range of 0%, 10%, 20%, 30% 40%, & 50% by weight for M-25 grade concrete. The wastes employed came from ceramic industry which had been deemed unfit for sale due to a variety of reasons, including dimensional or mechanical defects, or defects in the firing process. They have resulted demonstrate that the use ceramic masonry rubble as active addition endows cement with positive characteristics as major mechanical strength and the economic advantages. Reuse of this kind of waste has advantages economic and environmental, reduction in the number of natural spaces employed as refuse dumps. Indirectly, all the above contributes to a better quality of life for citizens and to introduce the concept of sustainability in the construction sector.

Lakshmi.R and Nagan.S[10] They have stated about the use of materials like electronic waste not only helps in getting them utilized in cement, concrete and other construction materials, it helps in reducing the cost of cement and concrete manufacturing, but also has numerous indirect benefits such as reduction in landfill cost, saving in energy, and protecting the environment from possible pollution effects. The Electronic waste, shortened as Electronic waste, consists of discarded old computers, TVs, refrigerators, radios basically any electrical or electronic appliance that has reached its end-of-life. Labors have been made in the concrete industry to use non biodegradable components of Electronic waste as a partial replacement of the coarse or fine aggregates. They have also studies about experimental study is made on the utilization of Electronic waste particles as coarse aggregates in concrete with a percentage replacement ranging from 0% to 30% on the strength criteria of M20 Concrete. Compressive strength, Tensile strength and Flexural strength of Concrete with and without Electronic waste as aggregates had observed which exhibits a good strength gain. Ultrasonic tests on strength properties had executed and the feasibility of utilizing Electronic plastic particles as partial replacement of coarse aggregate has been presented.

C Freeda Christy and D Tensing[11] The have investigated about the results of the cement mortar of mix proportion 1:3, 1:4.5 and 1:6 cement mortar in which cement is partially replaced with Class-F fly ash as 0%, 10%, 20%, 25% and 30% by weight of cement.

Richer the mix, higher the compressive strength has been obtained even with partial replacement of fly ash with cement. They have studies on the test results indicate the important improvement in the strength properties of mortar with fly ash as partial replacement with cement & fine aggregate in the cement mortar 1:6. They have also stated that it can be effectively used in masonry with the compressive strength of the brick unit ranges between 3-20 N/mm.

Dr. G.Vijayakumar et al.[12] They have instigated about the use of cement replacements, using many waste materials and industrial by products. Efforts have been made in the concrete industry to use waste glass as partial replacement of coarse or fine aggregates and cement. They have studied on finely powdered waste glasses are used as a partial replacement of cement in concrete and compared it with conventional concrete. This work examines the possibility of using Glass powder as a partial replacement of cement for new concrete. Glass powder was partially replaced as 10%, 20%, 30% and 40% and tested for its compressive, Tensile and flexural strength up to 60 days of age and had compared with those of conventional concrete; from the results obtained, they have stated that the glass powder can be used as cement replacement material up to particle size less than 75µm to prevent alkali silica reaction.

K. Muthusamy and N. A. Sabri[13] They have studied on the result on the workability and compressive strength of concrete containing various percentage of cockle shell content as partial coarse aggregate replacement. Concrete mixes containing 0%, 5%, 10%, 15%, 20%, 25% and 30% cockle shell replacement level had casted before subjected to water curing for 28 days. Workability test and compressive strength test had conducted in accordance to BSEN 12350 and BSEN 12390 respectively. They have been resulted that replacement of appropriate cockle shell content able to produce workable concrete with satisfactory strength. Integration of 20% cockle shell improved the strength of concrete making it to be the highest as compared to any other replacement level.

Umapathy U et al. [14] They have studied about rice husk ash have been used as partially replacements to the cement. They have also casted cubes and tested for compressive strength and modulus of rupture after a curing period of 7days, 17days, 28days. They have resulted about effectiveness of tiles as coarse aggregate by partial replacement of conventional concrete by 20 %, 30%, 50%and cement as rice husk ash with 10%,15% and 20% without affecting the design strength. Also Combined RHA & Tiles replacement was in above percentage mixing. A total number of 81 cubes, and had casted and tested .They have recommends that waste ceramic tiles can be used as an alternate construction material to coarse aggregate in concrete. They have also recommended to cement is partially rice husk ash.

Yogendra O. Patil et al.[15] They have investigated on currently focused on use of waste material having cementing properties, which can be added in cement concrete as partial replacement of cement, without compromising on its strength and durability, which will result in decrease of cement production thus reduction in emission in green house gases, in addition to sustainable management of the waste. The ground granulated blast furnace slag is a waste product from the iron manufacturing industry, which may be used as partial replacement of cement in concrete due to its inherent cementing properties. They have represented an experimental study of compressive and flexural strength of concrete prepared with Ordinary Portland Cement, partially replaced by ground granulated blast furnace slag in different proportions varying from 0% to 40%. It is observed from the investigation that the strength of concrete is inversely proportional to the % of replacement of cement with ground granulated blast furnace slag. They have also concluded that the 20% replacement of cement is possible without compromising the strength with 90 days curing.

III. CONCLUSION

Based on above literature survey we have concluded that materials like fly ash, RHA, ceramic waste, GGBS, Stone dust, Quarry dust, Glass powder, Rubber, electrical waste, silica fume, and iron waste from different industries used in varying proportion for partial replacement of concrete ingredients. For batter utilization of this waste material requires detail investigation of effect of different waste materials on the different properties of concrete.

IV. ACKNOWLEDGMENT

We are very thankful to all researcher those who have done a research in the field of concrete technology. They have done really fantastic job to save environment. We are also very thankful to Mr. Ankit Patel (M.TECH Structure), Mr.Dharmendrasinh Parmar (lecturer) and Dr.V.M.Patel (principal, SVBIT), who have been constant source of inspiration, guidance and encouragement.

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