UTILIZATION OF WASTE MATERIAL IN CONCRETE: A REVIEW

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Abstract: ***India is a developing country. Along with the increment in population, Industries are also expanding day by day and establishing a key stone in economic growth of nation as well as employing workers whether skilled or unskilled. But different industries produces massive amount of waste as sludge and fibres. This waste sludge degrades the quality of environment. Waste from industries has become nuisance for environment. It does not only endanger the environment as well as human health. This study is a review of application of different wastes of industries as aggregate and some amount of cement. It provides a guidance to treat the waste of various industries using as aggregate and cement. The main objective of this study is to give an overview of how mechanical properties of concrete changes with the usage of different wastes. This paper deduces that the mechanical properties improved a lot with the usage of industrial waste. Many researchers studied the various strength parameters of concrete by adding different types of by products of industries and concluded that the mechanical properties improved with application of industrial wastes.***

Keywords : concrete, waste material, sludge, testing, mechanical properties.

I. Introduction

The surge in population has given birth to various issues, one of them is increase in waste material. However, myriad non-decaying material is a cause of environmental issues and this problem is disseminated globally, considerably in densely populated areas. Many non-decaying and hazardous substances are left and illegally dumped in selected areas. As, large quantity of this waste cannot be eliminated but can be utilized for a productive work. Waste materials pose a threat to human health, safety and environment. However, the utilization of these waste materials in a creative and effective way is being researched which are looking for safe and cost-effective methods of waste disposal. As, it will save natural resources of being extincted, environment of being contaminated and prevent various ailments to be spread. This research study concentrates on the waste materials which can be used in construction by replacing conventional materials, mainly aggregates and cement mixes.

Literature Review

J.Peraet. al (1996) [1] studied on use of incinerator bottom ash in concrete. The author examined municipal solid waste incinerator (MSWI) bottom ash as an natural aggregate for concrete. The waste which passed 20mm sieve and retained on 4mm was used in concrete. The waste was of average quality for aggregate. The researcher concluded that the mix failed as cement reacted with metallic aluminium but author founded that after immersion of bottom ash in sodium hydroxide for 15 days, properties of concrete was attained without affecting the durability.

B. Ahmadiet. al (2000) [2] Studied on utilization of paper waste sludge in the building construction industry. The author examined physical and chemical properties of the paper waste material with concrete mixes containing various percentages of the waste and basic strength characteristics, such as compressive strength, splitting, flexural, water absorption, and density were determined and compared with a controlled mix. The researcher concluded that as the content of the waste increased the water to cement ratio for the mix was also increased, since the waste had a high degree of water absorption and as the amount of the waste increased the basic strengths, such as compressive strength were decreased. Only 5% of replacement was successful to fine sand so, it was used for masonry construction.

Mageswari M. et. al (2010) [3] studied on the use of sheet glass powder as fine aggregate replacement in concrete. The researcher examined that the water requirement decreases as the SGP content increases. The compressive strength increased upto some extent with increase in SGP but decreased as age of curing increases due to alkali silica reaction and the tensile and flexural strength increased upto some extent with increase in SGP but decreases as age of curing increases. The researcher concluded that optimum replacement level for fine aggregate was with SGP 10% and usage of SGP in concrete lead to greener environment.

M. Mavroulidouet. al (2010) [4] studied on discarded tyre rubber as concrete aggregate: a possible outlet for used tyres. The author studied rubber tyre particles which partially replaced natural aggregates. The physical and mechanical properties of concrete containing recycled tyre aggregates along with rubber aggregate content and size, as well as curing time was also considered. The researcher concluded that despite of loss in strength, this type of concrete was acceptable for various applications which required low compressive strength. The author founded that if tyre rubber is used at low percentages in mix concrete, it will reduce wastage of rubber as concrete is used worldwide.

Hebhoub H. et. al (2011) [5] studied on use of waste marble aggregates in concrete. The author stated that almost 70% of waste marble aggregate gets wasted in the mining, processing and polishing stages which have a serious impact on the environment. The waste was dumped and it threatened the aquifer. The researcher used 3 methods of sand substitution, gravel substitution and both (sand and gravel) substitution. The author concluded that use of marble

waste resulted in increase in compressive and tensile strength. The level of replacement with this material was 25%, 50% and 75%. This material can also be used for making bricks, road construction and landfills.

Rafat Siddique et. al (2012) [6] studied on utilization of wood ash in concrete manufacturing. Wood ash (WA) was generated from combustion of wood and wood products (chips, saw dust, bark, etc.). It was inorganic and organic residue remained after the combustion of wood or unbleached wood fiber. The author examined about the physical, chemical, elemental and mineralogical composition of wood ash along with compressive strength, splitting tensile strength, flexural strength, freezing and thawing resistance, and shrinkage of concrete. The researcher concluded that water absorption capacity of the concrete increased with increase in wood ash content and strength properties of concrete mixtures decreased marginally with increase in wood ash contents, but increased with age due to pozzolanic actions. Wood ash was used for making precast products and structural grade concrete.

Sajad Ahmad et. al (2013) [7] studied on study of concrete involving use of waste paper sludge ash as partial replacement of cement. The author examined waste paper sludge ash as partial replacement of cement for concrete as 5%, 10%, 15% and 20% for M25 mix concrete along with it compressive strength, tensile strength, water absorption and dry density were also tested. The researcher concluded that waste Paper sludge ash can only be replaced upto 5% by weight as it showed 10% and 15% increase in compressive strength at 7 and 28 days. The percentage of water absorption increased with increase in waste paper sludge ash. The author found it economical as the waste is non useful and free of cost.

Krishna Murariet. al (2014) [8] studied on use of waste copper slag, a sustainable material. Copper slag is a byproduct obtained during smelting and refining of copper. The author examined that by using this waste material the properties of concrete increased. This waste material was added and it showed 60-70% more strength of the concrete. The researcher concluded that concrete made with copper slag shows long-term durability as a fine or coarse aggregate replacement.

O. Zimbiliet. al (2014) [9] studied on a review on the usage of ceramic wastes in concrete production. The ceramic waste was used for construction as, it was noted that temperature used in manufacturing of these tiles (900˚C) was sufficient to activate pozzolanic properties of clay. After optimization (11-14% substitution) cement blend performed better. Sanitary ware and electrical insulators were used as aggregate. The author concluded that ceramic waste have better properties like density, durability, permeability and compressive strength than normal concrete.

Manhal A. Jibraelet. al (2016) [10] studied on strength and behavior of concrete contains waste plastic. The author showed a method of strengthening concrete by the addition of plastic waste. 126 samples were taken and tested for 7 to 28 days. On replacement of waste plastic bottles to sand with 1%, 3% and 5%. It was found that on increasing % of this material from 0-5%, compressive, tensile and flexural strength decreased by ratio 12.81, 10.71 and increased by 4.1% respectively at 7 days age and decreased by the ratio 7.93, 28.6 and 23.6% at 28 days. Similarily with waste plastic bags strength decreased by ratio 27.5, 29.54 and 7.98% at 7 days. The researcher concluded that both the waste materials can be used in non-structural concrete members.

Jugal V. Tailor et. al (2017) [11] studied on review on concrete from bio medical waste. The author used hospital waste (biomedical waste ash) in concrete production. One method namely incineration was used for the production of fly ash in order to reduce the huge volume of medical waste. The researcher concluded that biomedical waste can only be used if low degree workability is to be obtained. It also decreased the density of concrete upto 2542 kg/m^3. Compressive strength of concrete with 7.5% replacement by BMA was more than conventional concrete but replacement upto 10% showed comparable strength to conventional concrete.

S. R. Shamiliet. al (2017) [12] studied on an overview of electronic waste as aggregate in concrete. The author examined that the disposal and dumping of E-waste resulted in various health issues as, it contains lead, cadmium, mercury, beryllium, brominates, PVCs and phosphorus compounds. So, the researcher used it as aggregates in concrete and resultantly, natural aggregate can be conserved. The author concluded that it reduced self-weight of concrete but mechanical properties of concrete with e-waste as aggregate showed lesser values than the controlled mix.

Conclusion

THIS PAPER REVIEWED THE CONCEPT OF APPLICATION OF WASTE MATERIALS AS AGGREGATE IN CONCRETE AND ALSO AS REPLACEMENT OF CEMENT. MOST OF THE LITERATURE EXAMINED ABOVE SHOWED THAT UTILIZATION OF DIFFERENT WASTE IN CONCRETE AS REPLACING ONE OF ITS CONSTITUENTS IS SUCCESSFUL IN ACHIEVING COMPRESSIVE STRENGTH, COST EFFECTIVE AND ENVIRONMENT FRIENDLY PROPERTIES. THIS STUDY HELPS TO KNOW THE EFFICIENCY OF DIFFERENT WASTES TO INCREASE THE MECHANICAL PROPERTIES OF CONCRETE AS WELL AS HELP IN SAVING OUR ENVIRONMENT.

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