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A REVIEW : POLYMER INDUCED CONCRETE

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ABSTRACT— The rapid industrialization and urbanization across the country has led to increase in infrastructural developments. This has caused several problems like shortage of materials, increase in waste productivity etc. Plastic is one such waste product which has caused severe damage to ecosystems. Plastic is non degradable material due to which it can be introduced in concrete as replacement of traditional constituents of concrete. Polymer induced concrete is a composite material which comprises of cement based matrix with an ordered or random distribution of Polymer fiber. This study of using Polymer Fiber in form of waste plastic can be used in concrete as a partially substitute ingredient. Concrete Mix design is a primary need in Civil Engineering. Hence this review focusses on Polymer induced Concrete Mix Design in which plastic polymer is replaced as a substitute ingredient in concrete to study the strength parameters of the final product.

Keywords— Polymer Induced Concrete

I. INTRODUCTION

The concrete is one of the most widely used construction material in many countries. The performance of concrete depends on its ingredients. It is well known that conventional concrete is brittle and weak in tension, hence requires reinforcement to sustain flexural failures. The fiber reinforced concrete transforms conventional concrete into a pseudo ductile material which can adhere to flexural cracking. Adding fibers in concrete can arrest micro cracks which causes gradual failure. The fibers from cheap or waste materials may be used for manufacturing of structural concrete units. Variety of fibers such as steel, carbon, glass, synthetic organic and natural fibers has been incorporated in concrete and mechanical properties of such concrete are already studied to find a solution to encounter cracks in concrete..

Plastic Polymers are substances which have engineering properties and thus can be used as partial replacement in concrete. Polymer induced Concrete can be a solution to tackle the problems faced due to waste plastics. Plastic polymer comprises of lacquer, shellac, amber, horns, tusks, tortoiseshell, as well as inorganic substances such as clay, glass, and metals. Plastics Polymers can be subdivided into two types; thermoplastic, which can be melted for recycling in the plastic industry. These plastics are polyethylene, polypropylene, polyamide. The second type is thermosetting plastic. This plastic cannot be melted by heating because the molecular chains are bonded firmly with meshed crosslink. These plastic polymers are known as phenolic, melamine, unsaturated polyester, epoxy resin, silicone, and polyurethane. At present, these plastic wastes polymers have damaged the natural ecosystems as they are disposed by either burning or burying.

II. LITERATURE REVIEW

Zainab Z. Ismail and Enas A. AL-Hashmi said industrial activities in Iraq are associated with significant amounts of non-biodegradable solid waste, waste plastic being among the prominent. His study involves 86 experiments and 254 tests to determine the efficiency of reusing the waste plastic in the production of concrete. 30 kilograms of waste plastic of fabriform shapes was used as a partial replacement for sand by 0%, 10%, 15%, and 20% with 800 kg of concrete mixtures. All of the concrete mixtures were tested at room temperature. These tests performing slump, fresh density, dry density, compressive strength, flexural strength, and toughness indices. 70 cubes were molded for compressive strength and dry density tests, and 54 prisms were cast for the flexural strength and toughness indices tests. Curing ages of 3, 7, 14, and 28 days for the concrete mixtures were applied in this work. The results proved the

arrest of the propagation of micro cracks by introducing waste plastic of fabriform shapes to concrete mixtures. This study insures that reusing waste plastic polymer as a sand-substitution aggregate in concrete gives a good approach to reduce the cost of materials and solve some of the solid waste problems posed by plastics.

S. Gavela, C. Karakosta studied on concrete containing various types of polymer waste as aggregates. This study attracted a growing ecological interest especially due to increasing volume of polymer wastes. Used materials or industrial wastes from PP and PET were studied as alternative replacement of conventional aggregates. Sieve analysis, specific gravity and water absorption tests were performed in all types of aggregates. Two replacement levels 20% and 30% by volume of aggregates we used to cast cubes.

Prakash Rao and Giridhar Kumar carried detail investigations on concrete mixes with stone crusher dust as fine aggregate. They concluded that stone crusher dust is a good alternative material for river sand. The same study was extended by R. Kandasamy who reported that with addition of domestic plastic fibres in the concrete there is appreciable increase in compressive strength.

Mahendra and R.Chitalang continued the same study and make conclusions that using manufactured sand and steel fibres in concrete going can help to improved results compared to conventional concrete. Balasubramanianm .M also extended the study using E-Plastic waste and found that replacing 1% of E-plastic in concrete produces 2.5% of incremental strength compared to conventional concrete.

The above studies on replacing concrete ingredients has not been specified precisely in any Concrete Codes. Hence these studies are based on Trial and Error Experiments.

III. CONCRETE MIX DESIGN

A. Mix Design Samples Proportions

Table No. - 1

Series of Samples	Descriptions of Various Mix Proportions
PA1	100%Natural Coarse aggregates20mm
PA2	95%Natural Coarse aggregates20mm + 5%Plastic Waste
PA3	90%Natural Coarse aggregates20mm +10% Plastic Waste
PA4	85%Natural Coarse aggregates20mm +15% Plastic Waste
PA4	80%Natural Coarse aggregates20mm +20% Plastic Waste

B. Mix Design Calculations

Typical Mix design M25 calculations per unit volume of concrete :

a. Volume of concrete = 1 m^3
b. Volume of cement = 0.10 m^3
c. Volume of water = 0.138 m^3
d. Volume of aggregates = 0.759 m^3
e. Weight of coarse aggregates = 1356 kg
f. Weight of fine aggregates = 751 kg

IV. TESTS TO DETERMINE COMPRESSIVE STRENGTH

concrete cube will be cast in laboratory and will be tested by compression testing machine after 7 days or 28 days curing. Load should be applied gradually at the rate of 140 kg/cm^2 per minute till the specimen fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

V. LITERATURE CONCLUSION

The study reflects that the use of 'Waste Plastic' improves the workability, density and reduces the compressive strength of the concrete by 10 to 20 % when 10 to 24% aggregate is replaced by plastic respectively.

It is also found that when 4% replacing of waste plastic causes slight deviation of compressive strength hence adding waste plastics in concrete blocks can help in reuse of non-degradable polymer waste.The fresh density values of waste plastic concrete mix are found to be decreased by 5%, 7% and 8.7% compare to conventional concrete .The use of waste plastics in concrete is relatively a new development in the world of concrete technology and lot of research in this material is actively used in concrete construction.

It can be finally conclude that use of plastics reduces compressive strength, hence certain treatments using admixtures can tend to achieve target strength.

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