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A REVIEW STUDY ON APPLICATION AND STRENGTH OF CONCRETE WITH ETP SLUDGE AND LATHE WASTE

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Abstract:- Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. It is inevitable to think about sustainable development by reducing the wastes generated or reusing it. Due to rapid growth of population, rapidly increasing in industries which directly increases waste without any management. In this world where some countries are developed and some are developing, the unbelievable demand of steel is on its peak, but it leads toward a dumping ground of industrial waste. For reduction of this dumping of scrap and save the earth from this hazardous problem utilization of steel scrap in concrete is the key step for save the environment and achieving sustainability that will enable the earth to continue to support human life. This paper presents a review study to utilization of waste (CNC lathe waste and ETP Sludge) by partial replacement (5% by weight of natural coarse aggregate) with coarse aggregate.

Keywords: Steel scrap, compressive strength, Concrete, Optimum percentage of steel scrap, ETP Sludge

1.0 INTRODUCTION

Today construction industry is in need of finding a cost- effective material to increase the strength of concrete structures. It is inevitable to think about sustainable development by reducing the wastes generated or reusing it. Rapid Industrialization and Urbanization is causing serious environmental problems. One of the major concerns amongst these is safe and sound disposal of solid wastes. Sugar, paper pulp and Textile are three major agro based industries in India which produce large quantity of solid and liquid wastes after consuming greater amount of fresh water. Textile mills are one of the largest and oldest sectors in India. Every day about 8 to 10 kg of lathe waste are generated by each lathe industries in the kerala and dumped in the barren soil there by contaminating the soil and ground water, which creates an environmental issue. Many constructional industries also dispose there wastes likewise, which include binding wires, nails and other types of scraps. Hence by adopting proper management by recycling the steel scrap with concrete is considered to be one of the best solutions. These industrial steel scrap wastes can effectively be used for making high strength low-cost Fiber Reinforced Concrete after exploring their suitability. In the various studies, the tests were conducted as per the Indian standard procedure for its mechanical properties such as flexural, split tensile, compressive strength and compared with conventional PCC. The workability of fresh concrete that containing different ratios of steel scrap was carried out by using slump test.

1.1 ADVANTAGE OF ETP SLUDGE WASTE IN CONCRETE

Following are the various advantages of ETP sludge waste in concrete:

- Cost of Concrete production is reduced when ETP sludge waste is used as a fine aggregate in concrete.
- Due to less density of ETP sludge waste, it can be used in earthquake prone zone as it results in light weight concrete.
- As ETP sludge wastes have less capacity to absorb water they do not degrade easily.
- ETP sludge waste concrete can reduce the use of river sand in concrete.
- The bulking percentage of ETP sludge waste and fine aggregate are nearly same.

1.2 APPLICATION OF ETP SLUDGE CONCRETE:

1. **Residential:** including driveways, sidewalks, pool construction, basements, colored concrete, foundations, drainage, etc.
2. **Commercial:** exterior and interior floors, slabs and parking areas, roadways.
3. **Warehouse /Industrial:** light to heavy duty loaded floors and roadways.
4. **Highways/Roadways/Bridges:** conventional concrete paving, barrier rails, curbs and gutter work.
5. **Ports and Airports:** runways, taxiways, aprons, seawalls, dock areas, parking and loading ramps.

6. **Waterways:** Dams, channel linings, ditches, storm-water structures, etc.
7. **Mining and Tunneling:** Precast segments and shotcrete, which may include tunnel lining, shafts, slope stabilization, sewer work, etc.
8. **Elevated Decks:** including commercial and industrial composite metal deck construction and elevated formwork at airports, commercial buildings, shopping centers, etc.
9. **Agriculture:** farm and animal storage, walls, silos, paving, etc.
10. **Precast Concrete and Products:** architectural panels, walls, fencing, septic tanks, burial vaults.
11. **Other Applications:** includes any other FRC related applications not specifically described above.

2.0 LITERATURE REVIEW

Hema Patel et al studied the reuse Potential of Chemical Sludge from Textile Wastewater treatment Plants in India. This study was conducted to explore the reuse potential of the chemical sludge (considered as hazardous waste as per Indian Government Hazardous Waste Management Rules) generated from combined effluent treatment in textile clusters. These textile clusters mainly cover the cotton dyeing and printing operations. The sludge was characterized for its physico-chemical parameters and heavy metals. Standard blocks of dimensions 70.6´70.6´70.6 mm were prepared, in which chemical sludge was used as a partial replacement of cement by mixing 30-70 % of sludge in cement. After the experimental curing, the blocks were evaluated for physical engineering properties such as hardening time, block density, unconfined compressive strength. The chemical properties were determined in terms of concentrations of heavy metals in the TCLP leachate. The use of sludge can definitely be explored for other structural and nonstructural applications depending upon strength requirement. Other applications of textile sludge in the construction materials to be explored by conducting more bench scale studies.

Shivam P. Darji et al analyzed the compressive strength of concrete using steel scrap. This paper assesses the effective use of steel scrap in concrete. In this study, total 39 nos. concrete cubes of size 150 mm x 150 mm x 150 mm casted using steel scrap concrete grade M-20. Steel scrap used up to 2.4% by weight, at a gap of 0.2% (i.e. 0.2%, 0.4%, 0.6%, 0.8%, 1.0%, 1.2%, 1.4%, 1.6%, 1.8%, 2.0%, 2.2%, and 2.4%). As per Indian standard, after 28 days compressive strength test done on casted concrete cubes and test results are compared with plain cement concrete. After completing study, we know that the 28 days compressive strength of steel scrap concrete is more than plain cement concrete. The main objective of this study to find out optimum percentage of steel scrap in concrete up to which its compressive strength initially increased and then gradually decreased. At the end of the study, we found that up to 1.4% of steel scrap, compressive strength increased then after more percentage of steel scrap causes slight reduction in compressive strength.

Ashish Kumar Parashar et al studied the utility of Wastage Material as Steel Fibre in Concrete Mix M-20. The addition of steel fibre increases the properties of concrete, viz., flexural strength, impact strength and shrinkage properties to name a few. A number of papers have already been published on the use of steel fibres in concrete and a considerable amount of research has been directed towards studying the various properties of concrete as well as reinforced concrete due to the addition of steel fibres. Hence, an attempt has been made in the present investigations to study the influence of addition of Lathe Ma-chines waste material as fibers at a dosage of 5% to 30% by weight of cement. The properties studied include compressive strength. The stu-dies were conducted on a M20 mix and tests have been carried out. The results are compared and conclusions are made.

Vasudev R. et al studied the application of Turn Steel Scraps as Fibres in Concrete. This paper aims to have a comparative study between ordinary reinforced concrete and steel fibre reinforced high strength concrete under tensile and compressive loading. The fibres added in this study are the wastes from lathe shops. The behaviour of concrete samples is investigated by adding varying percentage of turn steel scraps as fibres, viz., 0.25%, 0.5%, 0.75% and 1%. The behaviour of steel fibre reinforced high strength concrete is also evaluated based on flexural capacity, load carrying capacity, cracking behaviour and deflection characteristics. The basic concrete mixes adopted were M40 and M60. The results obtained were promising, which can be adopted in the construction industry.

Senthil kumar Ariyamuthu et al studied on the effects of shredded waste plastics in rigid pavements. An attempt has been made to study the effect of using waste plastics less than 40 microns shredded as fibres in plain cement concrete of M40 grade used for rigid pavements. Tests were conducted on shredded waste plastics to determine their physical properties and the reaction with acids and alkalis. Concrete mix design for M40 grade concrete with different percentages of shredded waste plastics has been evaluated as per IRC: 44-2008. Shredded waste plastics was added as fibre reinforcement in various percentages such as 0.25%,0.5% and 1%.Reference concrete mix also made for comparative reasons. This experimental study reveals that optimum percentage of shredded waste plastics was found to be 0.25% by weight of cement at which addition of shredded waste plastics increase the cube compressive strength of concrete in 28 days to an extent of 3.02% and increase the 28 days split tensile strength to an extent of 3.35%.Results proved that adding of shredded waste plastics with 0.25% of weight of cement leads to improvements in both compressive strength and split tensile strength. Hence, shredded waste plastics may be used as fibre reinforcement in rigid pavements so as to pave a way for safe disposal of waste plastics less than 40 microns.

Vasudev R et al studied on Steel Fibre Reinforced Concrete. This paper aims to have a comparative study between ordinary reinforced concrete and steel fibre reinforced concrete. The fibres which were used in the study were the turn fibres. They were the scraps from the lathe shops. Experimental investigations and analysis of results were conducted to study the compressive & tensile behaviour of composite concrete with varying percentage of such fibres added to it. The concrete mix adopted were M20 and M30 with varying percentage of fibres ranging from 0, 0.25, 0.5, 0.75 & 1%. On the analysis of test results the concrete with turn steel fibres had improved performance as compared to the concrete with conventional steel fibres which were readily available in market. These sustainable improvements or modifications could be easily adopted by the common man in their regular constructions.

Sekar studied on fibre reinforced concrete from industrial waste fibers and reported that waste fibers such as lathe waste and wire winding waste significantly improved the compressive, split tensile and flexural strength values of concrete. It was also stated that wire drawing industry waste decreased the strength values.

Ramakrishna et al compared the theoretical and experimental investigations on the compressive strength and elastic modulus of coir and sisal fibre reinforced concretes for various volume fractions. It was observed that both the experimental and analytical values of elastic modulus had shown 15% discrepancy, which can be regarded as comparatively small.

Agopyan et al reported the developments on vegetable fibrocement based materials in Brazil. Taking into account the mechanical properties, with an adequate mix design, it is possible to develop a material with suitable properties for building purposes. To overcome the drawback, it was suggested that durability of natural fibres can be improved by making alternative binders with controlled free lime using ground granulated blast furnace slag.

Romildo D. Toledo Filho et al made some experiments on free, restrained and drying shrinkage of cement mortar composites reinforced with vegetable fibres. The free and restrained shrinkage were studied by subjecting the specimens to wind speed of 0.4-0.5 m/s at 40o C temperature for 280 min. The drying shrinkage tests were carried out at room temperature with about 41% relative humidity for 320 days. It was concluded that free plastic shrinkage is significantly reduced by the inclusion of 0.2% volume fraction of 25 mm short sisal fibres in cement mortar. Also, it was stated that the presence of sisal and coconut fibres promote an effective self-healing of plastic cracking after 40 days at 100% RH.

Murali Mohan Rao et al introduced and studied the extraction and tensile properties of new natural fibres used as fillers in a polymeric matrix enabling production of economical and light weight composites for load carrying structures. The cross sectional shape, the density and tensile properties of these fibres along with established natural fibres like sisal, banana, coconut and palm were determined experimentally under similar conditions and compared. The density of newly introduced fibres such as vakka, date and bamboo were less than the existing fibres.

Zeeshan Nissar Qureshi et al analyzed the concrete Reinforced with Lathe Machine Scrap. The aim of the paper was to study the feasibility of using lathe machine scrap in concrete by checking the compressive strength, splitting tensile strength, flexural strength and load deflection characteristics. All these parameters were found out by varying proportions of lathe machine by 0%, 1 %, 1.5% and 2% by weight in M20 concrete. Thus finding out optimum percentage of lathe machine scrap in concrete up to which its mechanical properties like compressive strength, splitting tensile strength, flexural strength can be increased. All the tests were conducted by following the guidelines set by Indian Standard. The compressive strength was found out to be 25.5N/mm^2, 26.8N/mm^2, 28.4N/mm^2 and 23.33N/mm^2 for 0%, 1 %, 1.5% and 2% lathe machine scrap reinforcement respectively. The splitting tensile strength was 2.85N/mm^2, 3.04N/mm^2, 3.37N/ mm^2 and 2.94N/mm2, where as flexural strength were 4.33N/mm^2, 5N/mm^2, 5.66N/mm^2 and 4.83N/mm^2 for 0%, 1 %, 1.5% and 2% lathe machine scrap reinforcement respectively. The strength properties of concrete were increasing by adding lathe machine scrap up to 1.5 % by weight in concrete after this slight reduction in strength properties of concrete was noticed.

CONCLUSION

The major conclusions drawn from this research are presented below:

1. The workability of the mix containing ETP sludge of TiO2 shows an inverse relation with the increase of replacement.
2. The environmental degradation due to the effect of ETP sludge can be reduced up to certain limits by the partial replacement.
3. The environmental degradation due to the effect of ETP sludge can be reduced up to certain limits by the partial replacement.
4. The increased cost of construction due to the scarcity of fine aggregate can be reduced with the ETP sludge up to some extent.
5. The waste steel scrap material which is available from the lathe can be used as steel fibres for innovative construction industry.

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