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STUDY ON REPLACEMENT OF CONCRETE WITH CRUMB RUBBER PIRATICAL

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ABSTRACT

Solid waste management has gained a lot of attention to the research community in recent days. Currently, waste materials resulting from various physical and chemical processes are the most important challenge in the industrial and developing countries. Extensive investigations on wastage recycling are being implemented to minimize the environmental damages. A lot of rubber is produced worldwide. For example, 3.6 million tons rubber is produced annually only in US. It is not possible to discharge the rubbers in the environment because they decompose very slowly and cause lots of pollution.

Keywords:- **Waste tyre crumb rubber concrete, Waste tyre crumb rubber particle, Impact Test Apparatus, Energy absorption capacity, Plane cement concrete, Ductility index.**

I. INTRODUCTION

This research carried out to assess the feasibility of using crumb rubber (the product of shredding used rubber tyres) as a partial sand replacement in foamed concrete, and investigates the effect of it on some properties of foamed concrete such as, density, water absorption, compressive strength, tensile strength, flexural strength and impact resistance. The basic material required in construction by using concrete are aggregate, scrap tyre rubber ,cement and steel. Concrete is the most used material in construction. Dredging of river sand from the river bed causes severe environmental damage. The researchers suggested the use of waste tyre crumb rubber which is available in large amount as alternative to aggregate in concrete because of scarcity of the fine aggregate like natural sand .Many researchers replaced fine aggregate by waste tyre crumb rubber and coarse aggregate by waste tyre rubber chips and mechanical properties are discussed. Tantala et.al in his study presented the toughness of normal concrete mixture and the concrete with WTRAC mixtures with 5%and 10% buff rubber replaced by volume of coarse aggregate the result shows that, toughness of both WTRAC mix was higher than normal concrete mixture however the toughness of WTRAC with 5% buff rubber was higher than 10% buff rubber (2to6mm) because for higher rubber content compressive strength decreases[1]. The possibility of making concrete tough has been generally pursued by introducing rubber phases among the traditional components (cement, water, and aggregates) and this idea has been largely investigated using, for this purpose, recycled grinded tyre rubber [2]. The basic material of concrete e.g. cement, sand, aggregate and scrap tyre rubber are used. At first, tire is cut into chip particles and then partially replaced the coarse aggregates, and some specimens was cast and tested for this purpose. The experimental results show that the replacement of coarse aggregates by rubber particles for up to 5% by weight have no important effect in prevalent properties of concrete, but more replacement of these materials, changes the concrete properties significantly.

Fig.1 Crumb Rubber

II. BENEFITS OF RECYCLING SCRAP TIRES

Preferred management methods for municipal solid waste are waste prevention, followed by recycling, followed by incineration for energy recovery, and finally land disposal. For tires, retreading is a form of waste prevention and saves valuable resources. Recycling also conserves materials. For example, the use of ground rubber in products and in rubberized asphalt saves new resources from being used. In cases like these, recycling makes good economic sense. In the fig show tire gardens can be a simple, cost-effective way to plant a garden in urban areas, and an environmentally-friendly way to turn a used tire into something productive again.

Fig. 2: Environmentally-friendly way to turn a used tire

III. SCRAP TYRE RUBBER

Tyre may be divided into two types – car and truck tyres. Car tyres are different from truck tyres with regard to constituent materials (e.g. natural and synthetic rubber). Pyrolysis of scrap tires offers an environmentally and economically attractive method for transforming waste tires into useful products, heat and electrical energy. Pyrolysis refers to the thermal decomposition of scrap tires either in the absence or lack of oxygen. The principal feedstock's for pyrolysis are pre-treated car, bus or truck tire chips. Scrap tires are an excellent fuel because of their high calorific value which is comparable to that of coal and crude oil. The heating value of an average size passenger tire is between 30 – 34MJ/kg. Figure 3 show the scrap tyre rubber.

Fig. 3: Scrap Tyre Rubber

IV. THEORETICAL BACKGROUND

The difficulties associated to the theoretical investigations to identify the mechanical properties of the rubberized concrete have necessitated the need for the experimental investigations on rubberized concrete. Therefore, in this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. Taha et al. [3] added various percentages of 5-20 mm crumb rubber to the concrete. By substituting 100 vol% of coarse aggregate by rubber, the compressive strength decreased by 75%. They related this decrease to variation of the shape and the size of transmission zone from the vicinity of coarse aggregate to the vicinity of rubber crumbs. Olivars et al. [4] observed that substituting 3.5 and 5 vol% recycled rubber in cement matrix has not significant effect on the compressive strength and the elasticity. In recent years, using silica fume in concrete in order to increase its strength has attracted much attention. Today, obtaining compressive strengths higher than 100 MPa has become possible by applying silica fume and super plasticizers [5]. Mavroulido. M et al. "Discarded tyre rubber as concrete aggregate" a possible outlet for used tyres" it can be concluded that despite the observed lower values of the mechanical properties of concrete there is a potential large market for concrete products in which inclusion of rubber aggregate would be feasible. These can also include non primary structural applications of the medium to low strength requirements, benefiting from other features of this type of concrete. Even if the rubber tyre aggregate was used at relatively low percentages in concrete, the amount of waste tyre rubber could be greatly reduced due to the very large market for concrete products worldwide. Therefore the use of discarded tyre rubber aggregates in concrete shows promise for developing an additional route for used tyres. In 2003, markets for scrap tires were consuming 233 million, or 80.4%, of the 290 million annually generated scrap tires.

V. PHYSICAL AND CHEMICAL PROPERTIES OF JUNK TYRES

Tyres are mostly made of rubber. Tyres are many constituent materials that go into making a tyre; the principle ingredient is indeed rubber. A Tyre rubber shred contains the following basic physical values [6].

A. Physical Property

Table 1 Physical Property of Junk Tyres [6]

Physical property	Typical values
Angle of friction	19^0-26^0
Compacted density	600-700 kg/m
Bulk density	350-500 kg/m
Compressibility	20-50%
Cohesion(kpa)	5-1
Loose Bulk density	3.3-4.8 kN/m3
Particle size	12.5 – 20mm
Poisson's ratio	0.2 – 0.35
Resilient modulus	1 – 2 Mpa
Water absorption	0%
Abrasion	0%

B. Chemical Properties

Tyres are complex combination of metals, minerals and hydrocarbons. Car and van tyres made of artificial rubber(styrene and butadiene). Lorry tyres mostly made of natural rubber. They made of vulcanised (cross linked polymer chains). Most commonly used tyre rubber is styrene-butadiene co-polymer- SBR containing 25% styrene. However this may be virgin rubber, synthetic rubber or recycled tyre rubber. Rubber constitutes approximately 30% of a tyre by weight with the remainder made up from other constituents including steel, nylon, rayon, carbon black, fibre glass, aramid and brass. In this process we have taken to find chemical components in the shredded pieces tyres [6].

VI. CONCLUSION

The disposal of waste material is one of the most serious environmental concern globally. There is no difference of opinion that the increasing piles of tires are creating environmental issues. For that matter there must be a way to dispose-off these tires. These tires have potential risks to environment and health. Compressive strength of rubberized concrete depended on two factors; grain size and shape of rubber aggregate and percentage of replacement.

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