A REVIEW ON THE EFFECT OF BAGGASE ASH AND RUBBER TYRE WASTE IN STRENGTH OF CONCRETE

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Abstract - *Concrete industry is one of the major consumers of natural resources. The main aim of sustainable development is to find alternative resources, which could decrease negative effect of concrete industry on environment and contribute to preservation of natural resources. Huge amounts of waste tyres accumulated all over the world are recognized as good supplement for natural resources in concrete. For the construction works, concrete leads main role and a large quantum of concrete is being utilized. This inevitably led to a continuous and increasing demand of natural materials or alternative materials used for their production. In this paper is given a view on possible use of waste tyres and baggase ash in concrete as replacement of part of the aggregate. At present the disposal of waste tyres is becoming a major waste management problem in the world. It is estimated that 1.2 billions of waste tyre rubber produced globally per annum. Only 11% of post consumer tyres are exported and 27% are sent to stockpiled, landfill or dumped illegally and 4% is used for civil engineering works. The mix proportion for M30,M25 grade concrete was derived. Rubber tyre waste has been used as coarse aggregate with replacement of conventional coarse aggregate and it is taken as constant of 10%. This paper outlines a study when the baggase ash and rubber tyre waste is added to concrete.*

Key Words: **Concrete with recycled waste tyres and baggase ash, tests.**

1. INTRODUCTION

Concrete industry spends annually 1.5 billion tons of cement, 900 million litres of water and 9 billion tons of sand and stone [Mehta, 2002]. Since concrete industry is one of the major consumers of natural resources, until today many efforts were made in order to replace non-renewable resources with renewable one without significant influence on concrete properties. In numerous research studies different waste materials were incorporated, depending on properties needed from composite. One of today's major environmental problems are waste tyres, left in environment they present great danger for earth and living creatures. That is why EU has adopted Directive 1999/31/EC [European Commission 1991] which clearly prohibits any kind of waste tyres disposal in environment [3].Concrete is a synthetic construction material made by mixing of fine aggregates, cement, coarse aggregate and water in the proper proportions. Each of these components contribute to the strength their concrete possesses Gambhir, (2004) [1].Ordinary Portland cement is the most extensively used as construction material in the world. Portland cement is the conventional building material that actually is responsible for about 5%-8% of global CO_2 emissions. This environmental problem will most likely be increased due to exponential demand of Portland cement. Today we are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste, utilization would not only be economical, but may also result in foreign exchange earnings and environmental pollution control [2]. Since concrete production is energy intensive and has a high capital demand, the use of alternate materials to replace some of its standard components solves two problems, the first one being the effective disposal of such wastes, in a safe as well as economic manner. Secondly, the incorporation of such additives in concrete can provide several advantages related to its mechanical properties and durability [4-5]. In recent years, due to the rapid development of the automobile industries which result in high demand of cars as a means of transportation, it has tremendously boosted tyre productions. As a result of this increase in tyre production, millions of tyres have been discarded into open fields in form of scrap or waste. There is need for the proper recycling and utilization of such waste, which if not properly disposed, recycled and reused, can cause an environmental pollution. These stockpiles are dangerous not only due to potential environmental threat, but also providing a breeding ground for mosquitoes since tyres often hold water inside which remained warm enough for optimal mosquito breeding [6].Few experiment focuses on coconut shell as the replacement material in the production of concrete. Coconut is grown in more than 86 countries worldwide, with a total production of about 54 billion coconuts every year. India ranks high in the production of coconuts, with an annual production of 13 billion coconuts [7].Whereas on the other side waste tyre creates a fire danger, since a large tyre pile is flammable. Some tyre fires have burned for months, since water does not adequately penetrate or cool the burning tyre. Tyres have been known to liquefy, releasing hydrocarbons and other contaminants to the ground and even ground water, under extreme heat and temperatures from a fire. The black smoke from a tyre fire cause air pollution and is a hazard to downwind properties. (Guneyisi et al., 2004; Siddiquel and Naik, 2004; Khatib and Bayomy, 1999; Li et al., 2004) [6]. The continuous research and development of concrete has resulted in the production of many types of concrete. Each of the concrete possesses their own unique characteristic to meet and suit the demand of industry. Although there are many advantages of concrete such as high compressive strength and low maintenance, the disadvantage is its low loading toughness compared to other materials. Therefore, an alternative material such as waste tyre particles is used as a replacement for concrete aggregate to possibly remedy or reduce such negative attribute. Elastic and deformable tyre-rubber particle could improve concrete properties. (Khaloo et al.,2008; Li et al.,2004). Ganjian et al., (2009) produced two mixes and studied the effect of tyre rubber in the mixes. In the first mix they replaced coarse aggregate particles with chipped tyre rubber, and in the second mix they replaced cement with ground tyre rubber. They reported that the tensile strength of concrete was reduced with replacement of rubber in both mixtures. The percentage reduction of tensile strength in the first mixture was about twice that of the second mixture for lower percentage of replacements. A reduction of 37% with respect to the control sample was observed in the first mixture. This value reached to 29% for the second mixture. Hence, research on the use of rubber in concrete is not conclusive until today. Recycling of non-degradable wastes, particularly discarded rubbers tire has become a major issue since these materials have been banned from landfills and also incineration of these wastes is not environmental friendly. Since last few years, many attempts have been made to utilize scrap tire rubber after some processing, in composite concrete materials such as asphalt pavement, water proofing systems, and membrane liners [9,10,11-12].

2. MATERIALS AND METHOD USED

The materials used to make concrete for the experiment are coarse aggregate, rubber tyre waste and the baggase ash, cement and water. Chip rubber was produced by shredding automobile tyre by an apparatus to 50 – 100 mm in dimension. The wires were removed and later converted into small dimensions of about (10mm) by cutters. Crumb rubber was manufactured by special mills which change big rubbers into smaller torn particles. A shovel was used to mix the mixture to get the required workability. Steel moulds of dimensions 150x150x150 mm, were used for casting which was compacted manually. After 24 hours of casting, the specimens were soaked in water for curing until the age of testing which is 28 days [1].

2.1 Bagasse ash

Sugarcane is major crop grown in over 110 countries and its total production is over 1500 million tons.Sugarcane production in India is over 300 million tonnes per year. The processing of it in sugar-mill generates about 10 million tonnes of SCBA as a waste material. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash. The residue after combustion dominates by silicon dioxide. After the extraction of all economical sugar from sugarcane, about 40-45% fibrous residue was obtained, which is reused in the same industry as fuel in boilers for heat generation leaving behind 8 -10 % ash as waste, known as sugarcane bagasse ash (SCBA). The SCBA contains high amounts of un-burnt matter, silicon, aluminum and calcium oxides In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in the sugarcane harvests [2].

2.2 Natural Aggregates

Natural coarse aggregate were obtained in crushed form were of granite-type. The natural coarse aggregate is of angular shaped crushed granite with maximum size of 20mm and its fineness modulus and specific gravity are 6.8 and 2.9 respectively. Crushed stone and sand gravel are the two primary sources of natural aggregate, which are used directly in construction or as a raw material for construction products such as concrete and bituminous road material [8].

2.3 Tyre Aggregates

Tyre aggregate is the waste product which can be obtained by automobile waste tyre. tyre aggregates from discarded tyre rubber in maximum sizes of 20 mm. Recycled tyre aggregate concrete has good material potential. According to the council of environmental of the cement concrete organization, the recycled tyre aggregate concrete can be used for pavements , concrete shoulders, side walk, curbs, and residential driveways and structural fills [8].

2.4 Water

Water is very actively participated in the chemical action with cement. Potable fresh water with pH value of 7 available from local sources free from deleterious materials was used for mixing and curing of the mixes in this investigation [8].

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3. ABOUT THE PROJECT

In the project 0%, 5%, 15%, and 25% of baggase ash used in M-30,M-25 grade of concrete, cube specimens of size 150mm*150mm*150mm. The tests performed on hardened concrete after 7and 28 days of curing were compression test, and flexural strength test

4. MIX DESIGN

The mix design of M30, M-25 grade concrete is calculated using IS 456-2000 and IS 10262-2009. The material required as per design.

4.1 Test

The specimens must be taken for testing such as compression test, split tensile test and flexure test. Three numbers of specimens in each should be tested and the average value is calculated.

4.2 Compressive strength test

The compressive strength of the cube specimen is calculated using the following formula

Compressive strength Fc = P/A N/mm^2 ,Where

P = Load at failure in N.

A = Area subjected to compression in mm^2

The compressive tests for the concrete cubes should be tested .A constant uniform pressure must be applied by the testing machine to the cubes of the concrete blocks until failure occurs. Cracks should be initially noticed on the specimen and the cracks propagated until failure was finally observed when the cube no longer could resist the force applied to it without failure [1]. It is observed that concrete specimen with 15% has given better results when compared to the control specimen. This shows that baggase ash increase the strength of concrete. Among all concrete cubes, 15% baggase ash concrete shows the best result. In 25% the compressive strength value reduces since baggase ash imparts brittle characteristics to concrete [2].

4.3 Split tensile strength test

The split tensile strength of the cylinder specimen can be calculated using the following formula Split Tensile Strength, fsp = 2P/ ∏Ld N/mm2

Where, P = Load at failure in N.

L = Length of the Specimen in mm.

D = Diameter of the Specimen in mm [2].

The Split tensile strength of the cylinder is observed to be increasing till the 15% of the baggase ash and then decrease slightly with increase in percentage of baggase ash. The percentage of the baggase ash with 15% is found to be reasonable with high split tensile strength compared to the other percentages. [2]

4.4 Flexural strength test

The flexural strength of the specimen is calculated using the following formula

The flexural strength fb = PL/ bd2 N/mm^2

The flexural strength of the specimens will increased gradually with increase in the percentage of baggase ash. The percentages of the baggase ash with 15% will be reasonable than other percentages [2].

5. SCOPE OF THE WORK

As India is fast developing country in all over the world. With the growth of modern societies of industrial revolutions, the movability within automobile sector got momentum. About one crore 10 lakhs all types of new vehicles are added per annum on the Indian roads. The increase of about three crores discarded tyres each year poses a potential threat to the environment. An estimated 1000 million tyres reached the end of their lives per year. Generally all the tyre waste is disposed by burning, during the process of buring very harmful gases are evolved and that polluted the environment. Besides the high temperature causes tyres to melt, thus producing oil that will contaminate water and solid. Still millions of automobile tyres are just being buried all over the world. The major advantage is for the environment. So by using the tyre as an aggregate in concrete we can minimize the environmental pollution [8].

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