Use of Waste Rubber Tyre in Concrete: Mini Review

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Abstract: *Waste-Tyre rubber is one of the most significant environmental hazards worldwide. Because of the increase in auto mobile production, there is a need to properly dispose the vast amounts of used rubber tyres. Owing to the fact that the available sites for waste disposal are rapidly depleting, various countries have already outlawed the retention of waste-tyre rubber in disposal areas. Hence, efforts are being made to discover the prospective use of waste-tyre rubber in construction technology. Crumb rubber is thought to be a potential material for use in concrete technology. It is considered as an alternative to the natural aggregates, used as filler in concrete matrix. Owing to lower strength, the rubberized concrete is recommended for non-load bearing structures and structural members. Rubber aggregates in concrete are mechanically cut to the required sizes. It was effortful, time consuming and was not easy to handle at the initial stages. However, all these complications can be easily figured out if large scale devices, proper cutting tools and machines are available for this particular usage.*

Key Words: *Waste-tyre rubber, environmental hazard, applications, concrete.*

1. INTRODUCTION:

Concrete is a mixture of cement, coarse aggregates, fine aggregates and water[1]. Concrete is cured for 28 days to attain good strength. Various properties are linked with concrete: Workability is considered as fresh concrete property, where as compressive, tensile and flexural strengths belong to hardened concrete properties. Coarse and fine aggregate used in concrete serve as filling and densifying the material[2].

Nowadays, concrete has become the most widely used material due to easy and local availability of sand and coarse aggregates. But there are many drawback of using aggregates in concrete on a large scale. Coarse aggregates are obtained from mountains and rocks through quarry and crushing: Nevertheless, these processes are hazardous and are badly damaging the environment [3].

There is a possible use of rubber tyre particles instead of coarse and find aggregate in concrete. Millions of rubber tyers become waste every year and their disposal has become a serious concern. Moreover, the burning of the waste rubber tyres becomes a cause of pollution for environment. Using rubber in concrete by partial replacing aggregates do not increase compressive and tensile strength than an ordinary concrete but a suitable strength still can be obtained for use in structures. Rubber can be reused in sizes of coarse aggregates as well as ground to the scale of fine aggregates.

2. LITERATURE REVIEW:

Discarded vehicle tyres constitute one important part of solid waste, which had historically been disposed of into landfills. An emerging reuse is the production of concrete, in which waste-tyre rubber particles in part replace the natural aggregates. This has an additional advantage of saving the natural aggregates used in concrete making. Recycled waste-tyre rubber is a rising material in the construction industry due to its low weight, elasticity, energy-absorption, heat and sound proofing characteristics. Waste-tyre rubber can be used as chipped (20-30mm) or crumbed (3-10mm) or ash rubber(less than 1mm) [4].The waste-rubber tyre particles cut into 20mm size are shown in Figure.1. Its benefits are numerous such as reduction of the cost of aggregates and disposal, prevention of environmental degradation, and increase in life span of landfill areas [5]. Concrete pavements are made of high strength mixtures, which lack sufficient flexibility. By partial replacement of fine and coarse aggregates with rubber, sufficient flexibility can be achieved and thermal changes can also be reduced.

It is reported that use of waste-rubber tire particles as partial replacement of aggregates in concrete leads to loss of its strength. However, such concrete can be used for non load bearing purposes such as insulation. Also the lost strength can be compensated by other factors e.g. by the use of magnesium oxychloride in concrete, the strength can be enhanced by 2.5 times [6]. The strength can also be enhanced by using supplementary cementitious materials and admixtures/additives. Also, for higher compressive strength, rubber particles can be made rougher for better bonding with the surrounding mix.

Similarly, for better bonding with the surrounding concrete, the rubber particles can be coated with cement paste, or some epoxy resin. Figure. 2 represents the cut rubber pieces coated with epoxy resin. The toughness of the rubberized concrete is reported to be superior than that of the conventional concrete along with improved ductility[7]–[9].

Rubber has lower specific gravity than the solid components of the concrete. It has been observed that the unit weight of rubber concrete decreases by approximately 4% for every 5% replacement of aggregates . It is reported that by the addition of rubber, workability is reduced and the air content is increased[10]. Several researches have shown that the rubber concrete is more resistant to thermal changes; with the fraction of 5% rubber shreds, cracking is reduced to 0.4-0.6mm as compared to 0.9mm in controlled specimens [11]. Use of rubber crumbs also reduces freeze and thaw damage; by adding 5-10 % rubber, mixture exhibits 60% higher durability factor after 300 cycles of freezing and thawing. It has also been reported that the rubber particles in concrete increase the amount of air content, which is useful for structures subjected to freeze and thaw[12]. Rubber shreds provide sufficient restrain against propagation of micro-cracks.

Figure 1 Waste rubber tyre particles cut into coarse aggregates size

Figure 2 Waste rubber tyre particles coated epoxy resin

3. CONCLUSIONS:

Use of rubber particles in concrete can be useful against its environmental impacts. Its use in concrete reduces its density, workability and strength. The strength reduction can be compensated by a number of other factors. It enhances the ductility and air content of the concrete. It can be used in special circumstances, such as non-load bearing structural members, noise reduction, earthquake resistant structures, foundations for machineries and railways etc.

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