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A REVIEW ON UTILIZATION OF CRUMB RUBBER IN GEOPOLYMER CONCRETE

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Abstract: *One cannot imagine life without transportation and tires keep the transportation rolling and alive. The advents of using pneumatic tires have increased the usage at immoderate level which leads to the causes of tire waste. The reason why the task of its disposal is very challenging as it requires large amount of land area. The present paper enlightens the suggestion of reusing or recycling waste crumb rubber so that technological development can be environment beneficial. The paper represents the recent developments in the field of utilization of crumb rubber waste for green and sustainable construction material. It also reveals the possibilities of utilization of crumb rubber in geopolymer concrete, from the work done so far. The utilization of crumb rubber in geopolymer concrete bears strong potential to meet a demand of healthy environment.*

Key Words: *Crumb rubber, Geopolymer concrete, Waste management, Concrete, Utilization*

1. INTRODUCTION

The term geopolymer was coined by Davidovits in 1978 to represent a broad range of materials characterized by chains or networks of inorganic molecules. There are nine different classes of geopolymer, but the classes of greatest potential application for transportation infrastructure are comprised of aluminasilicate materials that may be used to completely replace Portland cement in concrete construction. These geopolymer rely on thermally activated natural materials or industrial byproducts (e.g., fly ash or slag) to provide a source of silicon (Si) and aluminum (Al), which is dissolved in an alkaline activating solution and subsequently polymerizes into molecular chains

Crumb rubber is the name derived by reducing scrap or other rubber into uniform granules shapes. The use or benefit of crumb rubber is stress absorbing membranes that reduces the reflective cracking because of its elastic properties.The pavement has an increased lifespan because after multiple uses and exposure to different elements, regular asphalt loses elasticity over time. The use of the artificial rubber resists the formation of cracks andkeeps the asphalt in a better condition.
Crumb rubber is recycled rubber produced from automotive and truck scrap tires. During the recycling process, steel and tire cord are removed and that is converting into the granules shapes.The particles are sized are classified based onits color shapes (black only or black and white).Currently, waste materials resulting from various physical and chemical processes are the most important challenge in the industrial and developing countries.
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 done to minimize the environmental damages.In this regard, construction investigators, like other recycling and production industries, have also achieved advances in using these waste materials.
Based on examinations, another way is using the tires in concrete this results in the improvement of such mechanical and dynamical properties as energy adsorption, ductility, and resistance to cracking. However, this may cause a decrease in compressive strength of the concrete which will be compensated by adding Nano silica to rubber- containing concretes.
However, similar research for geopolymer concrete blended or mixed with crumb rubber has not been done in desired level. So that the present problem discussion and it may be the new trends in find at crumb rubber and may be desirable for healthy and friendly environment

2. LITERATURE REVIEW

Literature review on geopolymer concrete
M. I. Abdul Aleem [1] and etc. all investigate that they gives a brief review on geopolymer concrete and conclude that User-friendly geopolymer concrete can be used under conditions similar to those suitable for ordinary Portland cement concrete. These constituents of Geopolymer Concrete shall be capable of being mixed with a relatively low-alkali activating solution and must be curable in a reasonable time under ambient conditions. The production of versatile, cost-effective geopolymer

concrete can be mixed and hardened essentially like Portland cement. Geopolymer Concrete shall be used in repairs and rehabilitation works Mohd Mustafa Al Bakri [2] and etc. all investigate that they gives a review on fly ash based geopolymer concrete and concluded that Fly ash-based geopolymer is better than normal concrete in many aspects such as compressive strength, exposure to aggressive environment, workability and exposure to high temperature.
IRobina Kouser Tabassum [3] and etc. all are gives a review on geopolymer concrete and concluded that the reduced CO2 emissions of Geopolymer cements build them a good alternative to Ordinary Portland Cement. Geopolymer cement produces a substance that is comparable to or better than traditional cements with respect to most properties. Higher concentration of sodium hydroxide solution results in higher compressive strength of geopolymer concrete. Geopolymer concrete has excellent properties within both acid and salt environments.

Literature review on conventional concrete with waste tire rubber

L. Zheng [4] andetc.Allinvestigate that they using rubberized concrete in normal concrete in place of coarse aggregate in normal concrete in various volume ratios. The experiments revealed that strength and modulus elasticity of rubberized concretedecreased with the increasing amount of rubber content based on study the rubberized concrete had a slightly lower cylinder/cube strength ratio compared with normal concrete.
MohdKashifKhan [5] etc all investigate that Used Of Recycled Tire/Rubber as Course Aggregate and Stone Dust As Fine Aggregate in Cement Concrete Works and results shows that the substitution of natural sand to stone dust is taken to 30percentage replacement of weight of sand in ratio 1:1.5:3 of concrete the ultimate strength more somewhat same to the ultimate strength of concrete without substitution. The substitution of natural sand to stone dust up to 40percentage replacement of weight of sand in ratio 1:1.5:3 of concrete led to a corresponding drop in the strength. This is due to the fact that above the 30percentage weight the presence of stone dust tends to reduce the bonding between cement and aggregate Lending to a consequent decrease in strength Finally conclusion is that the use of stone dust and tire used for concrete is reduce the pollution and perform as low weight concrete and used in road base etc.
Swapnil Jain [6] etc all are investigates that Waste Tire Rubber as Concrete it concluded that despite the reduced compressive strength of rubberized concrete in comparison to conventional concrete there is a potential large market for concrete products in which inclusion of rubber aggregates would be feasible which will utilize the discarded rubber tires the disposal of which is an environment pollution problem and Reduction in the compressive and Tensilestrengths with increasing rubber content of the concrete mixes was observed Pradeep [7] etc all are investigates that Use of Scrap Tire Rubber Wastes in Concrete and they conclude that tire waste concrete is specially recommended for concrete structures located in areas of severe earthquake risk and also for applications submitted to severe dynamic actions like railway sleepers. This material can also be used for non-load-bearing purposes such as noise reduction barriers. Investigations about rubber waste concrete show that concrete performance is very dependent on the waste aggregates. Further investigations are needed to clarify for instance which are the characteristics that maximize concrete performance. Nevertheless, future investigations should clarify which treatments can maximize concrete performance being responsible for the lowest environmental impact.
R. BharathiMurugan [8] etc all investigate on the Experimental Study on Rubberized ConcreteThe waste tire crumb rubber is incorporated 5% to 25% in to concrete in place of river sand. It gives acceptable mechanical and durability properties such as compressive strength, split tensile strength, flexural strength, water absorption, sulphate resistance, acid resistance and chloride resistance up to 15% replacement. Hence 15% rubber content is to be considered as the optimum amount.
1G. SenthilKumaran[9] etc all are investigate on Rubberized Concrete and It is evident that from the reduction of compressive and tensile strength can be increased by adding some super plasticizers and industrial wastes as partial replacement of cement will definitely increase the strength of waste tire rubber modified concrete. Many studies reveal that there will be increase in strength enhancements as well as environmental advantages. The future NGC using waste tire rubber could provide one of the environmental friendly and economically viable products. Though problems remain regarding the cost of production and awareness among the society the wastes can be converted into a valuable product. But further research is needed to increase performance against fire.
El-Gammal [10] etc all are investigate on compressive Strength of concrete utilizing waste tire rubber and result or discussion shows that the

1. Concrete casted using crumb rubber as a full replacement to sand shows a significant reduction in the concrete strength compared to the control specimen. However, significant ductility was observed before failure of the specimens.
2. Concrete casted using crumb rubber as a full replacement to sand shows a significant increase in the concrete strength compared to the concrete caste using chipped rubber as a replacement to coarse aggregate.
3. There was no significant increase in the concrete compressive strength and the concrete density when different percentage of crumb rubber, as a replacement to sand, was used in the concrete mix.

4. It is recommended to test concrete with different percentage of crumb rubber ranging between (10% up to 25%) to study its effect on the concrete strength.
5. It is recommended to test concrete with different percentage of crumb rubber with silica fume additive to overcome the significant reduction in concrete strength resulting from the replacement of sand by crumb rubber.
6. It is recommended to use rubcrete in the production of curbs, roads, concrete blocks, and nonbearing concrete wall.

Ankit C. Patel [11] etc all are investigate on Concrete Containing Crumb Rubber as a Sustainable Material and results shows that theCompressive strength decreases by 96.5%, 96.4%, 96.3% and 96.2% at 0%, 10%, 20%, 30% and 40% of rubber contents respectively at 0-30% of flyash.

By replacing conventional fine aggre-gate with crumb rubber, the unit-weight of concrete can be reduced from 14% up to 28% depending on the type and the content of the crumb rubber.

A Mansoor Ali [12] etc all are investigate on concrete by Partial replacement of fine aggregate with crumb rubbercrumb rubber is the product of mechanical grinding of tire showed results were quite satisfactory with no compromise in strength requirements but the concrete is durable. Durability properties on acid attack shows curing on chemicals or crumb rubber treatment with chemicals show good results

YogenderAntil [13] etc all are investigate on rubberized concrete made with crumb rubber and results seen The test results of this study indicate that there is great potential for the utilization of waste tiresin concrete mixes in several percentages, ranging from 5% to 20%. Based on present study, the following can be concluded that the strength of modified concrete is reduced with an increase in the rubber content. Concrete with higher percentage of crumb rubber possess high toughness The slump of the modified concrete increases about 1.08%, with the use of 1 to 10% of crumb rubber..

3. DISCUSSION

Geopolymer concrete itself is a sustainable concrete by adding crumb rubber in it shall be an effective way to get crumb rubber utilized in geopolymer concrete. From review of past observed that replacement of fine aggregates with crumb rubber up to 15% by weight shows positive results in conventional concrete.

4. CONCLUSION

Based upon above literature review it can be concluded that over the last decades, satisfactory research has been conducted on mechanical, chemical and durability aspect of geopolymer concrete. Varying in proportion, curing temperature, curing time and additives. Also satisfactory work has been conducted on different aspect of concrete, blended with crumb rubber waste. However, a need of exact data is felt from the literature review on utilization of crumb rubber in geopolymer concrete.

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