Literature Review on Impact of Chemically Treated scrap Tyre Chips As Course Aggragate In Concrete

Pankaj Dayaram Kute[1], Nikhil Ramesh Rohankar[2], Bharati Fulsing Rathod[3], Sourabh Rajendra Charate[4]
[1, 2, 3] Assistant Professor'Dept of Civil Engineering
[4]Dept of Civil Engineering
[1, 2, 3, 4] MGI-COET, Shegaon.Maharashtra,India..

Abstract- *The idea of using tyre material in the construction materials sector due of its desirable features, such as high resilience to temperature and humidity extremes, lightweight relative to other materials, and good insulating ability. The goal of this study is to look into the use of scrap tyres in the building industry and see how they affect concrete qualities. The literature review and survey were employed to achieve this goal. The findings of the study might be classified as a new reference for scholars and people interested in the concrete and construction industries. The study provided a thorough analysis of the literature as well as a survey of the use of scrap tyres in the building industry and their behaviour. The study could be expanded to look into the impact of tyre debris on the environmentIn this regard, the goal of our current research is to determine the best way to use leftover tyre rubber as coarse aggregate in concrete composites. When compared to standard M30 grade concrete, 10 percent, 20%, and 30% of the tyre aggregate was replaced with coarse aggregate. Because of its light weight, energy absorption, flexibility, and heat insulating qualities, deserted tyre rubber is a reliable material in the construction industry as a coarse aggregate replacement. This has the additional benefit of reducing the amount of natural aggregate used in the production of concrete, as well as making the concrete lighter in weight. The various applications of discarded tyre rubber are arranged and discussed in this survey.*

Keywords- waste tyres, concrete, compressive strength, tensile strength

I. INTRODUCTION

The rapid expansion of transportation and the massive increase in the number of cars has resulted in a slew of issues, the most serious of which is environmental pollution. There are severe reasons for the burning of millions of tonnes of tyre waste. In the United States, for example, more than 240 million acceptor tyres were produced in 1990. According to the United States Environmental Protection Agency, between two and three million write-off wheels have accumulated in illegal caches and unmanaged gum cesspools around the country, with millions more strewn about in Ghats, shops, boards, and recreation areas. Countries such as the United States and the United Kingdom are burying underground tyres for disposal to avoid other pollution that may result from the combustion of these substances to avoid the dangerous effects of chemical gases produced by the combustion process, such as sulphur dioxide, and the distribution of carbon particles in their environment. Because of their strong resilience to shock absorption, many studies have attempted to utilise the large amounts of rubber tyres trash and reduce environmental pollution by mixing them with asphalt to generate mixtures used for road paving.As a result, highway design includes a visible bazaar for waste wheel recycling. Some countries, on the other hand, employ these tyres to make shock-absorbing pavement layers. The recycling rates of several items are depicted in Figure 1. Researchers have begun a number of large-scale investigations relating to the use of recycled tyre crops in construction. The idea of using used tyre material in the construction materials sector because of its ideal features such as high resilience to temperature and humidity weather conditions, light weight compared to other materials, and excellent insulation ability. Tires used in concrete and building activities provide a number of economic advantages, including. Reduce pollution and avoid the accumulation of tyres that have been consumed without being burned.As a result, highway design includes a visible bazaar for waste wheel recycling. Some countries, on the other hand, employ these tyres to make shock-absorbing pavement layers. The recycling rates of several items are depicted in Figure 1. Researchers have begun a number of large-scale investigations relating to the use of recycled tyre crops in construction. The idea of using used tyre material in the construction materials sector because of its ideal features such as high resilience to temperature and humidity weather conditions, light weight compared to other materials, and excellent insulation ability. Tires used in concrete and building activities provide a number of economic advantages, including. Reduce pollution and avoid the accumulation of tyres that have been consumed without being burned. Old frames, for example, can be painted in vibrant hues, as can chairs and tables. The goal is to repurpose used tyres as construction materials. The environment in our country, India, is being polluted by a vast amount of waste materials created

by companies. Considering the points raised in the preceding part, this research focuses on the recycling of one such waste item, namely old tyre rubber.1. Waste tyre management will not only benefit the environment, but it will also benefit the structure's economy when it replaces a more expensive material due to its abundant and free availability. 2. Rubber aggregates have a greater potential for usage in earthquakes than natural rock aggregates since they are more flexible and lighter. 3. Rubberized concrete has a better ability than regular concrete to attenuate vibration shocks during earthquakes.

II. LITERATUREREVIEW

Waste rubber tyres are one of the most major environmental issues facing the globe today, owing to the increased manufacturing of automobiles and the necessity to dispose of large quantities of waste tyres. Many nations have outlawed the disposal of waste rubber tyres in landfills due to the rapid depletion of existing waste disposal sites. As a result, attempts have been made to find potential waste rubber tyre applications in civil engineering projects. Rubber tyre chips are a waste product that is perfect for use in concrete. This has the added benefit of saving natural aggregates, which are becoming increasingly limited in concrete manufacture. Accordingly, the following is a synopsis of a few such studies:

1. **Ganjan, Khorami and Maghsoudi (2009) :** investigated the performance of concrete when cement and aggregate were replaced with rubber of 5, 7.5, and 10 percent. Two sets were made, where one set had chipped rubber of different percentage by weight in replacement of aggregate and other had scrap tyre powder of different percentage in replacement of cement. Different durability and mechanical tests were performed. The result showed up to 5 percent replacement in each set no major changes of concrete character. But further increase of rubber shown considerable changes like compressive strength at 28 days reduced to 10 to 23 percent for aggregate and 20 to 40 percent for cement replacement. Modulus of elasticity reduced to 17 to 25 percent in the case of 5 to 10 percent aggregate replacement and 18 to 36 percent reduction for powdered rubber. Tensile strength reduced to 30 to 60 percent in case of 5 to 10 percent replacement of aggregate and 15 to 30 percent for powdered rubber. Flexural strength also reduced to 37 percent for aggregate and 29 percent for cement. And water permeability increased in case of coarse aggregate replacement but decreased in case of cement replacement.[1]

2. **Eshmaiel Ganjian, Mortezan Khorami (2009):** in this research author investigated that the performance of concrete mixes including 5, 7.5 and 10 % of waste tyre rubber as aggregate and cement. Several projects have been conducted on replacement of aggregates by crumb rubbers. To study characteristics of tyre crumb rubber concrete, two sets were made. In the first set coarse aggregate replaced by waste tyre chips and in second set scrap tyre powder was replaced for cement. For examination mechanical tests were conducted such as compressive strength, tensile strength, flexural strength and modulus of elasticity. The results revealed that with up to 5 percent replacement, in each set, there were no major changes in concrete characteristics but in further increase in replacement ratios significant changes were observed [2]

3. **Abaza and Shtayeh (2010):** researched that crumb rubber from used tires can be used with Portland Cement Concrete (PCC) for the production of non-structural PCC. Fine aggregate (beach Sand) can be replaced using the volumetric method by crumb tyres at different percentage of replacement for the various types of PCC. As the percentage of crumb rubber increases, the compressive strength decreases and also density decreases. Water absorption increases partially with increase of crumb rubber. Abrasion, Noise insulation and Thermal Insulation also increase with the increase of crumb rubber percentage. It is recommended that crumb rubber should be used for non-structural PCC such as floor rips, partitions, support stone structures, concrete blocks and other non- structural uses.[3]

4. **K. C. Panda, P. S. Parhi And T. Jena (2012)**: In this paper author works on causes of decrease in the strength of concrete when waste tyre rubber was used. The causes are as follows. Lack of appropriate bonding among waste tyre rubber particles & the cement paste. Due to replacement of the aggregates by waste tyre rubber, the weight was decreased. High concentration of waste tyre rubber at the upper layer of sample due to lesser specific gravity of the waste tyre rubber particles. Due to non-uniform distribution of rubber particles in the concrete, which in turn results in decrease in concrete strength. The stiffness of rubber is lesser as compared to stiffness of coarse aggregate, the presence of rubber particles in concrete reduces the concrete mass toughness and also decreases load bearing capacity of concrete [4]

5. **Xiangshu and Huang (2014)**: stated that increasing production of tyres causes huge pile of waste tyres as waste which are currently applied in civil engineering practices, such as modifiers to asphalt paving mixtures, used as an additive to Portland cement concrete, .used as light weight fillers, used in whole tyres as crash barriers,

bumpers, and artificial reefs. It was concluded that use of waste tyre in asphalt paving mixture is being now widely gaining attention due to its economical, technical, environmental benefits. Addition of crumb rubber can lead to increase resistance to major modes of asphalt stresses. If constructed well then it can serve better than conventional asphalt roads.[5]

6. **Khalil, Abd-Elmohsen, and Anwar (2014)** researched that impact loads because of boat crash on water system structures was essentially diminishing their sturdiness. Loss of material and degradation are very basic issues confronting lock dividers and wharfs. With the increase in rubber percentage the protection to impact increased, however there was an abatement in specimen strength and modulus of elasticity. Here principle impediment is that the increase in rubber content lessens the compressive strength of such blends in as for concrete blends in with no rubber content. And this type of loading, its contribution to the internal stresses and the necessary protection must be concentrated on different kinds of structures[6].

7. **Fiore, Marano, Marti, and Molfetta (2014)** examined that incorporation of rubber aggregates got from waste tyres in cement-based materials can be a reasonable answer for some engineering manufactures, at the same time offering a chance to reuse non-reusable tyres. Various rates of rubber particles, from 0% to 75%, were utilized in the cement-based blends and for every percentage; the appropriate measure of sand was researched by experimental sensitivity tests so as to accomplish the best exhibitions. Regardless of certain downsides, for example, the lessening in compressive and flexural qualities, the high shrinkage, and the vulnerability to sulphate attack, the tests show that the proposed rubber cement composites have fascinating properties that can be valuable particularly for non- structural applications.[7]

8. **Prof. Waruldkar A A., Mr. Valekar N. S. (2015)**: According to author study, the rise in automobile industry there were major challenge in front of solid waste management to dispose the automobile waste. The non-degradable nature of the rubber and consequent disposal problem has led to a serious ecological impact in the recent decades. Due non-degradable nature of waste tyre rubber there were serious impact on environment. To recover this problem many research had been done. The using this discarded material in concrete can be resolve these problem. It is expected that 60 percent discarded tyres are disposed via. Unfamiliar routes in the city as well rural area. It causes environmental impact so it can be use as construction material because concrete is widely used material in construction. This certainly led to a constant and increasing demand of natural material used for their production and also to preserve natural resources by using alternative material which are reused waste material. In these research the use of recycled rubber waste tyre as a partial replacement for the coarse aggregate in concrete construction by using locally available waste tyre. The concrete mix design was prepared by using M-20 grade of concrete. The specimens were cast at a percentage replacement of coarse aggregate by waste tyre such as 1%, 2% and 5%. The prepared samples contain of concrete cubes, cylinder, beams. The tests conducted are slump, workability, compressive strength, Tensile strength, Flexural strength. The data collection was based on the tests conducted on specimens in the laboratory. [8]

9. **Sofi (2016)** investigated the effects of using scrap rubber tyre instead of Natural Aggregates in concrete. Brittle failure was found in control concrete whereas concrete with rubber did not show brittle failure. Under flexural tensile loading brittle failure was observed. When rubber content increased from 20-30% the flexural strength decreases. For control concrete diagonal cracks were seen and for concrete using waste tyre rubber, formation of horizontal cracks were observed. When crumb rubber percentage increases, flexural strength decreased. Water absorption decreases upon increase in size of the rubber particles. The crumb rubber particles present in the rubberized concrete arrested formation of cracks and material separation. Therefore, the main application of rubber concrete may be focussed in pavements, floors and concrete highways, hydraulic structures such as tunnels and dam spillways, and other similar rest.[9]

10. **Almaleeh, Shitote and Nyomboi (2016)** researched that waste rubber can be utilized as development material. Tyres cut into pieces with greatest size of 20 mm to use as coarse aggregate and crumb rubber tyres utilized as fine aggregate. The substitution was done in 3 stages. One was elastic tyres supplanted 50 percent of typical sand. Second was coarse rubber tires supplanted 50 percent of ordinary rock. The last one was both fine and coarse rubber tyres were utilized to supplant the sand and rock by 25, 50, 75 and 100 percent. Compressive quality, splitting tensile and flexural strength tests were led. Despite the fact that, concrete made of tyres had lower strength than normal concrete, it had elastic failure conduct. Compressive quality diminished to 5MPa on lower substitution and can be utilized in pathways. The weight of concrete was diminished and gave advantage for building finishing.

Plastic energy increased with increment of rubber content. The flexural quality diminished by 65 percent with increment of rubber percent. In this manner, it doesn't support bending. Splitting tensile strength likewise decreased up to half of the strength of the control.[10]

11. **Khitab, Arif, Awan, Anwar and Mughal (2017**) directed that the Waste-Tyre elastic is one of the most significant natural risks in our reality. Since step by step car creation turning out to be spreading quick in our reality. In this way, there is a need to appropriately arrange the tremendous measures of utilized rubber tyres. Attributable to the way that the accessible destinations for squander removal are quickly diminishing, crumb rubber is thought to be a potential material for use in concrete technology. It is considered as an option to the natural aggregates, utilized as filler in concrete matrix. Inferable from lower strength, the rubberized concrete is suggested for non- load bearing structures and structural members. Rubber aggregates in concrete are precisely sliced to the necessary sizes. It was effortful, and it takes a great deal of time and was difficult to handle in beginning levels. Rubber has lower specific gravity than the strong components of the concrete. Utilizations of waste rubber crumbs additionally lessens freeze and defrost harm; by including 5-10 % rubber. Blend shows 60% higher durability factor after 300 cycles of freezing and defrosting.[11]

12. **Xue and Cao (2017)** conducted experiment on the amount of use of modified rubber particles on the properties of cement mortar. The experimental results showed that on adding rubber particles, the toughness of the cement concrete was increased. Also, ratio of compressive strength to flexural strength was the smallest when the mixing amount of rubber was 19%. Meanwhile the impact resistance was high at that moment and drying shrinkage was rational. So, it was concluded that appropriate mixing amount of rubber particle in this test was 19%.[12]

13. **Shahid Rasool Tarry (2018):**In this paper author investigated that rubber has great ability of becoming an everlasting member of concrete because of its extensive range of decent properties like better flexibility, light weight and easy availability. It can be very eco-friendly to use this discarded material in construction industry. Treated rubberized concrete has more compressive strength as compared to the untreated rubberized concrete. However, even after the surface treatment is given to the rubber, only 92.57% compressive strength of normal conventional concrete is regained. Flexural and split tensile strength of almost all replacement levels of treated rubberized concrete is found to be more than in the normal conventional concretes. 28 days flexural and split tensile strength is found to be highest at NTR-5 and NTR-15 respectively. The resolution of this study was to determine if a waste material like worn out tyres enhance the basic properties of concrete. It is considered that used tyres would provide much greater opportunities for value adding and cost recovery, as it could be used as a replacement for more expensive material such as rock aggregate. Using rubber aggregates decreases the workability of the resultant mix, but this problem can be dealt with the use of the certain plasticizers [13].

14. **ParthSaika, OwaisMushtaq and A. Arunya, (2016)**:In this paper author investigated thatthe discarding of waste tyres is serious concern all over the world as it causes environmental problems. Our major goal was to use leftover tyre rubber chips as a partial replacement for coarse aggregate in concrete. The utilisation of leftover tyre rubber chips in concrete is both cost-effective and environmentally benign. The strength of concrete was tested using discarded tyre rubber chips as a partial replacement at varying percentages. At a 7-day curing period, compression and split tensile tests were performed on three different percentages of rubber chips, namely 0%, 4%, 8%, and 12%. The findings of the experiments show that as the amount of rubber chips in the concrete increases, the concrete's strength decreases.But in case of 4% replacement of waste tyre rubberchips in concrete it shows the maximum strength compared to the other percentage replacement that is 8% and 12%. The observed strength of control specimens and 4% replacement of waste tyre rubber chips in concrete found to be almost identical.[14]

15. **Oğuzhan Yavuz BAYRAKTAR, 2Gülsüm SAĞLAM ÇĠTOĞLU and 3Adel Easa Saad ABO AISHA (2019)**: in this paper author investigated that Many researches indicated thebenefits of use of recycledthe role of tyres in boosting the architecture and building industry's sustainability. In addition, usage the recycling tires decreasing cost and the need for natural resources, and giving solutions to environmental pollution. This research trying to spotlight on the using of tires wastes and reuse them in the Architectural usages, and given suitable idea about the recycling and itbenefits.[15]

III. DISCUSSION

1. For the concrete mix, Portland Composite Cement with 4.75 mm to 9.5 mm khoa as coarse aggregate and river sand as fine aggregate was employed.
2. Physical properties of fine and coarse aggregates are used for this. According to studies, shredded tyre rubber with a diameter of 15-25mm substituted course aggregate by 5%, 10%, and 15% by volume.
3. The water cement ratio in the concrete mix was 0.55. For compressive strength tests, a total of 24 cubes were manufactured and cured for 7 and 28 days.
4. For split tensile strength testing, another 24 cylinders were manufactured and cured for 7 and 28 days, and another 24 beams were made and cured for 7 and 28 days for flexural strength testing and shrinkage testing.

IV. CONCLUSION

From the literatures survey and their experimental study with their results the following conclusion is obtained. Rubber aggregates are feasible solution for Concrete production, economically and environmental. This Study provides a solution for disposal of rubber tyre which can be used as a aggregate at certain limit. This experimental study concluded that the reduced compressive strength of rubberized concrete in comparison to conventional concrete within acceptable limit.In this investigation, we discovered that rubberized concrete has a lower Split tensile strength than normal concrete. In this experiment, we discovered that rubberized concrete has a lower flexural strength than normal concrete. Rubberized concrete cost is less as compared to conventional concrete. Concrete produced is light weighted by 0.99% than conventional concrete. Rubberized concrete's low unit weight properties may make it suitable for architectural applications such as stone baking and interior construction. It can also be used as an earthquake shock wave absorber in buildings where vibration damping is required, such as machinery foundations and railway.

REFERENCES

[1] Ganjian, E., Morteza, K. and Maghsoudi, A.A.(2009).Aggregate and filler in concrete can be replaced with scrap tyre rubber. Construction and Building Materials, vol. 23, no. 5, pp. 1828-1836

[2] Eshmaiel Ganjian, Mortezan Khorami, “Scrap tyre-rubber replacement for aggregate and filler in concrete”, Construction and Building Materials, Volume 23(5): 1828-18

[3] Abaza, O.A. and Shtayeh, S.M., 2010For non-structural Portland cement concrete applications, crumbed rubber is used. 37(2)36, Dirasat.

[4] K. C. Panda, P. S. Parhi and T. Jena, "Scrap Tyre-Rubber Replacement for Aggregate in Cement Concrete: Experimental Study," International Journal of Earth Sciences and Engineering, (11): 1692-1701. Jena, "Scrap Tyre-Rubber Replacement for Aggregate in Cement Concrete: Experimental Study," International Journal of Earth Sciences and Engineering, (11): 1692-1701. Parveen

[5] Shu X, Huang B. (2014). An overview of waste tyre rubber recycling in asphalt and Portland cement concrete. 17-24 in Construction Building Material, 67:2.

[6] Eehab Khalil, Mostafa Abd-Elmohsen & Ahmed M. Anwar (2015) Impact Resistance of Rubberized Self-Compacting Concrete, Water Science, 29:1, 45-53

[7] Fiore, Alessandra Marano, Giuseppe Carlo Marti, Cesare Molfetta, Marcello (2014): On the Fresh/Hardened Properties of Cement Composites Incorporating Rubber Particles from Recycled Tires, Advances in Civil Engineering, v. 2014 (2014

[8] Prof. Waruldkar A A., Mr. Valekar N. S. : “Study on the behavior of rubber aggregates concrete beams using analytical approach”, Engineering Science and Technology on International Journal (2016).

[9] "An overview of sustainable concrete made from scrap tyre rubber with waste tyre rubber - An overview," vol. 9, no. 2, pp. 848–853, 2016.

[10] Almaleeh, A. M., Shitote, S. M., & Nyomboi, T. (2017).Waste rubber tyres are utilised as a concrete ingredient. Journal of Civil Engineering and Construction Technology, vol. 8, no. 2, pp. 11-19.

[11] Khitab, Arif, Awan, Anwar and Mughal (2017). “Use of Waste Rubber Tyre in Concrete: Mini Review”, International journal for innovative research in multidisciplinary field, 3(12), 21–23.

[12] Xue and Cao (2017). Advances in Civil Engineering, Effect of Modified Rubber Particles Mixing Amount on Cement Mortar Properties. 1–6. 2017.

[13] Shahid Rasool Tarry. (2018).Effect of using untreated and treated tyre rubber aggregates to partially substitute coarse particles in concrete.3(1):65-69 in International Journal of Advanced Science and Research.

[14] ParthSaika, OwaisMushtaq and A. Arunya,,“Effect of Recycled Waste Tire Rubber as Coarse Aggregate on the Performance of Concrete” IJET – VOLUME 4 Issue Journal of Engineering and Technology, (2018).

[15] Oğuzhan Yavuz BAYRAKTAR, 2Gülsüm SAĞLAM ÇĠTOĞLU and 3Adel Easa Saad ABO AISHA “The Use of Scrap Tires in the Construction Sector” Volume 6(1), ISSN: 2394-9333 www.ijtrd.com