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The Use of Scrap Tires in the Construction Sector

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***Abstract*—**The mind out of utilizing tire material in the construction materials industry because of its suitable properties such as high resistance to weather conditions of temperature and humidity and lightweight compared to other materials, and the ability of high insulation. This research aims to study using of scrap tires in the construction sector and find out its effect on the concrete properties. To reach this aim, the literature review and survey has been used. The research finding can be classifying as new reference to researchers, those who studies concrete and construction sector. The research given good literature review and survey of using of scrap tires in the construction sector and its behavior. The research could be extended to study the effect of tires scrap on other responses with other mechanical tests.

Keywords*—Scrap tire, Construction sector, Literature review and survey, Effect, and Properties.*

I. INTRODUCTION

The great development in transportation and the huge increase in the number of cars produced a lot of different problems, which the most important environment pollution. Behind the burning of millions tons of tire waste are very serious. For example, in 1990 more than 240 million acceptor tires were cast up in the U.S. The U.S. Ecological Safeguard Agency forecast that two and three million write-off wheels have in first place cumulative in unlawful stockpiles and uncontrolled gum cesspools all the territory, with millions over messy in ghats, products, boards, and leisure lots. Countries such as the United States and Britain are adopting the method of burying underground tires for disposal to avoid other pollution that may result from the combustion of these substances to avoid the dangerous effect of the chemical gases produced by the combustion process such as sulfur dioxide and the distribution of carbon particles in the air [1-4].

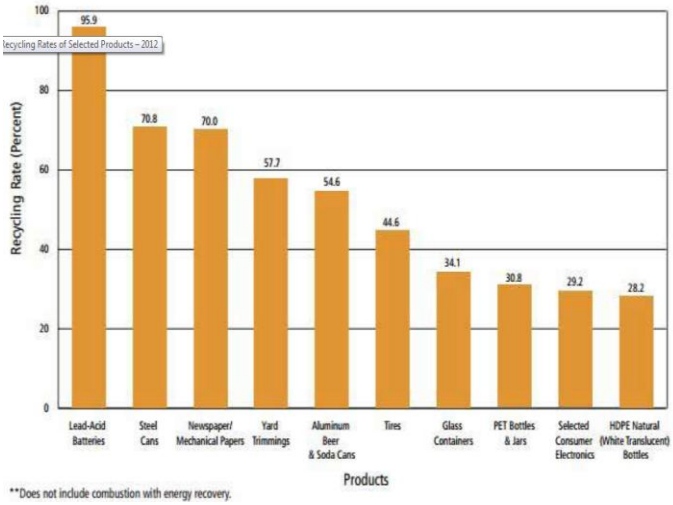

Figure 1: The percentages of recycling products [6].

Many researches have sought to use the enormous amounts of rubber tires waste and to reduce environmental pollution by mixing them with asphalt to produce mixtures used for road paving, because of their high resilience to shock absorption. For this reason, highway architecture maintains a prominent bazaar for waste wheel recycling. On the other hand, some countries use these tires to manufacture shock protection layers for pavements. Figure 1 shows the recycling rates of selected products [5].

Researchers begin sundry grand studies interrelated to employ recycled tire crops in the building. The idea of utilizing the used tire material in the construction materials industry because of its suitable properties such as high resistance to weather conditions of temperature and humidity and light weight compared to other materials, and the ability of high insulation [7-14]. The use of tires consumed in concrete and construction work has several economic benefits, including:

1. Reduce environmental pollution and prevent the accumulation of tires consumed without burning.
2. Manufacturing of lightweight insulating concrete.
3. The manufacture of concrete blocks light has an economic impact on the total cost of construction, as it reduces the weight of loads on the basis and time of completion and provision in the cost of transport and construction.
4. Provide high thermal insulation without the need to use coolers and heating.

II. DEFINITIONS

A. General definition of recycling:

Is the process of taking advantage of damaged materials that were thrown as waste, and converted into valuable materials.

For this reason, highway architecture maintains a prominent bazaar for waste wheel recycling. **recycling:**

The efforts of organizations are commendable and extremely effective in diverting tire waste from landfills to practical use products; however, there is still time for further refinement of how we process waste tires. Is the collection of damaged tires that cannot be re-installed for cars and converted into useful and valuable materials. Recycling may require manufacturing processes in order to extract raw materials. For example, tires undergo manufacturing operations to extract rubber and iron, or recycling of material by giving it a new value, for example adding accessories to it and thus becoming more useful. For example, old frames can be painted in bright colors and chairs or tables for tables and tables are prepared [20-25].

III. THE OBJECTIVE OF RECYCLING

- Reduce the rate of waste on the globe surface.
- Preserving the environment, especially since many materials need hundreds of thousands of years to decompose, and the current situation is working to increase the state of global warming.
- Reduce the cost of production, because the cost of recycled materials is less than the cost of new materials.

- Energy saving, since the energy needed to produce refined materials is lower.

IV. TIRES RECYCLING

In the modern era and with the great development in the car industry, and the increase in numbers on the roads in various countries around the world, a large problem has emerged, the amount of tires that are destroyed annually due to consumption and the end of life or the occurrence of accidents that make them unusable again, These tires accumulate significantly and are estimated to be around the world in billions and problems are caused by the inability to discharge them, so there was a need to exploit these tires and benefit from them [15, 16, 17, 26, 27]. There were four main ways of recycling tires:

A. Furniture Production

The use of frames as an alternative to some pieces of furniture, such as tables and chairs, especially in the gardens after decorating and coloring in attractive colors consistent with the overall decor, but this is not a real solution to the problem because of the large number of tires that are destroyed annually. Depend on the dismantling of the tire structure to get at its raw components.

B. Restoration of old tires

The old frame is repaired by removing the rough and faulty surface by using abrasive and smoothing machines for the surface. A new layer is then put in place and the adhesive is in a melting rubber material. The frame surface is exposed to thermal heating. The adhesive is then dissolved and merged with both the new surface and the frame, becoming a single block. This process is called the name of the frame.

C. Energy production

It is possible to melt tires at very high temperatures in reactors without oxygen, when evaporated melt is condensed by water through pipes passing through and produces useful materials, such as diesel and rubber and steel. But keep in mind that outdoor tires are not burned by factories or individuals, to avoid the release of many toxins into the atmosphere, from toxins emitted when tires are burned into the atmosphere by toxic gases: carbon monoxide, sulfur oxide, nitrogen oxides, and hydrogen chloride. Burning tires in the atmosphere also produces toxic quarries like ratsbane, cadmium, nickel, spelter mercury, chromium. These metals, if applied to the earth's layers and reached the groundwater, pollute them. This is a great loss [18, 19, 20, 28].

D. Extraction of raw materials

Where the following materials are extracted from the frame, where figure 2 shows the tires raw materials.

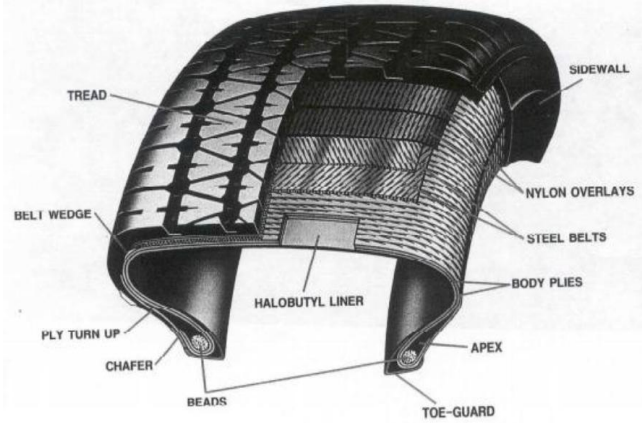

Figure 2: The tires raw materials and binders [6, 29].

1. Rubber.
2. Iron metal especially wire.
3. Fibers yarns.

E. Application of rubber

The follow rubber is wasted in plenty of industries, such as the manufacture of sports stadiums, and in the shoe industry. There is more than one mechanism for extraction of raw materials, which can be summarized as follows:

1. Direct cutting and grinding of frame

The frame passes through a cutting and grinding system, with the aim of cutting it into small pieces. The system contains a number of magnetic separation equipment, sieves to determine the diameter of the resulting pieces of each stage, it can be reached rubber to the degree of powder. But the smaller the diameter of the resulting pieces, the higher the stages and the higher the cost of production, the more expensive the method, which is dependent over the somatic or mechanical property of the ensuing ingredients.

2. Cooling and grinding

As is known, the cooling of the material increases its fragility, and thus helps in the ease of breaking it and dispersion, nitrogen gas is used for this purpose. Then the frame passes through a system of splinters and magnetic equipment to separate the materials as in the first mechanism. Therefore, the energy needed to cut the frame less and the stages of the frame to separate the materials and cut them less as well, while the cost of production is higher because of the high prices of nitrogen.

3. Chipping by adding solvents

The frame is immersed with hydrocarbon solvents that dissolve the bonds between the rubber particles, thus weakening the material, making it easier to separate.

4. Tire shredding and recycling as a comprehensive solution

Tire shredding and recycling that are currently in most countries of the world do not require large amounts of energy and can be carried out in small workshops and do not need large investments. The production lines are often relatively cheap, and do not need high expertise to operate, and can do this The process through three basic steps is:

- The steel wires in the frame are pulled out, either by cutting off the piece containing the wire and then removing the rubber elbows from it, or by pulling those wires with special bolts of great strength.
- The rubber part is cut into a rubber powder, or it is inserted into a granulating machine that produces rubber granules suitable for use in rubber extrusion machines, or is transported to use asphalt to cushion the roads and make them more resistant to natural conditions [30, 31].
- Wire drawn from tires can be recycled by smelting and remodeling to interfere in the manufacture of new steel equipment. It can also have a single recycling plant that can work with millions of tires a year and solve its problem completely. The factory may have all the stages of the recycling line, or one stage, such as pulling wires and tires. And transfer them to other plants to complete recycling or may be concerned with the re-production of new rubber products from recycled rubber granules, preferably recycled rubber

is mixed with new rubber to improve its properties and facilitate the formation process.

V. RUBBER AND CONCRETE

The largest quantity of recycled in engineering applications is waste tires. Exploratory on cement-based crops replaced of wheels elasticated - like concrete, daubs - exerted for very suns to investigate the back demand application of waste elasticity in concrete output. Surviving rubbers wasted for partly switch the amounts in daubs or concrete. Tire elasticated can be second handed for propagate workable concrete for apparent enforcements and ensured that adequate choice processes are stand - with the inclusion of the supply, gradation and mould of tire corpuscle. Figure 3 shows the Rubber particles by a stereoscope. While Figure 4 shows the portion deals with the property of nor grout neither concrete altered with left tire rubber. Elasticated particles are watched to be homogeneously distributed in the cement priming with no division [27, 32, 33, 34].

Figure 3: The Rubber particles by a stereoscope [32].

Figure 4: The Rubber distribution in concrete mixture [32].

VI. LITERATURE SURVEY

Literature survey about using tires recycling in the construction sector, and its affected.

N. OIKONOMOU & S. M A V R I D O U, (2009) studies the use of waste tire rubber in civil engineering works. They indicated that recycling of tires in the applications mentioned above represents a suitable means of disposal for both environmental and economic reasons. The research finding shows that the rubber tires, in different shapes and sizes can be used in many civil and no civil engineering applications – such as in the production of rubber composites, as a fuel in cement kilns, by incineration for the production of electricity, as an aggregate or additive in cement products, in road construction, as lightweight fill for embankments or as backfill material for retaining walls [32].

Farrag & Nermin Mokhtar, (2016), they study the utilization of waste-tire ingredients in the architectural implementation in Egypt. They mentioned that there are the benefits in increasing sustainability of the architectural usages and construction industry while decreasing cost and the need for natural resources, and giving solutions to environmental pollution [6].

Shu Xiang & Huang Baoshan, (2014), They mentioned that waste tires cannot be recycled properly, creating significant environmental and health problems. In addition, it summarizes the latest developments at the access of residual caoutchouc in Portland cement concrete. They analyzed the property of recycled asphalt coating or fervent blend asphalt. Portland cement contributes to its work by proposing various methods on its performance [34].

Johnny Bolden et al, (2013), they study the utilization of recycled and waste materials in various construction applications. This study presents an initial understanding of the current strengths and weaknesses of the practice intended to support construction industry in developing effective policies regarding uses of waste and recycled materials as construction materials. This include the benefits in enhancing sustainability of the construction industry while reducing cost, providing solutions to environmental pollution and reducing the need for natural resources [35].

Adriana Baglioni et al, (1994), they study the scrap tire as building material. The mentioned in their finding that the use of reclaimed rubber for the manufacturing of traditional end products of common use may represent a solution to the problem of waste lire disposal [36].

Rafat Siddique & Tarun R. Naik, (2004), they study the properties of concrete containing scrap-tire rubber – an overview. They conclude that workable rubberized concrete mixtures can be made with scrap-tire rubber. While, The reduction in compressive strength of concrete manufactured with rubber aggregates may limit its use in some structural applications, but rubberized concrete also has some desirable characteristics such as lower density, higher impact and toughness resistance, enhanced ductility and better sound insulation [37].

CONCLUSION

Many researches indicated the benefits of use of recycled tires in increasing sustainability of the architectural usages and construction industry. 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 it benefits.

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