International Scientific Journal of Engineering and Management
Volume: 04 Issue: 01 | Jan – 2025
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata
ISSN: 2583-6129
DOI: 10.55041/ISJEM02236

Manufacturing of Chairs, Tables and Planters from Recycled Car Tyres for Sustainable Applications

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Abstract. The high rate of increasing automotive use has led to high end-of-life car tyre stock-pile, which presents serious environmental and disposal problems. This work discusses the production of the chairs, tables, and planters made on the basis of the recycled car tyres as the sustainable alternative to the traditional materials. The work is concerned with the choice of materials, designing factors, and fabrication techniques to provide structural strength, stability, and functionality of the created products. The waste tyres were subject to cleaning, cutting and surface treatment then they were assembled mechanically together with supporting frames to get usable furniture and planter units. The products that were produced were tested on the basis of load-bearing capacity, stability, usability, and the visual appeal. These findings indicate that the products made by recycling tyres can be quite convenient in fulfilling the functional needs and preventing the excessive waste of materials and their harm to the environment. The suggested solution will help to improve resource use and facilitate the theme of the circuit economy by extending the life of automotive waste. This paper underlines the possibility of recycled tyres to be used as a potential material in the production of sustainable products in city and semi-urban settings.

Keywords: Sustainability, Car Waste Tyres, Welding, Network Cables, Wood, etc.

1 Introduction

The rapid urbanization and growth in car tyre ownership has resulted in a significant increment of the end-of-life car tyres that raise serious environmental issues because they are non-biodegradable and have a complicated way of disposal. The traditional processes of discarding waste like landfilling and open burning are contributing to land degradation and air pollution hence the need to develop sustainable reuse techniques [1]. One viable way to address such challenges and save the natural resources is through recycling and upcycling of car tyres into value-added products. Sustainable product manufacturing has been in the spotlight of recent years as one of the methods to help minimize the use of materials and encourage the principles of a circular economy [2]. Furniture and planter uses demand materials that are strong, durable and withstand exposure to the environment and therefore recycled tyres are also a good substitute. In this work, the recycled car tyres are discussed in terms of chair, tables, and planters manufacturing, where the emphasis is placed on practicable fabrication methods and functionality [3]. The aim is to show how automotive waste can be used to produce durable and sustainable products that can be used both in the domestic and urban use.

2 Wooden Support inside the tyres to provide the strength

Wooden supports were included in the cavity of tyres in order to increase the rigidity of the products made using recycled tyres. The support system was made of four wooden members placed at similar distances across the internal circumference of the tyres to provide a balance in the distribution of load [4]. The cross-sectional size of each wooden component was 25 mm x 25 mm because it seemed to be a sufficient size to be strong enough and at the same time not too heavy. The members were wooden in nature and they were cross structured and this enabled the applied loads to be transferred properly to the supporting frame without deforming the rubber material greatly [5]. This internal support enhanced the stability and carrying capacity of the planters, tables and chairs, Figure 1. The wood supports incorporated

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to the structure of the recycled tyres allowed its structure to be in shape during the service, which, in turn, increased the durability of its performance and functionality [6].

Fig. 1. Wooden Support in Tyres to provide the strength

3 Stand of Circular Hollow Pipe and Flat Iron Strips for tyres

A special supporting stand was made to add the chairs, tables and planters made of tyres with stability and load bearing capacity. The stand was a set of four hollow circular shaped pipes with their outer diameter of 40 mm, wall thickness of 2 mm and length of 300 mm [7]. The length of each pipe was carefully kept in a lathe machine to achieve the dimensional accuracy and uniformity. These pipes served as vertical supports and were installed in the same way to provide balance in the distribution of the loading. Besides the pipes, there were four flat iron strips that were used to ensure the tyre assembly was firmly held together [8]. A cutting fixture was used to prepare the flat strips so that the strips had uniform dimensions with each strip having a length of 325 mm, a thickness of 2 mm, and a width of 50 mm. The arc welding was done to connect the strips of flat iron into a rigid frame, Figure 2. The flat strip assembly and the circular hollow pipes were then welded to form one stand structure by way of arc welding. To make the stand even tougher and reduce deflection during loading, cross connecting iron rods were welded to the bottom of the stand [9]. This design served as a great improvement to structural integrity as well as provided safe and dependable performance on use.

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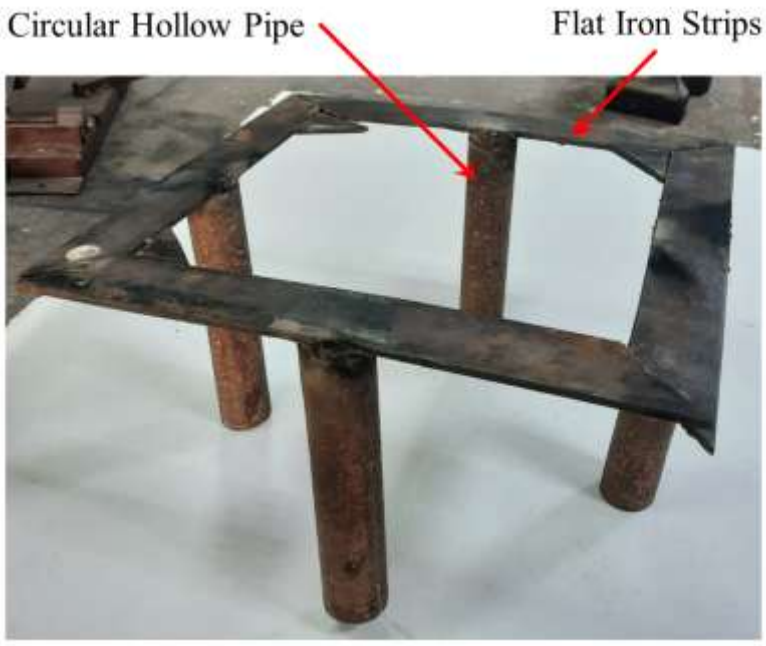

Fig. 2. Stand of Circular Hollow Pipe and Flat Iron Strips

4 Assembly of Iron Structure and Tyres

Mechanical fastening method was used in the finishing of the iron support structure and recycled tyres in order to make the structures to be user-friendly in terms of installation and maintenance. Drilling machine was used to drill holes with 11 mm diameter in the iron structure and the tyre material [10]. The holes were also precisely positioned to ensure that they sat well and uniformly transferred the load. Four points were positioned on the corners of the iron frame to attach the tyre to it and achieve a balanced and structural stability, Figure 3. The intended M10 bolts and nuts were used as a means of fastening, as they were chosen due to their sufficient strength and compatibility with the size of the hole that has been drilled [11]. This bolting construction process enabled rigid attachment of the tyres to the backbone and a dismantling process should need to be done in case of damage or replacement.

Fig. 3. Assembly of Iron Structure and Tyre with the help of Bolt and Nut

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5 Chair manufacturing by waste Network Cables

The secondary recycled material used in the designing of the seating surface of the chair was the waste network cables, which also helped in material reuse and sustainability [12]. The number of holes was made uniformly along the upper circumference of the tyre by the use of a hand drilling machine, the diameter of the drill being 10 mm. These openings were used as corridors of the cable when the weaving was taking place [13]. The network cables that had been discarded were then woven through the holes in a systematic order of weaving to create an interwoven pattern on the top surface of the tyre. The knitting structure was such that it gave a consistent tension and load distribution, which was comfortable and also structural. Elasticity and tensile strength of the network cables was good support when the cables underwent seating loads, Figure 4. Experimental use had shown that the cable-woven seat could safely carry the weight of a heavy individual without deformation of any kind [14]. The strategy not only increased functional performance but also encouraged the reuse of electronic waste in the production of furniture.

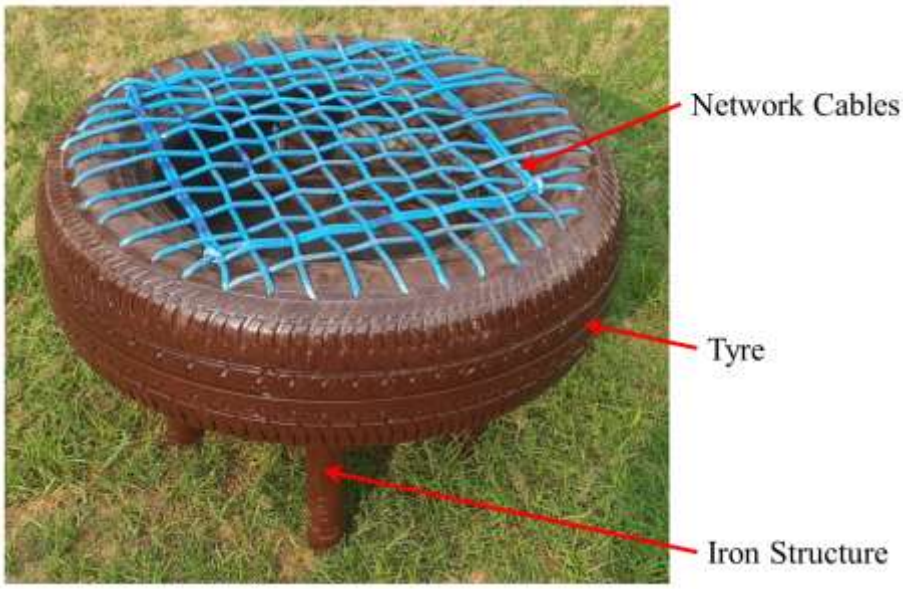

Fig. 4. Chair from Tyre, Network Cables and Iron Structure

6 Table manufacturing from Acrylic Sheet

This was a table that was created by combining a recycled tyre with an iron shell and an acrylic table top to get both beauty and ease of use. The material to be used as a tabletop was an acrylic sheet with a thickness of 3 mm because of its low weight and sufficient rigidity [15]. In order to increase the load bearing ability, two sheets of the acrylic sheet were laminated in order to create a layered structure that increased resistances to bending and strength. Holes were drilled in both the tyre and acrylic sheets six times with uniform spacing to ensure that it is easy to mount and align the acrylic sheets correctly [16]. At these points, stainless steel studs were used since they would be resistant to corrosion and reliable structurally, Figure 5. The studs were in such a way that they kept 25 mm distance between the tyre and acrylic tabletop that enhanced the appearance and could be easily cleaned [17]. The mixture of the ingredients resulted in a stable, long-lasting, and sustainable table to be used both indoors and semi-outdoors.

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Fig. 5. Table manufactured by Acrylic Sheet, Stainless Steel Studs, Tyre and Iron Structure

7 Planter manufacturing Waste Car Tyre and Iron Structure

The planter was developed by recycling the car tyres and bonded with an iron support structure to make it stable and easy to set to position. The tyre waste was used as the main containment body, and the iron structure was used to offer sufficient elevation and load bearing functions [18]. An acrylic sheet was put at the bottom of the tyre in order to hold the planting medium in the tyre cavity. The acrylic sheet served as a firming base of the mud, and it did not allow the loss of the material [19]. The acrylic sheet was used to draw holes to allow easy draining of excess water hence preventing water build up and damage of roots, Figure 6. Once assembled, appropriate mud was packed in the tyre, and then ornamental or utility trees were planted. Recycled tyre material coupled with a basic supporting construction gave rise to an effective and strong planter [20]. This form of manufacturing ensures sustainability of the landscaping process since the waste in automotive is utilized to manufacture products that are of use in urban and semi-urban green areas.

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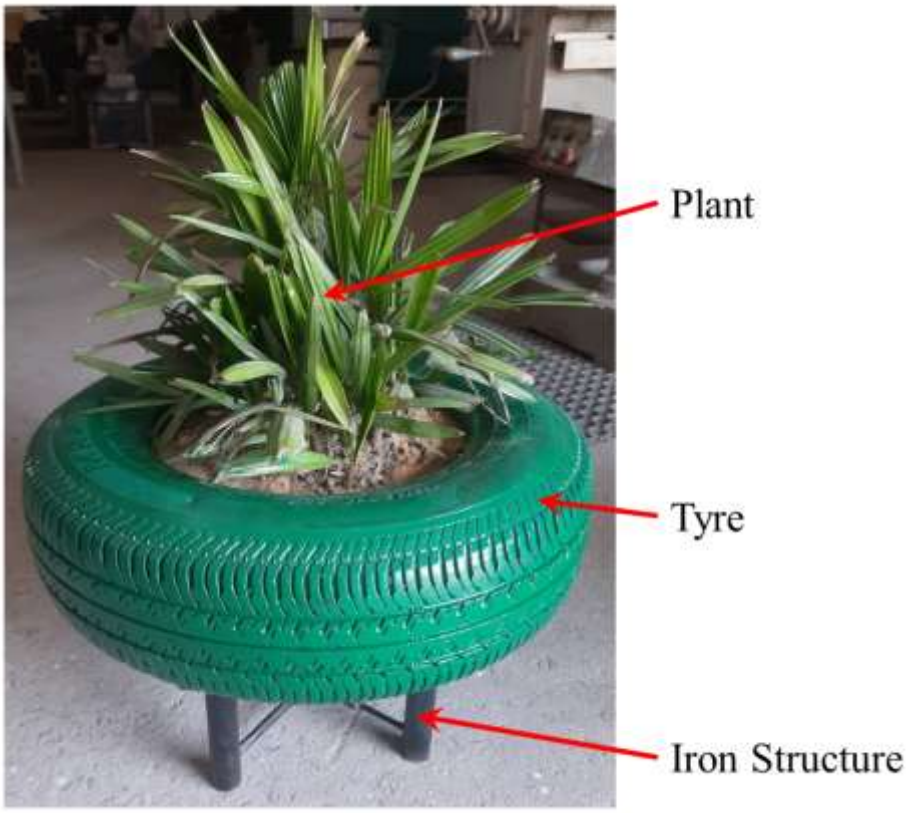

Fig. 6. Planter manufactured by Tyre, Iron Structure, Mud and Plant

8 Conclusion

The current work shows how the successful manufacturing of chairs, tables, and planters with recycled car tyres can be accomplished, which takes an effective and educative stance towards developing sustainable products. The exercise was very experiential to students as it stressed teamwork, problem issues and practical engineering activities. This project enabled the students to understand how to reduce wastes and why it is very crucial to convert discarded products into value-added products which can directly impact on the sustainability of the environment. The production process introduced students to a very diverse variety of materials such as rubber, wood, metal, acrylic and allowed them to acquire realistic experience working in carpentry, machining, welding, assembling, painting, and measuring methods. Students were introduced to the use of hand tools, power tools, measuring tools and machine including the lathe, milling machine, grinding machine, drilling machine and arc welding equipment. Other abilities like knitting with waste network cables facilitated creation and interdisciplinary studies. Several failures were faced during the fabrication by the students such as failure of welding joints and drill bits. These issues enhanced their knowledge on behavior of materials, joint design, limitations of tools and optimization of process. Such challenges helped them gain technical confidence, as well as, promote iteration-based learning. The ability to develop useful products using waste materials in an effective manner encouraged greatly self-confidence and creativity of students. This exercise is in line with the 17 Sustainable Development Goals (SDGs) of the United Nations, especially SDG 4 (Quality Education), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Combining sustainability ideas with the real-life production skills, the project proves to be an efficient approach to engineering education that promotes environmental sustainability, the principles of the circular economy, and education grounded in skills.

References

1. Araujo-Morera J, Verdejo R, López-Manchado MA, Hernández Santana M (2021) Sustainable mobility: The route of tires through the circular economy model. **Waste Manag** 126:309–322. https://doi.org/10.1016/j.wasman.2021.03.018. ScienceDirect
2. Formela K (2021) Sustainable development of waste tires recycling technologies—recent advances, challenges and future trends. **Adv Ind Eng Polym Res** 4(3):209–222. https://doi.org/10.1016/j.aiepr.2021.06.004 SCIRP
3. Mohajerani A, Burnett L, Smith JV, Markovski S, Rodwell G, Rahman MT, Kurmus H, Mirzababaei M, Arulrajah A, Horpibulsuk S, Maghool F (2020) Recycling waste rubber tyres in construction materials and associated environmental considerations: A review. **Resour Conserv Recycl** 155:104679. https://doi.org/10.1016/j.resconrec.2020.104679 Academia
4. Maga D, Aryan V, Blömer J (2023) A comparative life cycle assessment of tyre recycling using pyrolysis compared to conventional end-of-life pathways. **Resour Conserv Recycl** 199:107255. https://doi.org/10.1016/j.resconrec.2023.107255 OUCI
5. Laftah WA, Wan Abdul Rahman WA (2025) A comprehensive review of tire recycling technologies and applications. **Mater Adv** (2025). https://doi.org/10.1039/D5MA00463B RSC Publishing
6. Fazli A, Rodrigue D (2020) Recycling waste tires into ground tire rubber (GTR)/rubber compounds: A review. **J Compos Sci** 4(3):103. https://doi.org/10.3390/jcs4030103 MDPI
7. Czarna-Juszkiewicz D, Kunecki P, Cader J, Wdowin M (2023) Review in waste tire management—potential applications in mitigating environmental pollution. **Materials** 16(17):5771. https://doi.org/10.3390/ma16175771 MDPI
8. Torretta V, Rada EC, Ragazzi M, Trulli E, Istrate IA, Cioca LI (2015) Treatment and disposal of tyres: Two EU approaches. A review. **Waste Manag** 45:152–160. https://doi.org/10.1016/j.wasman.2015.04.018 PubMed
9. Sienkiewicz M, Kucinska-Lipka J, Janik H, Balas A (2012) Progress in used tyres management in the European Union: A review. **Waste Manag** 32(10):1742–1751. https://doi.org/10.1016/j.wasman.2012.05.010 SCIRP
10. Dabic-Miletic S, Simic V, Karagoz S (2021) End-of-life tire management: a critical review. **Environ Sci Pollut Res** 28(48):68053–68070. https://doi.org/10.1007/s11356-021-16263-6 pureportal.coventry.ac.uk
11. Sathiskumar C, Karthikeyan S (2019) Recycling of waste tires and its energy storage application of by-products—A review. **Sustain Mater Technol** 22:e00125. https://doi.org/10.1016/j.susmat.2019.e00125 ScienceDirect
12. Williams PT (2013) Pyrolysis of waste tyres: A review. **Waste Manag** 33(8):1714–1728. https://doi.org/10.1016/j.wasman.2013.05.003 ScienceDirect
13. Stevenson K, Stallwood B, Hart AG (2008) Tire rubber recycling and bioremediation: A review. **Bioremediat J** 12(1):1–11. https://doi.org/10.1080/10889860701866263 Taylor & Francis Online
14. Al-Anzi FS (2022) Building a planter system using waste materials using value engineering environmental assessment. **Sci Rep** 12:2344. https://doi.org/10.1038/s41598-022-05300-0 Nature+1
15. Nowaczek A, Kowalski Z, Kulczycka J, Makara A (2024) Determinants of the implementation of a circular economy model in the tire sector in Poland. **Sustainability** 16(24):11167. https://doi.org/10.3390/su162411167 MDPI
16. Zaragoza-Benzal A, Ferrández D, Atanes-Sánchez E, Morón C (2025) Upcycling automobile end-of-life tires for development and characterization of circular plasterboards. **Sustainability** 17(2):558. (MDPI). MDPI
17. van Hees M, Oskam I, et al (2024) Motives, drivers and barriers to urban upcycling: Insights from furniture upcycling in the Netherlands. **J Clean Prod** 486:144485. ResearchGate
18. Padilla L, et al (2025) Eco-management of end-of-life tires: Advances and performance of extended producer responsibility models. **Waste Manag Res** (2025). https://doi.org/10.1177/0734242X241237104 SAGE Journals
19. Laftah WA, Wan Abdul Rahman WA (2025) A comprehensive review of tire recycling technologies and applications. **Mater Adv** (2025). https://doi.org/10.1039/D5MA00463B RSC Publishing
20. Ibrahim H, et al (2025) Upcycling of waste plastics, end-of-life tire rubber, and bio-based materials: pathways, barriers and opportunities. **Sustain Mater Technol** (2025).