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ECO-TEXTILES FOR A SUSTAINABLE FUTURE IN THE PRODUCTION OF SPORTS SHOES

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Abstract: *The adoption of eco-friendly textiles plays an important role in transforming the fashion industry into a more sustainable sector. Despite the challenges faced, such as higher upfront costs and underdeveloped recycling infrastructure, it is essential to recognise the long-term benefits that can appeal not only to the well-being of the environment, but also to the health of consumers and the economic viability of producers. Recycled polyester yarn used in the textile industry, especially in the knitting process of a sports shoe, is a significant innovation that brings multiple environmental benefits. Sports shoe uppers made of such materials are not only an environmentally friendly choice, but also a viable option in terms of performance, providing comfort, durability and aesthetics. In addition, the use of recycled polyester contributes to the creation of a circular economy, in which products have a longer lifespan and are re-entered into the economic circuit. This not only fosters innovation in footwear design and production, but also improves the image of brands that adopt such sustainable solutions. In this context, consumers become more aware of the impact of their choices and can opt for products that reflect their ecological values.*
In conclusion, the recycled polyester yarn used to make sports shoe uppers is not only a sustainable alternative, but also an opportunity to redefine industry standards and promote more responsible practices that protect the environment and contribute to the development of a more sustainable society.

Keywords*: uppers for sports shoes, fashion industry, design program STOLL M1+.*

1. INTRODUCTION

The textile industry, renowned for its comfort-providing role, is undergoing a significant transformation to address its environmental impact [1].

It has been observed that textile waste generation has increased due to fast-changing fashion, rises in population, and an increased consumption of clothes per person in wealthier families. The escalating environmental impact of the textile industry demands urgent attention. It has also been noted that 90% of post-consumer textile waste is reusable [2].

Plastics have surpassed most man-made materials and have long been subject to environmental analysis. However, robust global information is lacking, in particular on their fate at the end of their life cycle [3]. The rapid growth in plastics production is extraordinary, outpacing most other man-made materials [3]. Despite the widespread use and benefits of plastics, environmental challenges remain acute. These issues require not only technological innovation, but also global cooperation to improve data collection and waste management so that we can navigate to

a more sustainable future [3].

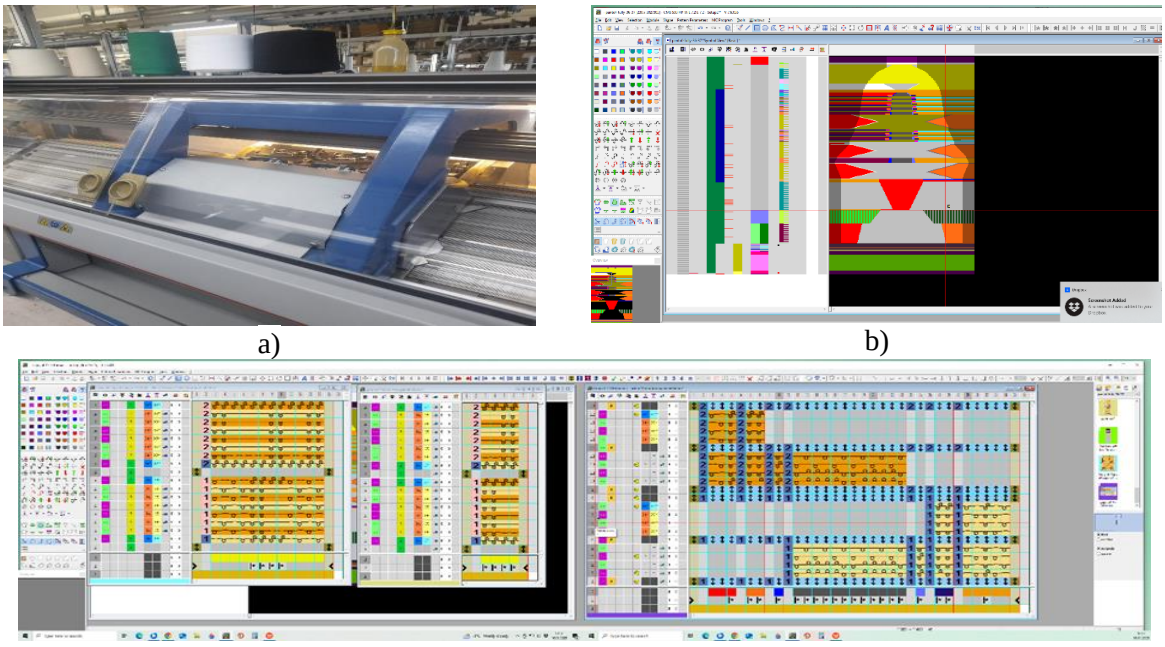
2. GENERAL INFORMATION

Advanced research in the field of materials has led to the development of significant innovations in the industry, including in the field of sports shoes [4], [5]. Tricotate sneaker uppears are a perfect example of how modern technology improves performance, comfort, and sustainability [6].

Knitted shoe girls [4], [5], also known as "knitted shoe uppers", are a recent innovation in the footwear industry, combining modern production technology with a comfortable and attractive design. These shoe uppers are made of yarns of different materials, including recycled polyester, cotton, wool or other synthetic and natural fibers, thus allowing for a wide range of options.

Knitted shoes [4], [5] are used not only for sports shoes, but also for sandals, boots or casual shoes. Many well-known brands are adopting these technologies to appeal to consumers who are looking for sustainable and comfortable products. The footwear industry continues to evolve, and knitted girls are just one of the innovative solutions that emphasize the commitment to sustainability and the response to changing consumer demands. This trend is in line with the global movement towards more responsible and eco-friendly fashion.

A concrete example of the use of rPET [7] in the production of eco-friendly sports shoes is the sneaker model developed by various renowned brands, which have integrated recycled materials into the design and manufacture of their products [7]. For example, a pair of sneakers can contain the equivalent of 6 recycled 2-litre PET bottles,[8] thus helping to reduce plastic waste [7]. In addition, companies in the textile industry are adopting this technology to create sustainable collections, with an emphasis on environmental responsibility.



a) b) c)

Fig. 1*: Rectilinear knitting machine CSM STOLL 530 HP (a) with the design software M1+ (b) and details from the knitting program (c)* [9]

The uppers for sports shoes as shown in **Fig. 2** were made of 100% recycled polyester yarn, with a fineness Nm 1/118, 100% recycled. A quantity of threads of 60 grams was used for manufacturing one face. These faces were knitted on the CSM STOLL 530 HP rectilinear knitting machine, multiguage fineness 7.2/ 14 [9]. For the realization of the knitting program of this product, the STOLL M1+ design program was used, as shown in **Fig. 1** [9].

The contoured panels as shown in **Fig. 2** are made in the Rex structure with ajur designs combined with knitted mesh retained on the entire back font, to obtain the 3D wave effect.

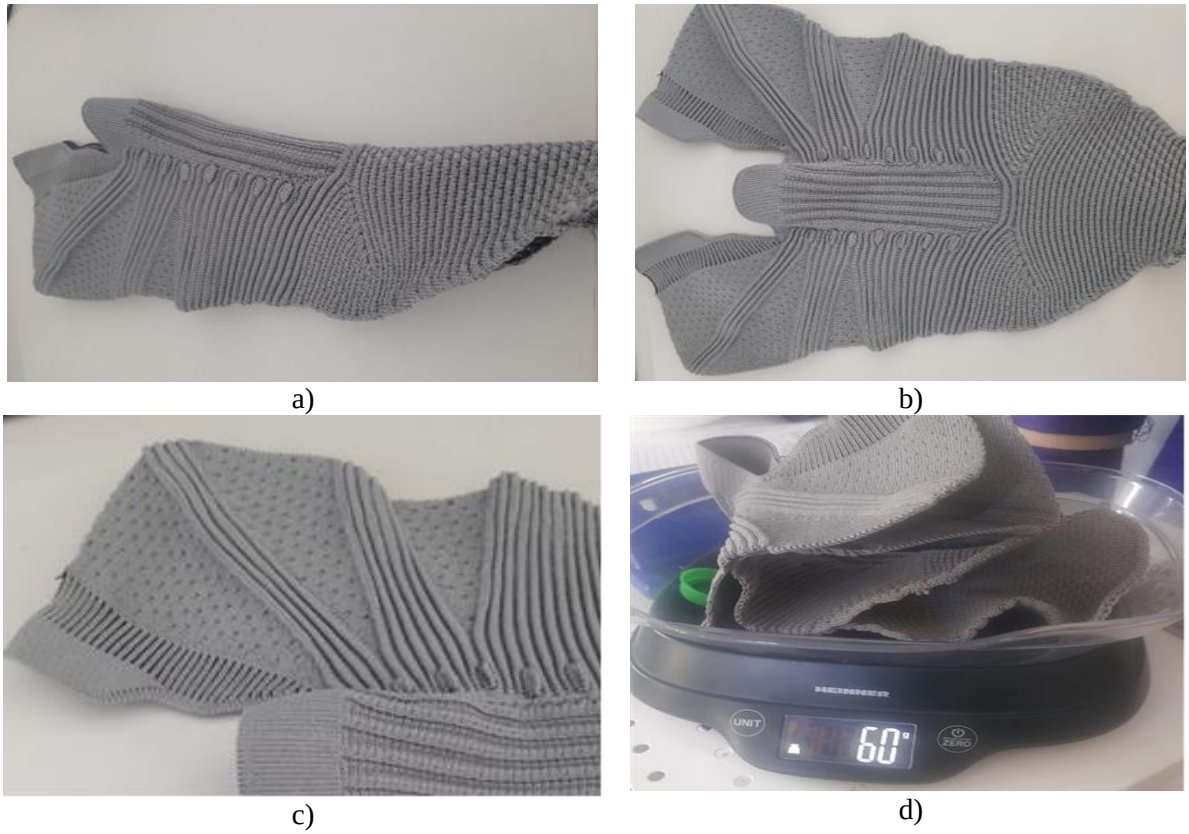


Fig. 2*: Uppers for sports shoes (a), (b), made by knitting (c) and the weight of yarn used (d) to make an upper for footwear*

To move towards a sustainable future, it is essential that both producers and consumers change their paradigm. The promotion of textile eco-materials involves not only the development of innovative materials, but also their integration into production and consumption practices that prioritize sustainability. Through education and innovation, the textile industry can be transformed into a source of sustainable solutions to today's environmental challenges.

3. CONCLUSIONS

In conclusion, this paper emphasizes the importance of adopting sustainable and innovative practices in the textile industry, aiming to reduce resource consumption and to reduce the negative impact on the environment.

Recycled polyester yarn used in the textile industry, especially in knitting a sports shoe, is a sustainable solution that contributes to reducing waste and conserving natural resources. It offers significant advantages such as durability, strength and flexibility, essential characteristics for products intended for intensive consumption.

Also, the use of these types of yarns helps to reduce the carbon footprint associated with the production process, having a positive impact on the environment. In addition, recycled polyester yarn can be efficiently integrated into modern production processes without compromising the performance and comfort of the final product. Thus, it is an important step towards a greener and more responsible future of the textile industry.

Eco-textiles represent the future of a responsible industry, the development and adoption of these materials, along with sustainable policies and consumer education, are essential for the transition to a sustainable future in fashion and textiles.

REFERENCES

[1] H. Jamshaid, A. Shah, M. Shoaib, and R. K. Mishra, "Recycled-textile-waste-based sustainable bricks: A mechanical, thermal, and qualitative life cycle overview," *Sustainability*, vol. 16, no. 10, p. 4036, 2024, doi: 10.3390/su16104036.

[2] F. Uddin, K. Umer, and S. T. Anjum, "Textile solid waste in product development studies," *Chem. Rep.*, vol. 3, pp. 203–209, 2021.

[3] R. Geyer, J. R. Jambeck, and K. L. Law, "Production, use, and fate of all plastics ever made," *Sci. Adv.*, vol. 3, no. 7, e1700782, 2017.

[4] P. F. Dragos and M. D. Şuteu, P. Rares, and S. D. Buhas, "Thermal transfer analysis for sports footwear, for performance athletes, during volleyball," *Sustainability*, vol. 15, no. 1, p. 652, 2023, doi: 10.3390/su15010652.

[5] P. Rares, M. D. Şuteu, T. Vesselenyi, S. D. Buhas, M. Szabo-Alexei, P. Szabo-Alexei, and P. F. Dragos, "Inverse kinematics proposal to automatize the 3D scanning of handball shoes by using a robotic arm with 3 actuated joints," *Appl. Sci.*, vol. 14, no. 1, p. 297, 2023, doi: 10.3390/app14010297.

[6] A. P. Cobuz, M. Greenley, M. Orban, and E. S. Lakatos, "Recycling textile materials for environmental sustainability," in *Proc. XVII Int. Multidiscip. Conf. "Prof. Dorin Pavel – Founder of Romanian Hydropower"*, Sebeş, 2017.

[7] L. Shen, E. Worrell, and M. K. Patel, "Open-loop recycling: A LCA case study of PET bottle-to-fibre recycling," *Resour. Conserv. Recycl.*, vol. 55, no. 1, pp. 34–52, 2010.

[8] K. Falkenberg, "The recycling concept in the context of the revision of the Waste Framework Directive," *Directive 2008/98/EC*.

[9] Mobiente, [Online]. Available: https://www.mobiente.ro/. [Accessed: Apr. 10, 2025].