ID 4
LIFE CYCLE ASSESSMENT OF A FABRIC BASED ON CONVENTIONAL COTTON VERSUS RECYCLED COTTON

Pinto C.[1,2], **Abreu, M. J.** [2*]
[1,] Lurdes Sampaio SA, Famalicão, Portugal
[2] 2C2T-Center for Textile Science and Technology, Textile Engineering Department, University of Minho, Campus de Azurem, Guimarães, Portugal
[(*)]*Email:* josi@det.uminho.pt

ABSTRACT
Through the Life Cycle Assessment (LCA), the study compares the environment impacts of two fabrics with different compositions: a 100% conventional cotton fabric versus a fabric with 60% pre-consumer recycled cotton and 40% conventional cotton fibers. The main purpose is to prove how much environmental impacts can be reduced using pre-consumer recycled cotton.

INTRODUCTION
The textile sector is one of the sectors that most harms the environment and has one of the highest levels of industrial waste. Due to the variety and the number of processes, it is causing several negative impacts on the global environment. The leftovers produced by the textile industry are particularly worrying, and become a serious threat to the environment and, consequently, to future generations when incorrectly managed (Refosco, 2012).
Given the growing concern about the environment and considering the textile industry has a prominent place in the pollution of the planet, companies are increasingly focused on finding strategies to minimize waste generation (Ramos, 2009).
To quantify the savings for the environment by reusing pre-consumer waste, it´s calculated through the Life Cycle Assessment (LCA).
For the development of this study, cotton was the selected fiber, cause is one of the most used natural fibers in the textile and garment industries, that is nearly 30% of all textile fiber consumption worldwide (Remy, Speelman, & Swartz, 2016).
According to the standards NP EN ISO 14040:2008 – Environmental management – Life cycle assessment, and NP EN ISO 14044:2008 – Environmental managent – Lyfe cycle assessment, the LCA is a method through which it is possible to “assess the environmental aspects and impacts associated with a product process, throughout its life cycle” (Appel, 2019). The LCA is composed of four phases: 1. definition of the goal and scope, 2. Life Cycle Inventory (LCI), 3. Life Cycle Impact Assessment (LCIA) and 4. Interpretation.

RESULTS AND CONCLUSIONS
The results of LCA are shown in the tables above: Table 1 - Specific consumptions and emissions for the analysed fabrics and Table 2 - Categories of environmental impact for the analysed fabrics. In each table, the values of the last column are the comparation between the production processes of conventional and recycled cotton fabrics.

The results are shown considering the production of 100 kg of finished fabric.

Indicators	Conventional	Recycled	Difference
Primary energy consumption (kWh)	4 791,07	2 947,56	-38,48%
Non-renewable primary energy consumption (kWh)	2 806,97	1 550,15	-44,78%
Renewable primary energy consumption (kWh)	1 984,10	1 397,41	-29,57%
Freshwater usage (kg)	2 593 193,30	1 567 993,86	-39,53%
Freshwater consumption (kg)	531 491,60	211 152,52	-60,27%
Waste (kg)	240,63	286,08	18,89%
Emissions to freshwater (kg)	2 060 037,56	1 354 719,88	-34,24%
Emission to air (kg)	14 589,54	11 768,38	-19,34%

Table 1 - Specific consumptions and emissions for the analysed fabrics

Categories	Conventional	Recycled	Difference
Climate change, default, excl biogenic carbon [kg CO2 eq]	870,20	484,72	-44,30%
Climate change, incl biogenic carbon [kg CO2 eq]	511,57	340,95	-33,35%
Fossil depletion [kg oil eq.]	236,40	130,18	-44,93%
Freshwater ecotoxicity [kg 1,4 DB eq.]	51,14	19,36	-62,14%
Freshwater Eutrophication [kg P eq.]	0,49	0,19	-61,18%
Human toxicity, non-cancer [kg 1,4-DB eq.]	988,32	372,23	-62,34%
Terrestrial Acidification [kg SO2 eq.]	7,32	3,02	-58,79%
Terrestrial ecotoxicity [kg 1,4-DB eq.]	1 144,07	434,63	-62,01%

Table 2 - Categories of environmental impact for the analysed fabrics

According to the study, the recycled fabric has less environmental impacts then the conventional fabric. The results for the indicators relate with resource consumption and emissions generated has shown lower values for recycled fabric, with the lonely exception of waste quantity but with a not significant difference. Concerning to the impact categories, the results are also lower for the recycled fabric.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the collaboration of the companies Lurdes Sampaio SA, Recutex and Fiavit, and the funding by the project UIDB/00264/2020 of 2C2T Center for Textile Science and Technology, University of Minho funded by National Founds FCT/MCTES.

REFERENCES

[1] Refosco, E. C. (2012). Estudo do ciclo de vida dos produtos têxteis: um contributo para a sustentabilidade na moda. Universidade do Minho.

[2] Ramos, F. M. (2009). Tratamento de Resíduos Sólidos da Indústria Têxtil. Maringá, Brasil.

[3] Remy, N., Speelman, E., & Swartz, S. (20 de Outubro de 2016). McKinsey Sustainability. Style that's sustainable: A new fast-fashion formula.

[4] Appel, M. (2019). Avaliação do Ciclo de Vida da Produção de uma Malha Têxtil de Algodão. Florianópolis.