Life Cycle Assessment

Recycled *ecotec*® cotton yarn

Results of the study

This study, which was carried out in accordance with the methodology of the Life Cycle Assessment (LCA) of the product, analysed the production process for cotton **ecotec®** yarns in the versions of PEGASUS and POLARIS with the aim of evaluating and quantifying the environmental impact of yarns obtained using recycled cotton fibres.

In detail, the application of the LCA instrument enabled:

- Quantification of the environmental impacts associated with the production phases of the fibres used as raw materials, with the transport of the raw materials and, finally, with the production of the yarns using the Marchi & Fildi spinning process;
- Evaluation and identification of possible strategies to improve the environmental performance of the production system;
- Determination of the benefits of alternative technological solutions, already used by the company, intended to increase the occurrence of the cotton fibre content in the composition of the final product.

With the aim of obtaining exhaustive results from the study, an analysis was carried out comparing the impacts relative to the LCA of the two **ecotec®** yarns with differing occurrence of pre-consumer recycled cotton (65% PEGASUS, 80% POLARIS) and a comparative study was carried out with the LCA of a virgin cotton fibre obtained using the same technology as described and analysed in this study.

Looking at the comparison of the environmental impact indicators (Tab. 1), it can clearly be seen that:

- Production of **ecotec®** yarns enables a substantial reduction in the environmental impact compared with yarns obtained from dyed virgin cotton in all categories of environmental impact studied.
- The reduction of the environmental impacts and therefore also the increase in environmental benefits are related to the increase of occurrence of recycled cotton in the composition of the final product.

The environmental benefits associated with the use of recycled cotton fibres for the production of yarn can be quantified as follows:

- A reduction of the impact equivalent to **46.6%** (PEGASUS) and **56.3%** (POLARIS) with regard to Global Warming, which measures the effect of global warming resulting from the emission of greenhouse gases;
- A reduction of **43.0%** (PEGASUS) and **51.9%** (POLARIS) in the consumption of abiotic resources (fossil fuels);
- A reduction of **53.1%** (PEGASUS) and **64.1%** (POLARIS) with regard to the acidification potential, which measures the effect of the lowering of the pH caused by acid emissions into the atmosphere, in turn causing damage to living organisms;
- A reduction of **63.6%** (PEGASUS) and **76.8%** (POLARIS) of the eutrophication potential, which measures the effects of waste water and their polluting contents on aquatic ecosystems.

Consumption of energy resources

With regard to the consumption of energy resources (Tab. 2), the results show how the use of recycled cotton fibres for the production of **ecotec®** yarns leads to a quantifiably significant reduction of:

-56.6% - **ecotec® POLARIS yarn** (80:20)

-46.9% - **ecotec® PEGASUS yarn** (65:35)

Consumption of water

Comparing the total water consumptions (Tab.3) associated with the production of the yarns as analysed, a substantial reduction in the consumption of water can be observed in ratio with the increase in the occurrence of recycled cotton fibres, which can be quantified as follows:

-77.9% - **ecotec® POLARIS yarn** (80:20)

-61.6% - **ecotec® PEGASUS yarn** (65:35)

The comparison of the different indicators used to characterise the environmental impacts of the products included in the study shows moreover how the choice of using recycled cotton fibres to produce cotton fibre yarns brings about benefits both in terms of the environment as well as energy consumption.

Table 1. Indicators of environmental impact associated with the production of 1kg cotton fibre yarn

Impact category	Unit of measurement	ecotec® yarn		Dyed virgin cotton fibre yarn
		POLARIS	PEGASUS	
Abiotic depletion	kg Sb eq	2.19E-06	3.80E-06	**1.15E-05**
		-81.0%	***-67.0%***	
Abiotic depletion (fossil fuels)	MJ	51.08.00	61.04.00	**108**
		-51.9%	***-43.0%***	
Global warming (GWP100a)	kg CO_2 eq	04.14.00	05.05.00	**09.46.00**
		-56.3%	***-46.6%***	
Ozone layer depletion (ODP)	kg CFC-11 eq	3.93E-07	4.84E-07	**9.24E-07**
		-57.5%	***-47.6%***	
Human toxicity	kg 1.4-DB eq	179	222	**430**
		-58.4%	***-48.4%***	
Fresh water aquatic ecotoxicity.	kg 1.4-DB eq	96	147	**392**
		-75.6%	***-62.6%***	
Marine aquatic ecotoxicity	kg 1.4-DB eq	886	1076	**1999**
		-55.7%	***-46.1%***	
Terrestrial ecotoxicity	kg 1.4-DB eq	07.10.00	70	**198**
		-78.3%	***-64.8%***	
Photochemical oxidation	kg C_2H_4 eq	8.11E-04	8.97E-04	**1.32E-03**
		-38.7%	***-32.2%***	
Acidification	kg SO_2 eq	04.19.00	05.39.00	**12.02.00**
		-64.1%	***-53.1%***	
Eutrophication	kg PO_4^{---} eq	12.44.00	12	**33**
		-76.8%	***-63.6%***	

Table 2. Environmental impact indicators associated with the production of 1kg cotton fibre yarn

Energy indicators	Unit of measurement	ecotec® yarn		Dyed virgin cotton fibre yarn
		POLARIS	PEGASUS	
Total consumption of energy resources	MJ	**65.07.00**	**80.04.00**	**151.05.00**
		-56.6%	***-46.9%***	

Table 3. Water consumption for the production of 1 kg cotton yarn

Indicators	Unit of measurement	ecotec® yarn		Dyed virgin cotton fibre yarn
		POLARIS	PEGASUS	
Water consumption	litre	**576**	**1003**	**2611**
		-77.9%	***-61.6%***	