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## **CLOTHES MADE FROM EUCALYPTUS – OUR FUTURE?**

*Sandra Roos\* and Greg Peters*

*\*Swerea IVF AB, PO Box 104, SE-431 22 Mölndal, Sweden, Department of Chemical and Biological Engineering, Chalmers University of Technology, SE-412 96 Göteborg, Sweden, [sandra.roos@swerea.se](mailto:sandra.roos@swerea.se)*

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### **ABSTRACT**

This paper is an illustration of how life cycle assessment (LCA) was successfully applied to provide a scientific background for decision making in the textile sector. The life cycle environmental performance of a new eucalyptus based textile was compared to the current cotton based textile in the application of a women's hospital uniform. The results from the life cycle impact assessment showed clear benefits with replacing the cotton based textile, mainly through avoiding water depletion and pollution from pesticides caused by the cotton cultivation. The raw material production and the laundry during the use phase are the two main aspects of the uniform. Further, the knowledge gained during the LCA was used to formulate environmental requirements for the suppliers.

### **INTRODUCTION**

The Swedish textile sector is characterised by long distribution chains and products imported mainly from south-eastern Asia. Among Swedish textile companies, the awareness is growing of the downsides of cotton in the early life cycle stages. Cotton cultivation today is infamous for environmental impacts from its heavy use of pesticides and water (Pfister, Koehler, & Hellweg, 2009), and social responsibility issues including both forced labour and child labour (Bärlocher, Holland, & Gujja, 1999). Many companies are asking the same question - are there better alternatives to cotton? At the same time the demand for textile fibres is growing with the increase of the global population. Today, fossil based fibres such as polyester and polyamide stands for around 57 percent of the world market for textile fibres, cotton stands for 37 percent and cellulose fibres such as viscose and modal stands for 4 percent, wool 2 percent (Humphries, 2009). What will our clothes be made of in the future?

TvNo Textilservice AB is a Swedish laundry service providing textiles for rent to hospitals, medical clinics and aged care facilities. TvNo investigated a eucalyptus/polyester based textile as an alternative to their cotton/polyester textile used in women's uniforms. In addition to comfort testing and validation of technical parameters such as tear resistance, pilling and service life, TvNo also wanted to make an informed decision of the environmental performance of the two alternatives.

## METHOD

A cradle-to-grave LCA was performed where a women’s hospital uniform made from fifty percent cotton and fifty percent polyester provided the base case. As the alternative product, a uniform was chosen where the cotton was substituted with Tencel™ (lyocell fibres made from eucalyptus).

The study focused on the difference between the cotton and the eucalyptus fibres, which means that the same data were used for all life cycle stages of the uniform that do not differ between the two fibres. The end-of-life scenario was set to incineration of both uniforms, as this is the most common waste management route for textiles in Sweden (Carlsson, Hemström, Edborg, Stenmarck, & Sörme, 2011). The specific data collected from the suppliers for this study concerned the manufacturing of the Tencel™ fibres, the weaving, the wet treatment and the confectioning (cutting/sewing/printing) in the production phase, and the laundry and transports in the use phase, see Table 1. The dialogue with the suppliers around data collection was also used in order to understand the current environmental work in the supply chain and identify the possible knowledge gaps. The generic data was collected from Ecoinvent 2.2 and Swerea IVF’s own database. The calculations were performed in SimaPro 7.3.3.2.

Table 1. Data sources for the life cycle inventory.

Life cycle stage	Data source	Life cycle stage	Data source
Cotton fibre production	Ecoinvent 2.2	Weaving	Swerea IVF data
Tencel™ fibre production	Lenzing AG	Wet treatment	Lauffenmühle / Swerea IVF data
Polyester fibre production	Ecoinvent 2.2 / Swerea IVF data	Confectioning	Nybo Jensen Konfektion A/S
Yarn spinning	Swerea IVF data	Use	TvNo Textilservice AB

The functional unit is a single use, which for the hospital uniforms is the same as one laundry cycle. Both the cotton/polyester uniform and the eucalyptus/polyester uniform were assumed to be used for 75 laundry cycles.

Textiles are generally associated with environmental impacts such as pollution from chemicals, water depletion and climate change (Allwood, Laursen, Rodriguez, & Bocken, 2006). Therefore the chosen midpoint environmental impact categories were climate change, energy use, eutrophication, freshwater toxicity, human toxicity, water use and land use. For toxicity calculations UseTox™ (Rosenbaum et al., 2011) was used and for primary energy the guidelines in Hischer & Weidema (2009) was used. For the other categories ReCiPe, Midpoint (H) V1.06/World ReCiPe H (Goedkoop et al., 2008) was used.

## RESULTS AND DISCUSSION

### *Environmental performance of the two products*

The eucalyptus alternative scored better than the cotton alternative for all parameters except energy use (see Figure 1 below). The life cycle contribution to climate change is for the Tencel/polyester uniform 8.5 kg carbon dioxide equivalents. This corresponds to around 500 grams of beef meat or a 70 kilometer drive with a green car. The LCA gave thus the background needed for TvNo to make an informed decision and choose the eucalyptus uniform. Further, the knowledge gained during the life cycle assessment was used to formulate environmental requirements for the suppliers.

**Results from LCA for the uniforms: Normalised to highest environmental impact per category (%)**

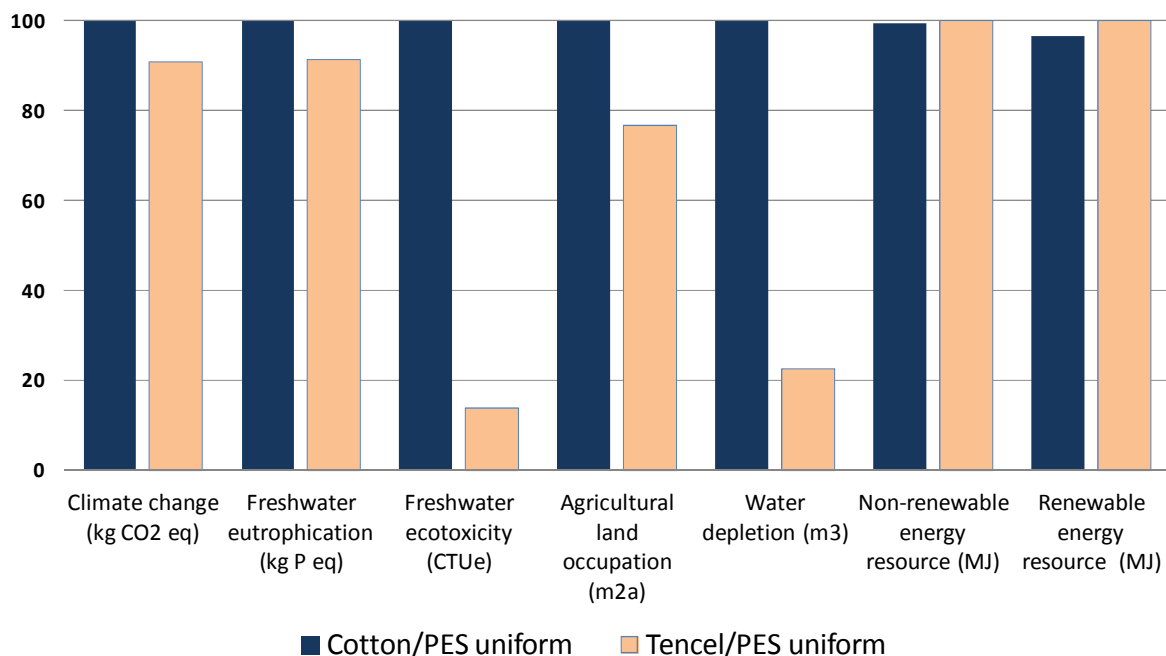


Figure 1. Results for the comparison between the cotton/polyester uniform (blue bars) and the Tencel/polyester uniform. Please note that the results are normalised within each impact category and do not describe any weighting between the different impact categories.

### *Formulation of environmental requirements on the suppliers*

In a long textile distribution chain the transparency is easily lost, making the compliance with environmental requirements difficult. Different environmental labels imply different criteria. Environmental requirements can ideally be complemented by setting knowledge requirements on the suppliers.

Examples of environmental requirements include:

- Restricted substance lists (RSL).
- Certified raw material (FSC, GOTS, OEKO-TEX 100 etc.).
- Certified processes (ISO 14001, BlueSign, BCSI etc.).



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Examples of knowledge requirements include:

- Be able to report how the compliance with the RSL is ensured.
- Be able to explain what applied environmental labels include.

The discussions in the supply chain with suppliers and sub-suppliers that were initiated by the LCA study also led to an increasing awareness of the importance of controlling the environmental performance in the early life cycle stages, e.g. the use of environmentally certified eucalyptus wood.

### CONCLUSIONS

The eucalyptus alternative scored better than the cotton alternative for all the investigated parameters except energy use. The LCA gave thus the background needed for TvNo to make an informed decision and choose the eucalyptus uniform. Further, the knowledge gained during the life cycle assessment was used to formulate environmental requirements for the suppliers. The discussions in the supply chain with suppliers and sub-suppliers that were initiated by the LCA study also led to an increasing awareness of the importance of controlling the environmental performance in the early life cycle stages.

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