

Contact person

Michael Sturges
Associate consultant
+44 (0)7787 531141
michael.sturges@ri.se

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Reference

Metsä Spring

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Comparing the environmental performance of Kuura® fibre with the alternative cellulosic fibres

Review background

Previously, Etteplan was commissioned by Metsä Spring, to perform a life cycle assessment study of Kuura® fibre. Kuura® is a novel textile fibre product that can be used as an alternative to various currently used natural fibres such as cotton or man-made fibres such as viscose or lyocell fibre. The LCA study of Kuura® fibre was critically reviewed and found to be performed in conformance with ISO 14040 and ISO 14044. In addition, the reviewer conclude that the partial carbon footprint result presented in the study were produced in conformance with ISO14067.

The original study only considered the production of Kuura® fibre. No attempt was made to compare the environmental impact of Kuura® fibre with the existing staple fibres. However, having completed the study Metsä Spring are now interested to understand how the Global Warming Potential (GWP) impact of Kuura® fibre compares to existing market solutions. Subsequently, a comparison has been made of the results from the Etteplan study and the Global Warming Potential of cotton fibres, viscose and lyocell as derived from publicly available sources, considering cradle-to-factory gate system boundaries.

The comparison was prepared by Markus Nuopponen, R&D Manager, Metsä Spring Oy (Metsä Group's innovation company investing in new business opportunities related to wood-based value chains).

This document forms the critical review statement for the comparative life cycle assessment presented in the article "Comparing the environmental performance of Kuura® fibre with the alternative cellulosic fibres version 2.0", dated 20th December 2024.

Critical review process

The review was performed by an independent expert: Michael Sturges of RISE Research Institutes of Sweden – a life cycle (LCA) assessment practitioner with specific experience of environmental studies relating to packaging and forest industry value chains. Michael also performed the critical review of the initial Etteplan LCA study of Kuura® fibre, detailed in the report "Life cycle assessment study of Kuura® textile fibre" report v3.0, dated 30th October 2024.

The reviewer was contracted directly by Metsä Spring and is independent of the LCA study.

RISE, Research Institute of Sweden

Postal address

RISE
Box 5609
SE-114 86
STOCKHOLM
Sweden

Office location

United Kingdom

Phone / Fax / E-mail

+44 (0)7787 531141

The scope of the critical review was to consider the validity of the cradle-to-gate GWP results presented for each of the solutions, and therefore the validity of the comparative assertions made.

The review was performed based on the requirements of ISO14044:2006 Section 6.2, i.e., critical review by an external expert.

The critical review was undertaken at the end of the study, beginning with the delivery of the draft article to the critical reviewer. The reviewer considered in depth the following materials:

- The sources used for the GWP for the comparative materials (Kuura® textile fibre, cotton, viscose and lyocell) – in particular, evaluating these to determine whether they are representative of the current production technologies and locations; that the system boundaries and methods comparable for all systems; and to evaluate which impact assessment methodologies were applied
- The draft article presenting the comparisons – in particular, considering whether the comparative assertions made are reflective of the results and any uncertainties that may be inherent in the results.

The reviewer provided feedback on the sources used and on the contents of the article. Subsequently, changes were made by the authors including selection of more relevant data for cotton fibre production and improved phraseology in the article to ensure clarity. The article authors also provided written responses to the comments, describing subsequent changes to the data and article. The reviewer considered these responses and changes and was ultimately satisfied that appropriate clarifications and actions have been provided.

Result of the critical review

The article presents comparative assertions based on life cycle assessment methodology. The results for each of the systems in the study are based on the best available data:

- The GWP results for Kuura® fibre are based on a recent critically reviewed LCA study
- The GWP results for cotton fibre are sourced from Ecoinvent 3.10. This is a well-respected life cycle database and the data contained within is regularly updated and subject to quality controls
- The GWP results for viscose and lyocell are sourced from the article “Life cycle assessment of man-made cellulosic fibres”, Shen and Patel, 2010. Although this article is more than ten years old it is deemed to be the best available data for viscose and lyocell. Close inspection of the viscose data in Ecoinvent 3.10 revealed that although it is presented as a global average it is in fact based on data from one non-integrated facility in China, and the original source data is from 2004.

In addition, the system boundaries for each of the systems in the study appear to be comparable.

There are some limitations to the available data that are highlighted:

- The lyocell production in the Shen and Patel study is non-integrated (meaning that the pulp production and the fibre production occur at separate sites). Integrated production of lyocell is possible, which reduces the production energy requirement (as the pulp does not need to be dried) and eliminates transport of the pulp. Therefore, for integrated production the impact of lyocell could be considerably lower than that reported in Shen and Patel. However, considering the scale of the differential in GWP results between Kuura® fibre and lyocell any advantages from integrated production are unlikely to be significant enough to affect the comparative standing of the solutions.
- The Shen and Patel study applied the CML baseline method 2000 – global warming potential (GWP) 100a- to calculate fossil GWP for the viscose and Lyocell. The characterisation factors will have changed since the study, but again the scale of the difference between the Kuura®

fibre and the viscose and lyocell is so marked that the influence of applying different impact assessment methods will not affect the comparative standing of the results.

- Although the Shen and Patel study is more than ten years old, a more recent product environmental statement from Lenzing covering its Tencel lyocell product (<https://www.tencel.com/images/assets/claims/document/claim-proof-tencel-modal-fiber-snapshot-202401.pdf>) gives the global warming potential in a similar range at 2840 kgCO₂eq. Although this later LCA study is not transparent, it provides a degree of confidence in the Shen and Patel results.

Although the comparative assertions presented in the article are not based on a formal comparative life cycle assessment study containing all the elements required by ISO14040 and ISO14044 (e.g., formal goal and scope document, life cycle inventory, etc), the comparisons are legitimate considering the data quality and system boundaries. Any uncertainties and sensitivities in the secondary data sources used for the GWP of cotton, viscose and lyocell are unlikely to be significant enough to change the relative standing of the existing systems compared to the Kuura® fibre.

Opinion of the reviewer

The reviewer concludes that the study's level of quality, detail and transparency is appropriate for making the comparative assertions. The scientific methods applied and data used are acceptable and justified.

Overall, the reviewer considers the results and conclusions to be a sound and fair reflection of the potential environmental impacts of the studied systems representing the production cradle-to-gate impact of Kuura® fibre, cotton fibre, viscose and lyocell.

The results are likely to be very robust, even considering any uncertainties and sensitivities. Subsequently, the interpretation and comparative assertions made are appropriate and reflect the results of the study.

Critical review sign-off

The reviewer certifies that the statement provided is a fair reflection of their assessment and views of the study presented in the article "Comparing the environmental performance of Kuura® fibre with the alternative cellulosic fibres version 2.0", dated 20th December 2024

Signed.....


Dated: 8th January 2025

Michael Sturges, RISE Research Institutes of Sweden