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Friedrich Halstenberg
Loay Radwan
Julia Cilleruelo Palomero
Andreas Ciroth



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Comparing waste treatment options: A LCA case study on paper and board from lightweight packaging waste

Köhler, Hannah[1]; Spies, Alena Maria[1]; Hegemann, Natalie[1]; Raulf, Karoline[1]; Greiff, Kathrin[1]

[1] RWTH Aachen University, ANTS. Wüllnerstr. 2, 52062 Aachen, Germany.
E-Mail (corresponding author): hannah.koehler@ants.rwth-aachen.de.

Abstract

The paper industry ranks third among the most energy-intensive industries in Germany[1]. Using recycled paper and board (following referred to as paper) instead of primary pulp wasidentified as the main driver to a sustainable paper industry[1]. Additionally, legal regulationsaim for higher recycling quotas to enhance circularity – e.g., German Packaging Act: 90% recycling quota for packaging paper from 2025. Therefore, recycling of yet unexploited secondary material sources, like paper from the lightweight packaging (LWP) collection, moves into focus. To determine if recycling paper from LWP is the environmentally best option, the environmental impacts must be assessed.

Thus, the aim of this study was to give insights, under which circumstances the recycling of paper from LWP is environmentally beneficial compared with incineration. We assessed the recycling of paper from LWP via Life Cycle Assessment (LCA) in OpenLCA to determine the break-even point of benefits and efforts. The case study involved the cardboard production from 20% paper from LWP and 80% paper from separate paper collection in a standard cardboard production process. As a baseline scenario, the cardboard production from 100% paper from separate paper collection and incineration of paper from LWP was selected.

Primary data for the Life Cycle Inventory was collected in a sampling campaign at a LWP sorting plant, a paper sorting plant and at a carton production plant. Lacking data came from literature and the ecoinvent v3.9.1 database. Since material substitution has a major impact on the results, two substitution scenarios were considered. For the Life Cycle Impact Assessment (LCIA), the LCIA method *ReCiPe Midpoint (H)* was used focusing on the main impact categories of the paper industry – Climate Change and Water Consumption and Land Use.

First results showed that the developed recycling process leads to higher environmental impact in the impact category Climate Change mainly due to the necessary substitution of energy generated from incinerating paper from LWP. However, concerning impact categories Land Use and Water Consumption, the recycling of paper from LWP is environmentally beneficial due to substituting primary fibers. Next, these impacts will be complemented with additional impact categories and substitution scenarios.

With the described approach, a case study was conducted to environmentally assess two different waste treatments – incineration and recycling – of paper from LWP. The resultsare crucial for decision making as they show how targets and legal regulations around waste recycling affect environmental impacts.

[1]DIE PAPIERINDUSTRIE - Leistungsbericht PAPIER 2023.