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LCA of Chocolate Packed in Aluminium Foil Based Packaging

Sybille Büsser

Niels Jungbluth

ESU-services Ltd., Uster, Switzerland

Commissioner

German Aluminium Association (GDA)

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ESU-services Ltd. Kanzleistrasse 4 CH - 8610 Uster
Rolf Frischknecht T +41 44 940 61 91 frischknecht@esu-services.ch
Niels Jungbluth T +41 44 940 61 32 jungbluth@esu-services.ch
Sybille Büsser T +41 44 940 61 35 buesser@esu-services.ch
Marianne Leuenberger T +41 44 940 61 38 leuenberger@esu-services.ch
Matthias Stucki T +41 44 940 67 94 stucki@esu-services.ch
www.esu-services.ch F +41 44 940 61 94

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Authors	Sybille Büsser
	Niels Jungbluth
	ESU-services GmbH, fair consulting in sustainability Kanzleistr. 4, CH-8610 Uster
	www.esu-services.ch Phone +41 44 940 61 35
Customer	German Aluminium Association (GDA) in cooperation with the Euopean Aluminium Foil Association (EAFA)
	Stefan Glimm
	Am Bonneshof 5, D - 40474 Düsseldorf
	stefan.glimm@aluinfo.de
	Phone +49 211 4796 150; Fax +49 211 4796 408
Steering Group	Gerald Rebitzer, Alcan Packaging
	Melinda Bonamour, Constantia Teich
	Christian Bauer, EAFA
	Jörg Schäfer, GDA
	Hans-Jürgen Schmidt, Hydro
	Jean-Paul Duquet, Novelis
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Executive Summary

"LCA of Chocolate Packed in Aluminium Foil Based Packaging"

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Packaging within the food supply chain has to fulfil a variety of purposes. Besides the protection of the packed product also its safe transportation and storage at the retailers and households is of great importance.

Chocolate as a typical confectionary product is usually stored for long periods. Exposed to air and light, taste can deteriorate and the surface can quickly lose its gloss. Therefore aluminium foil is frequently used to provide a barrier for light, moisture and other gas, thus preventing from desiccation, oxidation and any penetration of unwanted aroma and flavour. Additionally, the mechanical properties of aluminium foil allow a re-wrapping of opened packages supporting the prevention of spoilage. Together with an outer paper wrap adding additional mechanical resistance and options for printing, aluminium foil is frequently used in chocolate packaging.

This life cycle assessment (LCA) study investigates **chocolate packed in aluminium foil and wrapped with paper**. The analysis and assessment is focused in particular on:

- the environmental performance of the packaging with respect to its function within the life cycle of chocolate.
- the environmental relevance of stages and interdependencies within the life cycle of chocolate including consumption patterns.

The functional unit in this study is 1 kg chocolate, packed in 100 gram chocolate bars to be consumed in the household.

The life cycle of chocolate encompasses the whole food supply system including the cultivation of cocoa beans in tropical regions until its consumption in the household. Cocoa beans are transported to Europe by ship and processed to semi-finished cocoa products (butter, powder, liquor). The produced chocolate is packed in aluminium foil and paper, transported to the retailers where it is bought and transported to the household. Used packaging is partly recycled and partly disposed off in landfills or in an incineration plant. In the methodology used the content of recycled material for the packaging production has been considered and therefore no credits for recycling and energy recovery are given.

Four different chocolate compositions are investigated in this LCA in more detail: dark, milk and white chocolate and chocolate with sultanas.

The results of the study are calculated for ten environmental indicators. The main impact assessment and discussion is based on a selection of five widely accepted indicators. These are Cumulative Energy Demand (CED), non-renewable [MJ-eq.], Global Warming [kg CO_2 eq.], Ozone Layer Depletion (ODP) [kg CFC-11 eq.], Acidification [kg SO_2 eq.] and Eutrophication [kg PO_4^{3-} eq.].

Figure 1 shows the scores for these selected impact indicators for milk chocolate scaled to 100%. The most relevant aspect concerning the life cycle of chocolate is the chocolate production including farming and processing of the necessary raw materials (semi-finished cocoa products, milk powder, sugar…) and manufacturing of chocolate (77% to 97%). The impact of the production phase is also predominant in the other category indicators not shown in the graph.

The share of retail packaging is between 1% (eutrophication) and 9% (CED non-renewable). About two thirds of this burden stems from the use of aluminium and one third derives from the wrapping paper. It must be considered that the aluminium and the paper part of the packaging fulfil different functions contributing to a single packaging solution. The influence of distribution and selling of chocolate is

second most important in the indicator non-renewable cumulative energy demand and ozone layer depletion.

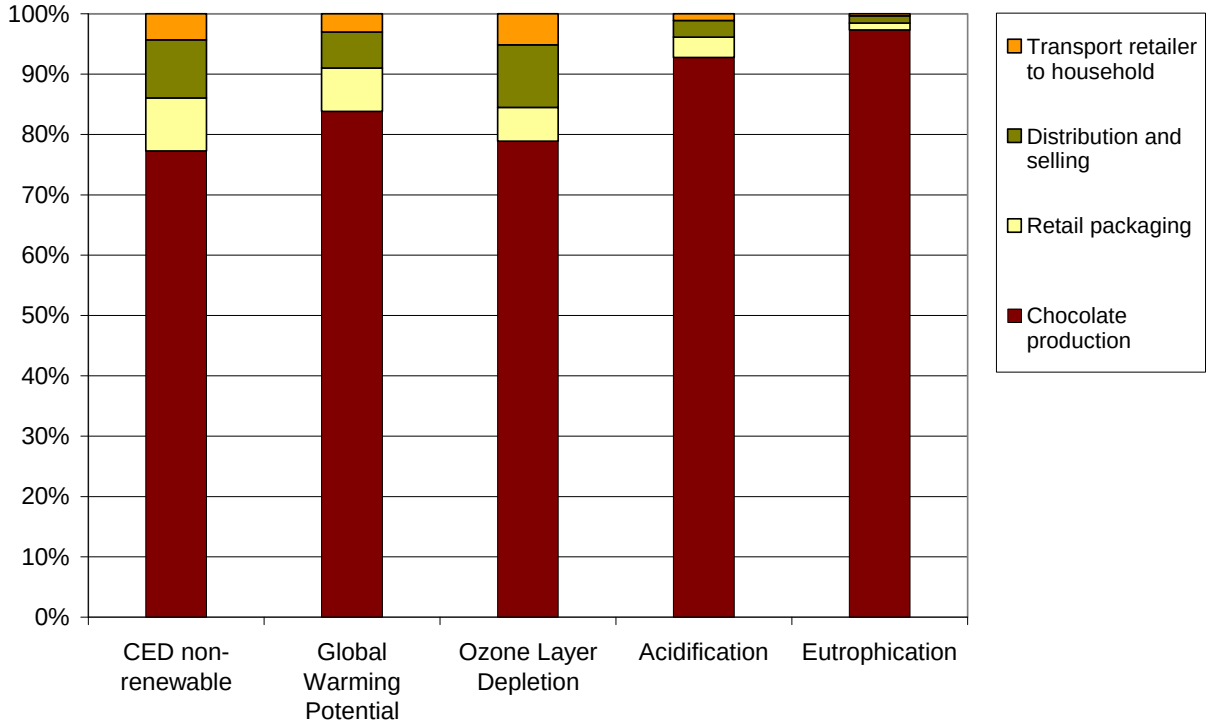

Figure 1: Results of the standard case for 1 kg milk chocolate packed in 100g bars made from aluminium foil and wrapped with paper; the results are scaled to 100%.

The differences between the investigated chocolate compositions are significant. Figure 2 reveals the greenhouse gas emissions associated with 1 kg chocolate as absolute values and in percentages. In total one kg milk chocolate corresponds to the emission of about 3.6 kg CO_2-eq in a range between 2.1 kg CO_2-eq (dark) and 4.1 kg CO_2-eq (white). Dark chocolate exhibits the lowest impact scores also for all other categories and white chocolate the highest of the investigated cases.

It is mainly the abandonment of milk powder in dark chocolate and the extra milk powder added in white chocolate which is responsible for the differences compared to milk chocolate. Furthermore in dark chocolate mainly cocoa liquor is used. In milk chocolate more cocoa butter than cocoa liquor is used and in white chocolate only cocoa butter.

Within the sensitivity analysis the relevance of assumptions but also consumer choices and consumption patterns for the overall results are investigated. In this LCA different shopping scenarios and refrigeration at home have been assumed. The relation between chocolate types is not changed, however a shopping scenario with more individual traffic increases the impact scores slightly as well as additional refrigeration at households. In an extreme scenario it was assumed that chocolate is bought during a trip and transported home by airplane instead of purchasing it locally. The impact on the results is substantial and burdens can increase by a factor of about 3 compared to the standard case.

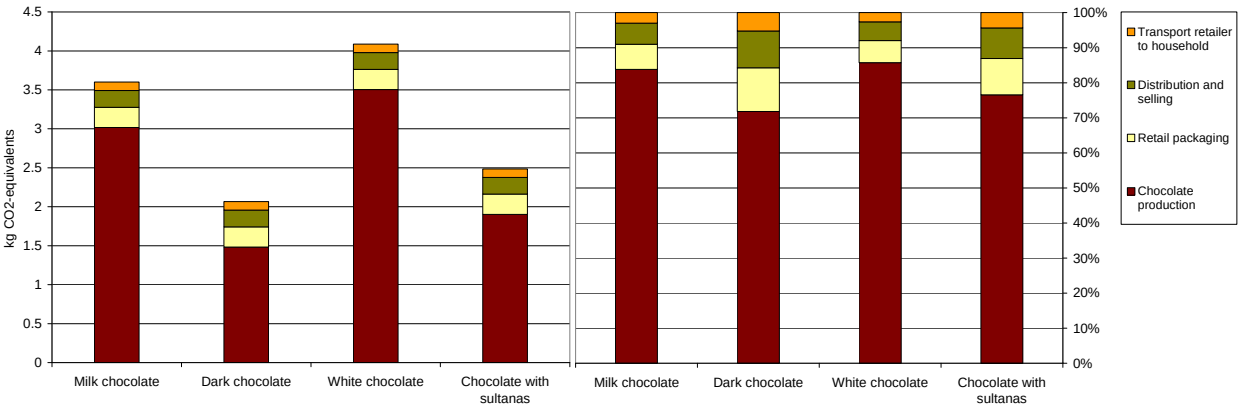

Figure 2: Results of the standard case for 1 kg chocolate wrapped in 100g bars and aluminium foil based packaging with regard to global warming. Absolute values given on the left side, percentages are given on the right side.

In conclusion the most relevant factor concerning the environmental impacts from the whole supply chain of chocolate is for the majority of indicators the composition of the chocolate particularly with regard to the amount of milk powder used and the agricultural production of cocoa beans. In all cases the production of chocolate is the most contributing phase in the life cycle. Retail packaging and distribution are far behind, more or less of similar importance. As a consequence the most relevant measures to reduce environmental impacts for the production and supply chain would be improvements in the agricultural production of cocoa beans and milk. Even though burdens of retail packaging and the distribution phase are considerably lower than for the chocolate production itself, further improvements could help to decrease the overall impacts.

From a consumers point of view the choice of the chocolate type has the largest impact. Second most important aspect is the shopping behaviour with regard to emissions from individual and public transportation.

The chocolate types, portion sizes and packaging systems in this study do represent examples on the European market. Thus, no conclusions can be drawn for options not investigated as e.g. other compositions, other packaging sizes or other packaging materials.