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LCA study of two different sandwich packs: A rigid plastic lunchbox and household aluminium foil

Executive summary of the Final Report

Prepared for the European Aluminium Foil Association e.V. (EAFA)

The LCA was critically reviewed according to ISO 14040 and ISO 14044 by Walter Klöpffer (Frankfurt/M), Fredy Dinkel (Basel) and Philippe Osset (Paris)

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Executive summary

Background, goal and scope

The “LCA study of two different sandwich packs: A rigid plastic lunchbox and household aluminium foil” conducted by IFEU investigates the environmental performance of household aluminium used to safely pack a sandwich. The results of this assessment are compared to those of a reusable plastic box, another commonly used sandwich packaging. Main goal of the study is to challenge existing consumer belief that aluminium packaging generally has a far greater environmental impact than other solutions.

The study is performed in accordance with the relevant ISO standards (ISO 14040 and ISO 14044) and accompanied by a critical review process. The results may be used in both internal and external communication, i.e. customers, retailers, authorities, NGOs.

A wide range of environmental impact categories and inventory level indicators is covered. The environmental impact categories are *Climate change*, *Acidification*, *Summer Smog, Human toxicity: PM10*. *Terrestrial* as well as *Aquatic Eutrophication, Stratospheric Ozone Depletion* and *Abiotic Depletion*. The inventory categories included are *Total Primary Energy Demand (CED total)* and *Non-renewable Primary Energy Demand (CED non-renewable)* as well as the *Use of Water*.

In this study two different ways to pack a sandwich are examined. A household aluminium foil packaging is compared with a reusable rigid plastic box. For the modeling of the base scenarios 1.95 g of aluminium foil (12 µm * 30 cm * 20 cm) is used to pack a typically sized sandwich made from two slices of bread with a filling in between. Figure 1 shows the aluminium foil used and the sandwich packed.

Figure 1: Household aluminium foil and sandwich

For the alternative packaging of the same sandwich a rigid plastic box by one of the world's leading plastic box manufacturers that can be considered to be a typical sandwich box is used. Its measurements are 16 cm x 12.6 cm x 4.9 cm. The plastic box is cleaned after each use in a dishwasher. The choice of a modern dishwasher with an energy efficiency class of A+, that is only run fully loaded and in the most efficient eco-mode, can be considered as a conservative choice from the viewpoint of the aluminium foil. Calculations based on measured and manufacturer's data and loading trials show that the plastic box uses up at least 5% of the available space. Therefore 5% of the consumed energy, water and detergent per cycle are allocated to the cleaning of the rigid plastic box. The production and recycling/disposal of the plastic box are excluded from this study as it is assumed to be negligible due to the many uses of such boxes. Figure 2 shows the rigid plastic sandwich box and the fully loaded dishwasher.

Figure 2: Plastic box and loaded dishwasher

In addition to the base scenarios, sensitivity analyses are conducted. These sensitivity analyses examine the influence of different assumptions regarding the recycling rate of aluminium foil, the incineration rate, the amount of aluminium used, the amount of sandwiches packed, the type of dishwashing detergent used and the allocation factor for open-loop recycling.

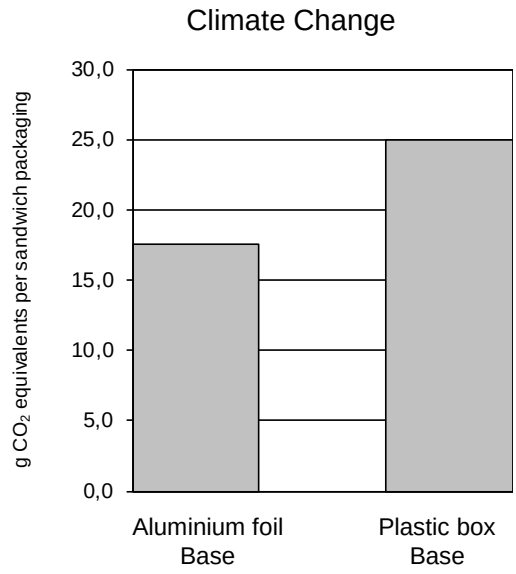
In order to evaluate the relative importance of each single indicator, a normalisation step was included in this study.

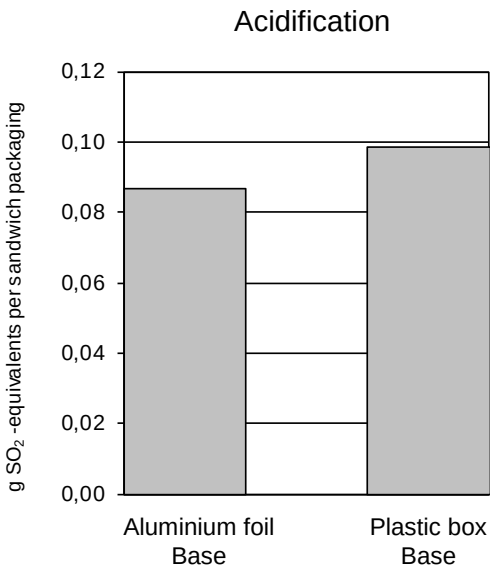
Results

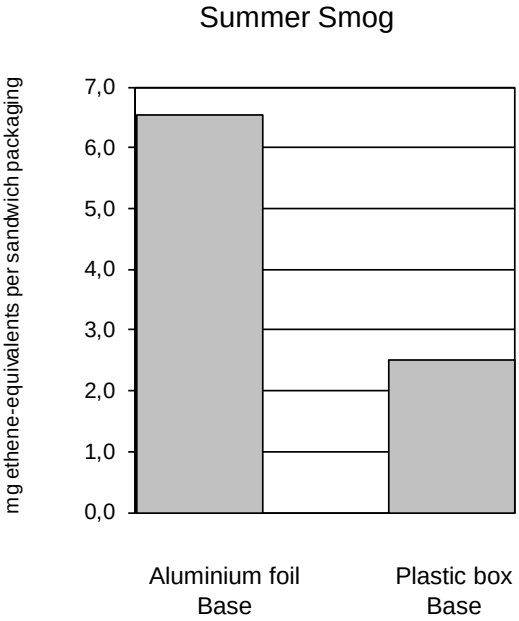
The LCA results show that the major impact in most of the examined environmental impact indicators originates from the production of electricity for producing aluminium foil, or in case of the plastic box, for the operation of the dishwasher.

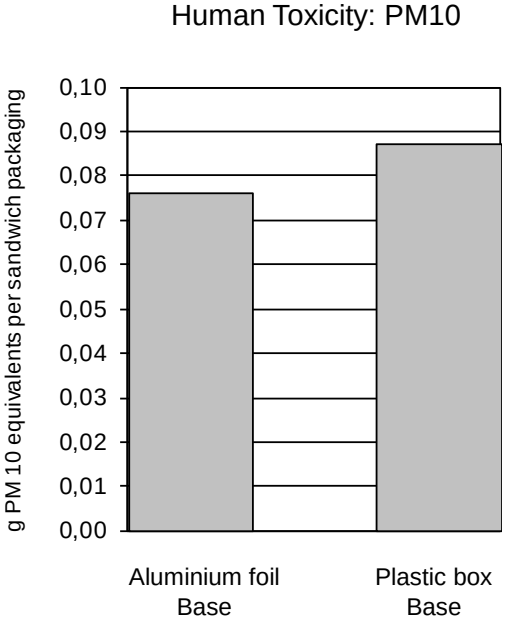
Compared with the plastic box the aluminium foil shows lower or equal environmental impacts than the plastic box in almost all examined impact categories. This is true not only for the base scenarios but also for the results of all sensitivity analyses including those that lead to slightly higher impacts for the foil (e.g. thicker foil, 50% allocation factor). Only for the impact category Summer Smog the aluminium foil's results are considerably higher than those of the plastic box. Differences in results are being considered equal if a significance threshold of 20% is not exceeded.

Figure 3 shows simplified result graphs of the impact categories examined in the LCA. Results are from the base scenario.









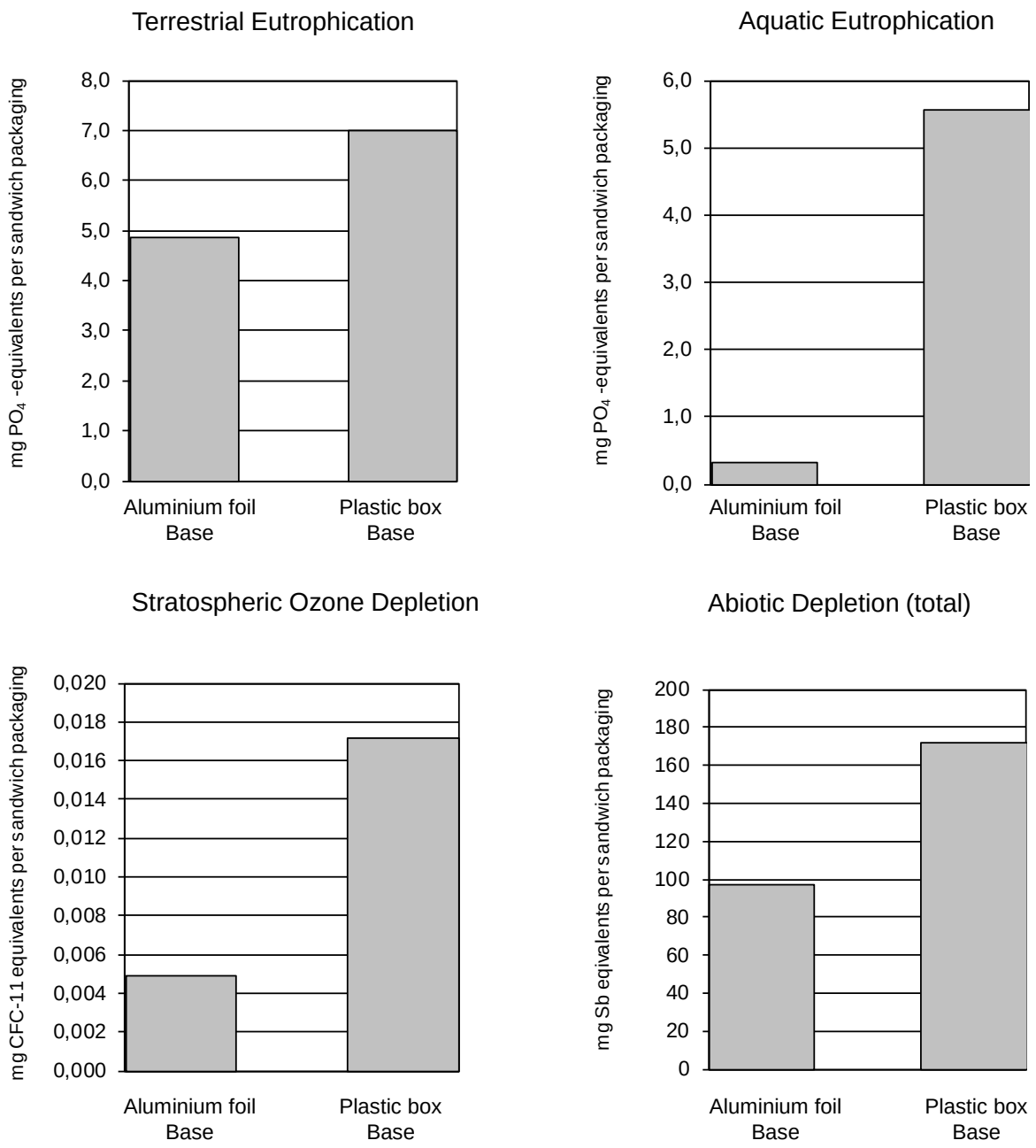


Figure 3: Environmental impact results of the base scenario

Recommendations

Based on the findings of this study, in consideration of the limitations described in the full report, the authors developed the following recommendations:

- From an environmental point of view the aluminium foil performs no worse than the plastic box to which it is compared. The environmental impacts due to the aluminium foil are lower than those of the plastic box in most relevant environmental impact categories and equal in the remaining ones, not only in the base scenarios but also in the analysis of the additional sensitivity scenarios. Therefore use of an appropriate amount of aluminium foil to pack one or two sandwiches on the European market (EU27+2) should be considered responsible.

- The sensitivity analysis regarding the thickness of the aluminium foil used shows that the environmental performance of the aluminium foil packaging improves if thinner foil is used. If using aluminium foil to pack sandwiches the authors therefore strongly recommend to consumers to prefer thinner household aluminium foil over thicker one if there is a choice of different aluminium foils available on the respective market. The authors also realise that there is a lower limit (around 10-12 microns) after which the functionality of the foil to pack sandwiches will be compromised.
- The sensitivity analysis regarding the thickness of the used aluminium foil can also be interpreted as a sensitivity analysis on the amount of foil (by area, not thickness). It shows that with a higher amount of aluminium used the environmental performance of the foil wrapping worsens. Therefore it is mandatory to ensure that only the necessary amount of aluminium foil to safely wrap a sandwich is used.
- The sensitivity analyses modelling higher incineration and recycling rates respectively show that the environmental performance of the aluminium foil can further be improved by a more developed waste management system for aluminium foil. It is therefore recommended to the legislation of European countries to aim for an increase of recycling rates of aluminium foil within their country's waste management system.
- In countries where a collection of household aluminium foil for recycling is already in place the authors strongly recommend to consumers to make sure the used foil is discarded in a way that facilitates a collection (e.g. by choosing the ‘correct’ waste recovery bin’).
- Although the calculation of a sensitivity analysis regarding the use of different dishwasher detergents does not lead to a change of the ranking order between the aluminium foil and the plastic box in any of the regarded impact and inventory categories, it shows that the environmental burdens of the cleaning process could be lowered by the use of phosphate-free dishwasher detergents. If using a reusable plastic box and cleaning it in a dishwasher the authors therefore recommend to prefer phosphate-free dishwasher detergents over phosphate-based ones.