INSTITUT FÜR ENERGIE- UND UMWELTFORSCHUNG HEIDELBERG

Comparative Life Cycle Assessment of different pouches and alternative packaging systems for food (Pasta Sauce and Olives) on the European market

Executive summary report

commissioned by Flexible Packaging Europe (FPE)

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Background, goal and scope

The "Comparative Life Cycle Assessment (LCA) of different Pouches and alternative packaging systems for food (Pasta Sauce and Olives) on the European market" conducted by ifeu Heidelberg investigates the environmental performance of multi-material flexible pouch systems used for Pasta Sauce and Olives and compares it with those of alternative packaging systems i.e. glass jars and steel cans. In the comparison, both the primary packaging, in which the filled product itself is transported, and the transport packaging for the distribution of the filled packaging to the point of sale are considered. The packaging systems are shown in table 1 and table 2.

Table 1: Studied packaging systems for the packaging of Pasta Sauce

Pasta Sauce Case	Pouch	Glass jar	Steel can
mass of contained food per unit	**400**	**400**	**400**
primary packaging composition	multi-material flexible (PP; Alu; PA; PET; PE)	glass jar + tin closure + paper label	tin can + paper label
weight of primary packaging unit	**10 g**	**216 g**	**54 g**
Secondary packaging composition	corrugated cardboard	corrugated cardboard + shrink film	corrugated cardboard
weight of secondary packaging (cardboard trays) per unit of primary packaging	**16.6 g**	**5.6 g**	**4.9 g**
tertiary packaging composition	EURO pallet + stretch film	EURO pallet + stretch film	EURO pallet + stretch film
Weight of tertiary packaging per unit of primary packaging	**20.9 g**	**19.7 g**	**17.6 g**

Table 2: Studied packaging systems for the packaging of Olives

Olive Case	Pouch	Glass jar	Steel can
mass of contained food per unit	**125 g**	**130 g**	**120 g**
primary packaging composition	multi-material flexible (PE; PET)	glass jar + tin closure + paper label	tin can + paper label
weight of primary packaging unit	**6 g**	**150 g**	**36 g**
Secondary packaging composition	corrugated cardboard	corrugated cardboard + shrink film	corrugated cardboard
weight of secondary packaging (cardboard trays) per unit of primary packaging	**8.3 g**	**3.7 g**	**3.2 g**
tertiary packaging composition	EURO pallet + stretch film	EURO pallet + stretch film	EURO pallet + stretch film
Weight of tertiary packaging per unit of primary packaging	**10.4 g**	**13.1 g**	**11.7 g**

The study is designed as a 'cradle-to-grave' LCA without the use phase, in other words it includes the extraction and production of packaging raw materials, converting processes, all transports and the final disposal or recycling of the packaging system; production and processing of the food products themselves are excluded from the scope.

The study covers the market situation in Europe (EU27 + United Kingdom, Switzerland, Norway, EU 27+3) in 2020.

Even though the study has not been subjected to a critical review it is done in accordance with the relevant ISO standards for life cycle assessment (ISO 14040/ISO 14044) in all other aspects.

A wide range of environmental impact categories is covered. The considered impact categories are Climate Change, Acidification, Photochemical Ozone Formation, Terrestrial Eutrophication, Aquatic Eutrophication, Particulate Matter. On an inventory level also cumulated primary energy demands are reported.

For each packaging system two sets of scenarios with different system allocation approaches regarding the end-of-life are chosen. The conclusions of the study are based on the results of both of these analyses. In addition a third set of scenarios is regarded as a sensitivity analysis, in which the influence of higher recycling rates are examined.

Results

The major impact in most of the examined environmental impact indicators originates from the production of the base materials used for the primary packaging. This is especially true for the production of plastics and aluminium as well as for the production of tinplate and glass.

Figures 1 and 2 show an example of the environmental category 'Climate Change'. Here, the high burdens of the life cycle step 'raw material' for the primary packaging can be clearly identified. The total impacts of the various packaging systems when considering the current recycling rate (red dot) are compared with the total impacts of a theoretical recycling rate of 100 % (blue triangle).

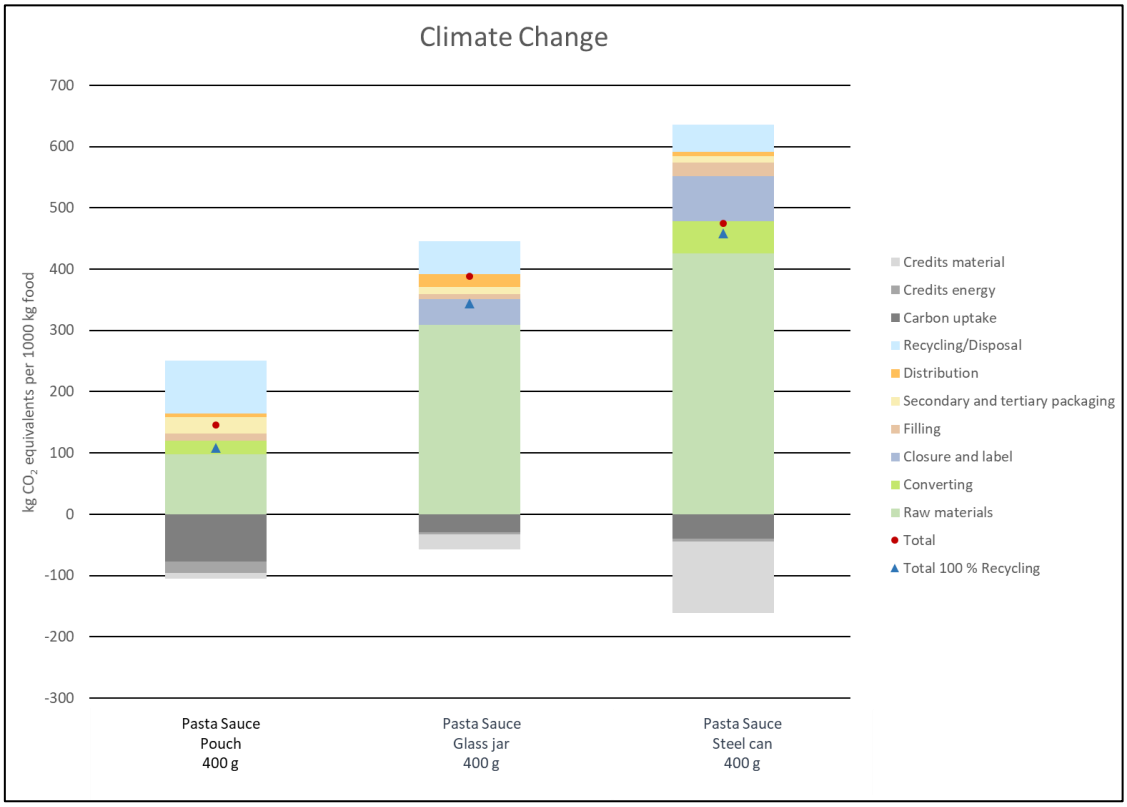

Figure 1: Climate Change Indicator comparative results; Pasta Sauce case; allocation factor 50%; current recycling quota; potential improvement with 100% recycling

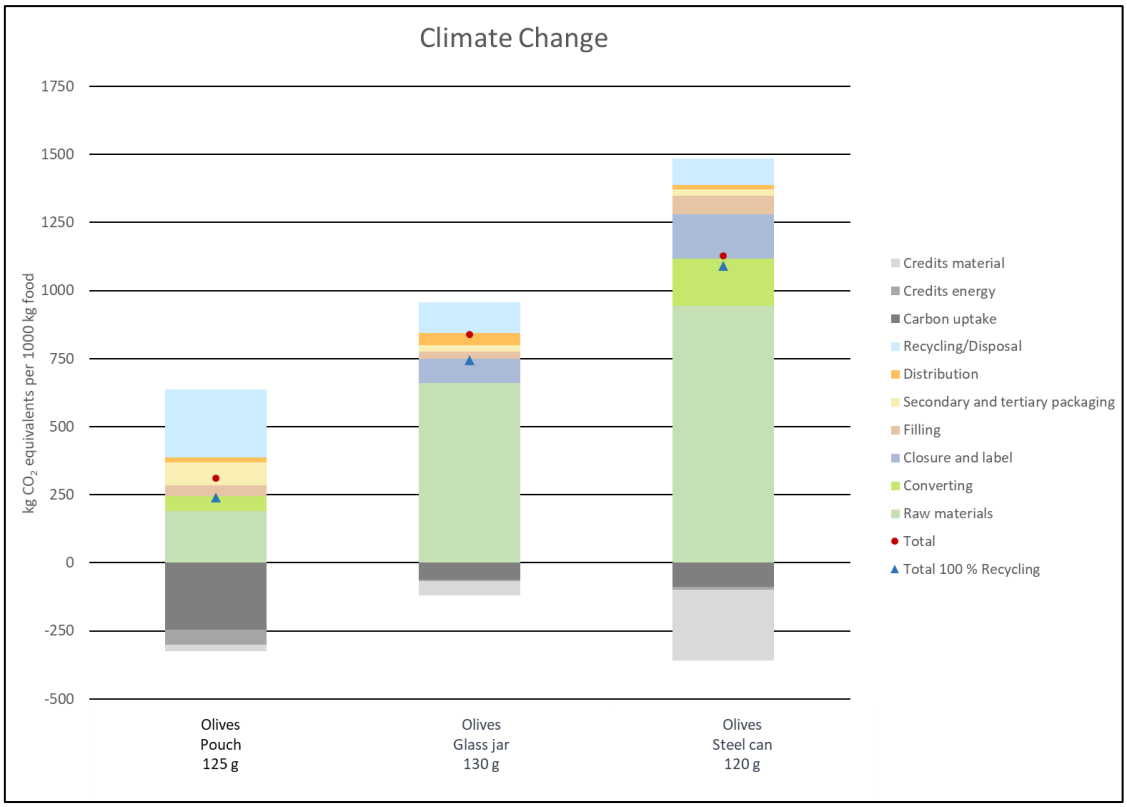

Figure 2: Climate Change Indicator comparative results; Olive case; allocation factor 50%; current recycling quota; potential improvement with 100% recycling

In all regarded environmental impact categories the examined pouches show lower impacts in terms of their packaging system than the glass jars and steel cans, with the exception of Aquatic Eutrophication, whose impacts are dominated by the heavier corrugated cardboard secondary packaging used for the pouches (see table 3 and 4). This is true for all sets of scenarios. The choice of allocation factor regarding the end-of-life plays only a minor role on the overall results. The application of a 100% collection for recycling rate leads to lower results for all packaging systems without changing the ranking order between the packaging systems.

Table 3: Comparison of pouch packaging with glass jar and steel can

Pasta Sauce *current recycling quota* *AF50*	The net results of **Pouch (400g content)** are lower (green)/ higher (orange) than those of	
	Glass jar (400g content)	Steel can (400g content)
Climate Change	-63%	-69%
Acidification	-61%	-53%
Photochemical Ozone Formation	-60%	-54%
Terrestrial Eutrophication	-56%	-48%
Aquatic Eutrophication	179%	105%
Particulate Matter	-64%	-55%
Non-renewable primary energy	-37%	-48%
Primary energy (total)	-24%	-39%

Table 4: Comparison of pouch packaging with glass jar and steel can

Olives *current recycling quota* *AF50*	The net results of **Pouch (125g content)** are lower (green)/ higher (orange) than those of	
	Glass jar (130g content)	Steel can (120g content)
Climate Change	-63%	-72%
Acidification	-62%	-58%
Photochemical Ozone Formation	-53%	-53%
Terrestrial Eutrophication	-49%	-44%
Aquatic Eutrophication	290%	164%
Particulate Matter	-63%	-58%
Non-renewable primary energy	-28%	-46%
Primary energy (total)	-12%	-37%

Conclusion

Based on this study, from an environmental viewpoint, the use of multi-material pouches for the packaging of Pasta Sauce or Olives on the European market is recommended when compared to the alternative packaging systems glass jar and steel can which are common on the European market.