Eco-Design for Food Packaging as a Result of Its Properties and Performances

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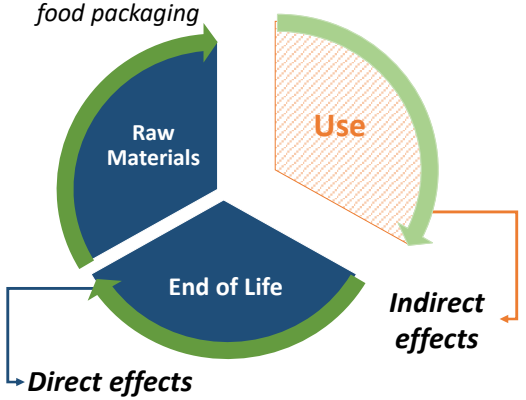
Introduction

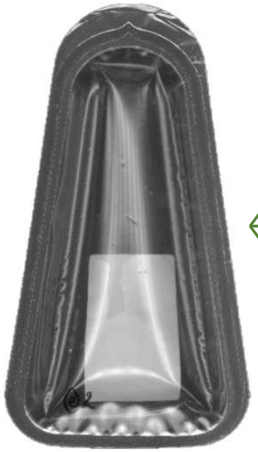
- The requirements for more sustainable packaging options have led to the necessity of eco-design.
- Food packaging sustainability is often associated with end-of-life issues such as lack of recyclability.
- Recent researches highlighted the importance of packaging performances related to food waste reduction, i.e. thanks to shelf life extension (Licciardello, 2017)

Figure 1. *Direct and indirect effects of food packaging*



An empirical-based model intended to evaluate the different contributions of packaging into environmental impacts of food-packaging systems is still lacking (Coffigniez *et al.*, 2021).

Procedures



Geometrical features

Volume, surface, thickness and thickness reduction. Composition of material

Diffusional properties

Oxygen, Carbon dioxide (23 °C and 0% RH)
Water Vapour (38 °C and 90% RH)

Environmental impacts

SimaPro software (V9.1.1.1),
Cut-off system modelling, referred to Europe.
IPCC 2013 100 years (v1.03)

Figure 2. *Methods of Ph.D. project*

PET/EVOH barrier film/APET + R-PET (1); BOPET/PET + R-PET (2); BOPET/BOPET + R-PET (3); OPA/PE + PET/EVOH/PE (4,ref.). Each containing 200g of P..D.O. Grana Padano cheese.

Results

Figure 3. *Gas resistance ratio (O_2; H_2O) for the different packaging solutions (a); Expected shelf-life windows based on maximum GTR tolerances for original and thermoformed solutions (b)*

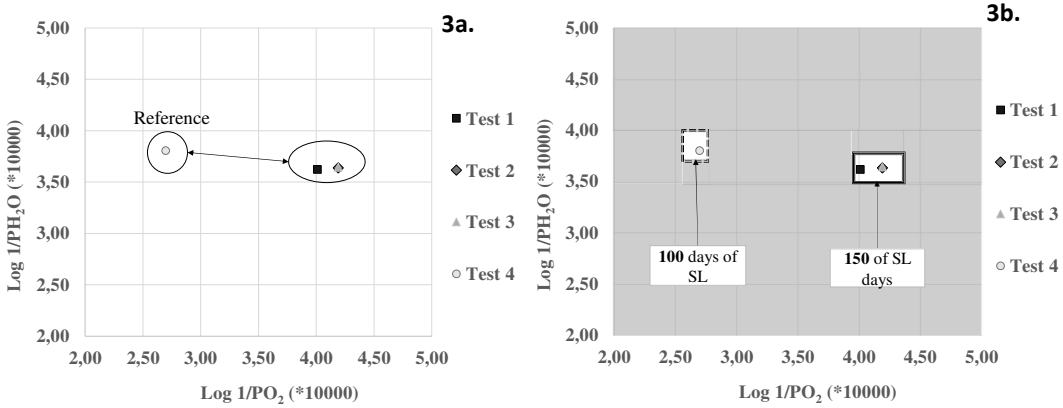


Table 1. *Environmental impacts for 100 pieces of tray-lid solutions corrected per FLW value (adapted from Conte et al., 2015)*

Sample	Expected Shelf Life (Days)	Cheese (*100p)	Packaging (*100p)	Total Impact (*100p)	FLP	PFLEI	WEI exp. SL	ΔWEI
		(kg CO_2 equivalents)				(kg CO_2 equivalents)		
1	150	206	2,3	208,3	8%	16,5	18,8	-346%
2	150	206	2,2	208,2	8%	16,5	18,7	-348%
3	150	206	2,1	208,1	8%	16,5	18,6	-351%
4	100	206	4,3	210,3	39%	79,7	83,9	0%

References

Frigerio V (2020) Life Cycle Thinking: a new scientific approach to prevent food wastage through sustainable packaging solutions (SaveFoodPack). *Proceedings of the Workshop on the PhD Research in Food Systems.* Università degli studi di Milano (Italy). 14-18 September 2020, pp.12-14.

Coffigniez F, Matar C, Gaucel S, Gontard N, Guilbert S and Guillard V (2021) The Use of Modeling Tools to Better Evaluate the Packaging Benefice on Our Environment. *Frontiers in Sustainable Food Systems* **5:** 634038.

Conte A, Cappelletti GM, Nicoletti GM, Russo C and Del Nobile MA (2015) Environmental implications of food loss probability in packaging design. *Food Research International* **78**, pp. 11–17.

Licciardello F (2017) Packaging, blessing in disguise. Review on its diverse contribution to food sustainability, *Trends in Food Science and Technology* **65**, pp. 32–39.