MONOFILM: ECO CONCEPTION TOWARDS THE RECYCLING OF SEALED PET TRAYS

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I. INTRODUCTION

The MONOFILM project aimed to support the transition from complex plastic trays to sealed PET (polyethylene terephtalate) trays, meeting eco-design recommendations (able to be inserted without disruption into current or future recycling) but also to the various functional constraints: sealability, peelability, barrier properties, printability, etc. One of the main challenges for PET was to find a tray/lid couple with a lid with a density of less than 1 allowing it to be separated from the body of the packaging during the flotation stage.12 manufacturers were partners in this project, which made it possible to test more than 50 packaging solutions.

II. MATERIALS AND METHODS

The first step of the project aimed to write the technical specifications for the packaging (functionality and recyclability) before identifying the suppliers (tray/sheet, lid, equipment manufacturers, etc.) with the aim of finding tray/ operculum meeting the specifications. The second step consisted in carrying out laboratory tests (sealing, verification of densities, peelability, etc.) in order to properly characterize them. In a third step, the packaging was taken to the food industry to assess sealability, suitability for use (peelability tests) and storage performance (throughout the shelf life). During these tests, the packaging was tested empty, with dirt on the weld bead (water, animal fat, vegetable fat) and with the final food. Each packaging tested in industry was 60 in number in order to have a statistical representativeness.

III. RESULTS AND DISCUSSION

On PET trays, the project made it possible to obtain numerous technical data at the laboratory level, but also on industrial sites and to identify the problems linked to the transition from complex trays to single-layer trays, the mains results are summarized in table 1. The sealing of lids on mono PET trays seems possible but less easy and safe than on PET/PE trays [1]. The objective of zero non-conformance is difficult to achieve, but promising solutions must be tested over longer production times. The percentage of operculum tears is low except for two series. The main difficulty remains the quality of the sealing. Manufacturers aim for 0% non-conformities, but they fluctuate between 0 and 3%, which is not acceptable to achieve the expected shelf-life. Soils of vegetable origin significantly degrade the seal, while the presence of soils of animal origin has a more moderate impact. Sealing is strongly influenced by the machine park (in particular its age) and the sealing parameters used [2]. To date, lids with a density of less than 1 available on the market and sealable on PET trays all have a density close to 1 (between 0.97 and 0.99) which probably does not allow systematic separation of lids by flotation. The presence of an EVOH (Ethylene Vinyl alcohol) barrier and the sealing agents used tend to increase the density of the seal. All plastic packaging recyclers in Europe use density sorting (floating stage) on their regeneration lines. If you change the density of your plastic resins: the bodies of PET pots and trays must have a density > 1 [3]. The project also made it possible to work on other technical aspects and to highlight that the inks affixed to the lids increase the overall density of the lids (about +0.05) making the search for inked lids with a density less than 1 impossible to date.

Table 1. Characteristics of packaging tested in laboratory and in industry (n=60 by modality)

	Product packed	Ham cooked	Dry ham	Duck mousse	Dry ham	Ham cooked	Dry ham	Ham cooked	Ham cooked	Ham cooked
Laboratory	Structure operculum	OPP/PE /PET/Pe el	OPP/PE/E VOH/PE/A PET	OPP/Co ex HB peel	OPP/PE/ EVOH/Pe el	BOPP/a dh/PE/E VOH/PE T	BOPP/adh/P E/EVOH/PET Peel	BOPP/PE/ EVOH/PE /PET Peel	OPP/PE /EVOH/ PET Peel	OPP / - / EVOH
	Thichness (µm) operculum	60	55	75	40	50	50	50	62	62.5
	Density operculum	0.96	0.99	0.98	0.97	0.97	0.97	0.98	0.98	0.97
	Type of sealant	PET	PET	PET	PET	PET	Coating on PE	PET	PET	PET
Industry	Sealing parameters	155°C/ 1.2 sec / 4 bars	150°C/ 1.2 sec	150°C/ 1.2 sec		150°C/ 1.2 sec /4 bars	160°C/ 1.2 sec	150°C/ 1.2 sec /4 bars	145°C/1. 2 sec/ 4 bars	145°C/1. 2 sec /4 bars
	Peelability rating (1-2-3-4-5)*	3	3	3	3	3	3	3	3	3
	% of Tear	0	0	0	88	0	16	0	1.25	0
	% NC with sealing	3	2	0	2.5	3	1	2	1.5	2.5

*1= poor sealing, 2= insufficient sealing 3= good peelability,4=difficult opening 5= no peelablity; OPP: oriented-polypropylene ; PE: polyethylene ; PET: polyethylene terephtalate ; EVOH: ethylene vinyl alcohol ; Coex HB : coextruded high barrier; BOPP: bi-oriented polypropylene ; adh: adhesive ; NC: non-compliant.

For sealing on PET trays, several types of sealing agents have been tested (modified PE, modified PET, varnish, etc.). 97% of the solutions that have given satisfaction at the industrial level use a sealing agent from the Polyester sealant family (modified PETs including PETg). Several “improved APET” (Amorphous Polyethylene Terephathlate) thermoforming sheets developed to facilitate lid sealing, using different technologies, have also been tested. These thermoforming sheets did not show a real improvement in sealing, especially in soiled conditions. A few sealing tests under industrial conditions were carried out on preformed PET trays. The results were unfortunately not conclusive in terms of sealability, but made it possible to carry out a state of the art on the possibilities of improving the sealing on these packages: addition of wax, physical modification of the sealing area, modification material structure, etc.

IV. CONCLUSION

Working together with the various players in the value chain seems inevitable in order to continue the work initiated during the “MONOFILM” project. Solutions that have given encouraging results on mono PET trays can be tested during new industrial tests, which are longer and representative of real production conditions. Work on reducing the inking rate of printed lids should be carried out in order to consolidate data on the impact of printing on density, with the aim of determining the technical feasibility of inked lids with a density lower than 1. The PET25 consortium created in France will provide global visibility on the brakes and levers allowing the creation of a sealed and unsealed PET jars/trays sector and take concrete collective action for its.

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