Report on new multimaterial packaging designs

Deliverable 4.1

WP4. Demo Case B. Creation of innovative formats and testing materials that improve recyclability and the end-of-life scenario

CIRC-PACK - Towards circular economy in the plastic packaging value chain

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PUBLISHABLE SUMMARY

Today, multimaterials are widely applied by the packaging sector. This can be explained by the fact that both plastics and packaging are subject to sustainability related discussions. On the contrary paper and board are often perceived as sustainable and good recyclable. For that reason, more and more packaging producers shift from plastic to paper packaging. Paper packaging can however not offer the same barrier properties as plastic packaging. Therefore, layers of plastic are added to the paper packaging, to ensure the protection of the enclosed product. This results in multimaterial packaging.

Another reason for a shift to multimaterial packaging is changing consumer behaviour. Consumers require convenience, since they have less time and want their products in easy-to-use, individual doses and ready-to-eat. Furthermore, transparency is an important trend: consumers would like to see what they purchase, to check the freshness and the quality. All these trends, in combination with the trend to pack in paper and board lead to the production of increasingly complex materials; windows are added to the paper packaging to facilitate visibility and layers of plastic are added to protect the product.

Multimaterial packaging is used in both food and non-food applications. Food products that are often packed in multimaterial packaging are ready-made food, spirits, confectionary, pastry, dry food, frozen food and chilled food. Non-food products that are often packed in multimaterial packaging are homecare products, tobacco, health and personal care products and flowers.

Multimaterial packaging in a circular economy

Multimaterial packaging is however often not fitting a circular economy. Multimaterial packaging cannot be recognised as such by a consumer to dispose of in the right way. Even if the consumer would classify it as a multimaterial packaging, there is no right way to dispose this packaging. Most multimaterial packaging ends up in the paper recycling process, where the plastic parts hinder the paper recycling process. As an exception in some European EPR systems, i.e. in Spain, multimaterial packaging is requested in the yellow container (plastic packaging, cans and beverage cartons), excepting those which contains more than 75% of paper, that are requested in the blue container (paper and cardboard). When multimaterial packaging is disposed through the residual waste stream, it will be incinerated or sent to landfill. This deliverable therefore aims to demonstrate new multimaterial packaging formats that improve the end-of-life scenario.

There are currently some alternatives on the market. These alternatives have different approaches. First approach is trying to lower the environmental footprint by using biodegradable plastics in combination with paper. Since paper is biodegradable by nature, these alternatives aim for creating an alternative route to dispose multimaterial packaging: through composting. Second approach is to try to make the multimaterials separable into monomaterials, either by the consumer, or during the recycling process. This approach is more favoured from a circular economy point of view, since this allows recovery and reuse of the valuable materials that are inside the packaging, instead of giving them back to nature (through composting).

Case study

As a case, detergent powder packaging is eco-designed such that it is recyclable through the paper recycling process (multimaterial packaging is most likely to end up in this process, since it can hardly be distinguished from normal paper). To pack detergent powder, multimaterial packaging is often chosen in the form of pouches, boxes and bags. The detergent industry is, like other industries, dealing with the two matters: the reduction of packaging size/compaction (concentration) and the development of packaging recovery schemes to optimise the use of packaging resources. When packing detergent powder in paper-based packaging, it is important to add barriers against moisture, grease and fragrance. Furthermore, detergents can cause colour bleeding on the packaging.

For designing an alternative to the poorly recyclable detergent powder box, multiple requirements are important to be met. Firstly, consumers require aesthetic appeal of the packaging, convenience, durability and versatility. Furthermore, environmentally friendly packaging becomes increasingly important. Secondly, the packaging must fulfil the protection that the detergent requires, and the packaging must be adaptable to the fast and efficient filling machines. Finally, legislation must be followed, regarding hazardous chemicals.

Eco-design

Based on the product requirements, four eco-designs were proposed that focus on the recyclability of the multimaterial packaging. The plastic components in these eco-designs do not hinder the recycling of the paper components and ideally the plastic components can be recovered and exploited as well. Therefore, the eco-designs focus on the separability of the multimaterial into separate monomaterials. This separation can be either facilitated and encouraged to consumers, or, more reliably, be facilitated during the paper recycling process.

The eco-design that is selected consists of multiple layers of board. To the inner layer, a dispersion coating is applied. A dispersion coating is an aqueous dispersion of fine polymer particles, which is applied to the surface of board as such to form a solid, non-porous film after drying. When recycling the board with dispersion coating, the water will bring the polymer particles into dispersion again. Hereby, the dispersion does not hinder the process water from penetrating into the board and thereby the disintegration of the board into fibres. Research is done on the recovery of the dispersion coating from the process water and using this to produce new plastic packaging.

Overall conclusions

Generally, new multimaterial packaging can be based on bio-based plastics to lower the environmental footprint of extracting the raw materials. Besides, one could make use of plastics that are biodegradable as well to improve the scenario of the packaging ending up in the environment as well. Multimaterial packaging is however most likely to end up in the paper recycling process, since it can hardly be distinguished from normal paper. Therefore, one could better focus on the separability of the multimaterial into separate monomaterials, either by the consumer, or during the recycling process. Most ideally,

plastics would be chosen that can be recovered from the recycling process and be exploited subsequently.