

Sustainability as a pivotal point in packaging design. Innovative oil packaging case study.

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Abstract. This paper aims to present a possible solution of reducing the quantity of waste cooking oil and exposes the design process of an innovative oil packaging concept that facilitates the collection of it after the container is empty. The innovation resulted as solution to the tedious process of collecting oil and consists in a bottle stopper that functions as a funnel when reversed. The bottle stopper/funnel (designed with a no leakage geometry) contains a detachable strainer which retains the impurities. The packaging is designed for 3 quantities (1, 2 and 5 liters) and is designed to be manufactured from recycled PET and ABS. The approach of the concept focuses on identifying alternative solutions that develop new methods and approaches to change mindsets and behaviours through objects.

Keywords: *packaging, innovation, sustainability, recycling, waste cooking oil*

Introduction

According to statistics, approximate 15 million tonnes of waste vegetable oils are produced each year in the world, from which 1 million within the European Union [1], which equals less than 1 kg per inhabitant per year [1]. In addition, it is a known fact that a single litre of waste cooking oil pollutes a million liters of water and according to statistical data 25% of water pollution is caused by waste oil and in the European Union. The quantity of waste cooking oil is increasing due to the large preparation of food not only in households, but mainly in fast food chains, restaurants or hotels. Oil that is not properly collected often ends up in rivers, creating a film on its surface that blocks the transmission of oxygen and affects aquatic life. Although the fact that filtering oil from water produces substantial costs with a real economic impact and that the European Union created a specific directive (namely 2008/98/EC), waste oil is not treated like a priority from an environmental point of view. Furthermore, as reported by the American Petroleum Institute recycling just 7,57 kg of waste oil can be create enough electricity to run household approximate 24 hours.

Taking all this statistical data into account, it is imperative to find new solutions that can improve the environment not only through legislation or education, but also through oil packaging that can facilitate the collection of waste cooking oil by the end user, generating a substantial behavioural change.

Premises of the creation process

Developed by product designer Alexandra Ghioc in collaboration with mechanical engineer Dragos Mititelu, the innovative oil packaging was first presented as a contest proposal that was held in 2020 in a digital form, on a design platform. Entitled „Disruptive Plastic Packaging Challenge”, the competition

aimed to find new product concepts that were exclusively realised through stretch blow moulding and were manufactured from Polyethylene terephthalate (PET). The concept proposals should have addressed environmental issues and a circular economy focusing on the bottle-to-bottle recycling technologies. The beneficiary was an Italian company that provoked international designers and studios to imagine a better usage of PET containers by creating a secondary function or usage after the consumption of the content. Although the project was not initially awarded, the idea was further developed and improved in 2021 by the two authors.

Taking the brief into account product designer Alexandra Ghioc and Engineer Dragoș Mititelu designed an innovative oil packaging that would help users with the collection of waste cooking oil. The proposal is based on the patent registered by Dragoș Mititelu at State Office for Inventions and Trademarks (No.RO116247 (B1) from 29th of December 2000) (figure 1).

The invention consists in a multifunctional container designed for straining, measuring, storing and transferring liquids that include a funnel, a graduated cup, a separator/strainer and a cap. The product can be either used as an assembly or as individual parts that can be used separately.

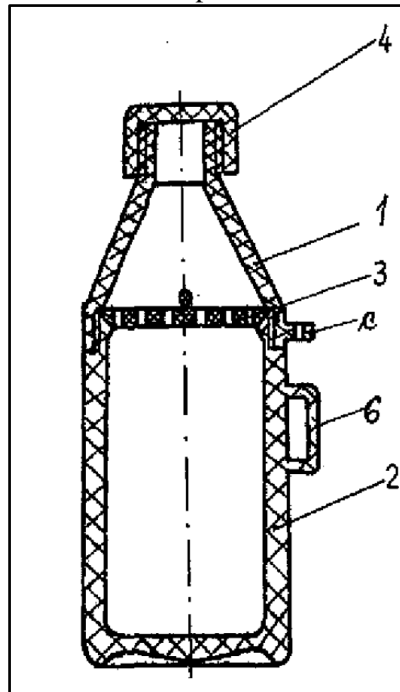


Figure 1. Image of the patent registered by Dragoș Mititelu in 2000

The innovative oil packaging. Case study

Instead of collecting the used cooking oil in a separate container which should be later stored in collection centres, most of the users throw it in the sewage systems (sink or toilets) or in the general garbage disposal. This behavioural pattern is mostly due to the complicated collection process of waste cooking oil that implies the usage and cleaning of a dedicated container, a strainer and a separate funnel in order to strain impurities and prevent leakages. The innovative and ecological packaging concept for oil that designer Alexandra Ghioc and engineer Dragoș Mititelu created facilitates the collecting of waste cooking oil after the container is empty (figure 2).

The innovative solution consists in a bottle stopper that functions as a funnel when reversed. The assembly containing the bottle stopper and funnel also contains a detachable strainer which retains the impurities and facilitates the recycling of the waste oil (figure 3).

In the user scenario, the end customer buys the oil bottle needed and consumes the containing oil. After its consumption, the empty bottle is used for recycling the waste cooking oil creating a circular behaviour and encouraging the end user to extend the basic functionality of a PET Bottle.



Figure 2. Exploded view of the 1 liter packaging and assembly

The optimal ergonomics were taken into consideration when designing the oil packaging, which is provided not only through the diameter of the main container or handle of the strainer in relation with the general dimension of fingers and hand, but also through ease of manouvering, assembly and disassembly, cleaning each component of the packaging.



Figure 3. Steps in usage of the innovative oil packaging when collecting waste cooking oil

The main body of the package and the funnel are designed to be manufactured through PET stretch blow moulding technology, while the bottle stopper/funnel and the strainer can be produced using

injection technology. Withall, the proposed materials from the innovative oil packaging are recycled PET and ABS. Based on the elasticity of the materials, the asambley is designed in order to dismount, deform (when needed due to the designed grooves) clean and further recycle easely.



Figure 4. Images explaining the functionality when recycling waste cooking oil

Although the 1 liter packaging is one of the most frequently used and bought product, the concept was developed for 3 dimensions in connection with 3 quantities: 1 liter, 2 liters and 5 liters using Autodesk Inventor software (figure 5). The 3-dimensional modelling of the packaging made by the engineer Dragos Mititelu took several aspects into account such as calculation of the volume, the functional and ergonomic restrictions, the manufacturing technology, the number of parts resulting from the proposed design, the fitting of the assembly or the elasticity of the materials.

The stylistic outlook has been followed in all of the 3 packaging quantities, making the packaging easy recognisable in comparison with other products on the market. The overall shape of the oil package is neutral (not limited to a typology) and versatile offering the possibility of customization with various types of cooking oils (avocado, palm, sun flower oil etc.). Designed to stand out on the shelf due to the strong chromatic contrast between the yellow main container and the dark brown funnel and bottle stopper assembly, the packaging has a unique aesthetics which is enhanced by the distinction between the opaque and translucent materials.

In addition to the general design of the packaging, two more refined elements were inserted, namely the rings from the main container (which make the packaging more easily flexible and foldable) that are strategically positioned and shaped so that the overall appearance of the bottle would be more dynamic and the radial grooves on the funnel which subconsciously suggest the flow effect.

The concept has respected all the stages of the design process starting with a thorough research of the competitive market, a stylistic analysis on the typology of the product, an overview of how users recycle oil, a list of standards and requirements in manufacturing and continuing with numerous bi and three-dimensional sketches, the conception of the final digital model and technical data.

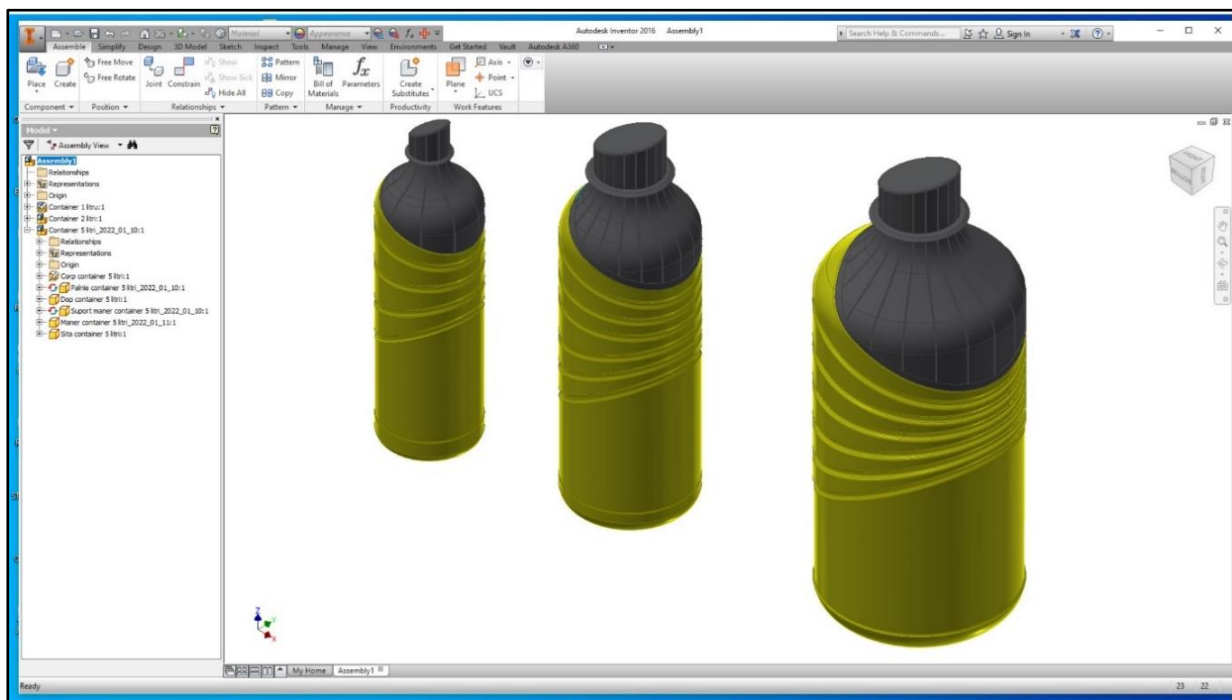


Figure 5. Print screen of the 3-dimensional packaging proposals (1, 2, 5 Liter) developed in Autodesk Inventor software



Figure 6. Images for 1,2 and 5 liter packaging

The package proposal for 2 and 5 liters contains a dedicated handle for easy manoeuvring. The handle slides from the edges of the funnel and is retractable offering the possibility of usage only when needed (figure 7).



Figure 7. Assembly and detail views for the retractable handle

Implementation

For a better understanding of the concept, a model of the 1liter concept was created using the 3-dimensional printing technology (figure 8). The model was materialized using CREATBOT printer (product code F430) in PETG as the main material (figure 9). Each part of the assembly was imported in Slicer Software and further designed and developed in order to prepare for the actual 3-dimensional printing. In this sense, a series of iterations with different adjusted parameters were required in order to obtain the desired result.

The model of the packaging helped Alexandra Ghioc and Dragos Mititelu to validate a series of aspects such as the functioning principles, the ergonomics in handling the container, overall proportion of the product, the transparency effect of the main container in contrast with the opaque funnel and bottle stopper assembly.

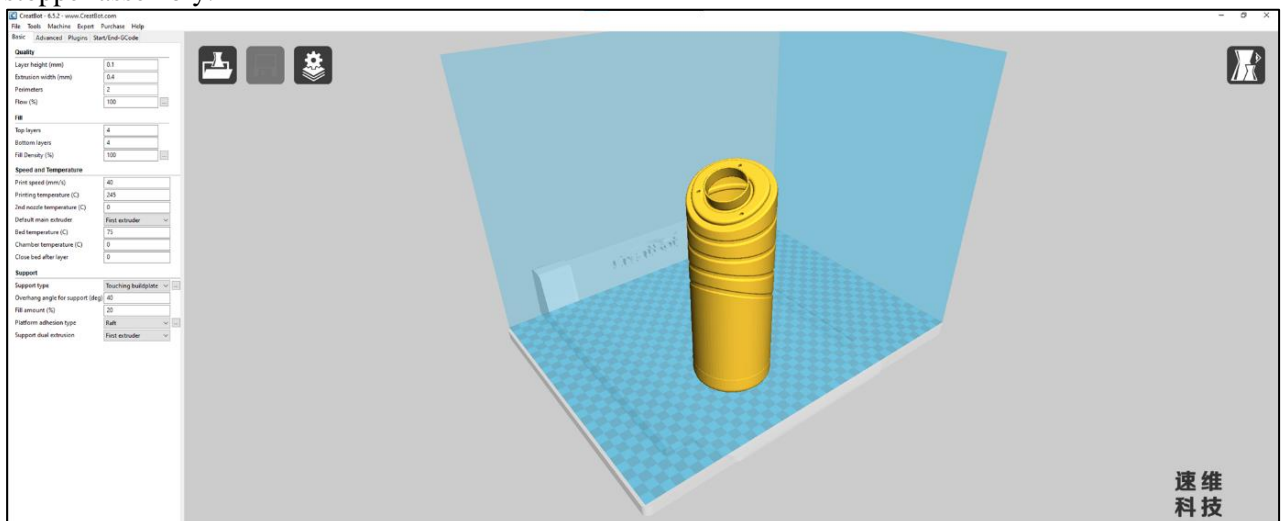


Figure 8. Print screen of the 3dimensional model imported in Slicer software



Figure 9. 3 D printed model of the 1 liter packaging, scale 1:1

Conclusions

Far from being just a financial tool that helps manufacturers to increase their turnover, design has, as its main mission, the conception of innovative goods that improve the quality of life by offering products made from eco-friendly materials, with minimal impact on the environment, both in manufacturing, as well as after the end of the product's life. Designers have the responsibility to conceive sustainable and ethical projects, not only in ecological terms through the materials or processes used, but also in a conceptual manner from the perspective of innovation. Therefore, it is more important than ever that designers are focused more and more on alternative solutions, to develop new methods and approaches to intrigue and change mindsets and behaviours through objects. In the era of overconsumption, design is one of the most important components of the economy and has the mission of generating durable common goods according to the 5 Rs: Refuse, Reduce, Reuse, Repurpose, Recycle.

The designed packaging is fundamentally distinctive from all existing products on the market not only by its particular aesthetics, but especially by the functional innovation that makes the user's life easier and helps to address an improvement from an ecological point of view. Designed with a no leakage geometry, the assembly can be used and refilled an unlimited number of times, making the process of collection of the waste cooking oil easier and more comfortable.

The innovative Oil Packaging concept proposal was awarded at 2 of the most renowned competition in September 2022, namely Red Dot Award (concept category) and Pentawards in London (silver medal). The model is currently exhibited at the Red Dot Design Museum in Singapore and is in the process of being registered as an industrial object at the European Union Intellectual Property Office (EUIPO).



reddot award 2022
winner



2022
Pentawards
Silver

Figure 10. Innovative Oil Packaging awards

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