

# Inclined Enamels and Accessories Support Made of Polyethylene Terephthalate (PET)

Fernanda Regina Tavares<sup>1</sup>, Kaue Aparecido Peres Person<sup>1</sup>, Rene Anderson de Souza<sup>1</sup>, Victor Rustiguelli Mauro<sup>1</sup>, Júlio Francisco Blumetti Facó<sup>2</sup>, Alexandre Acácio de Andrade<sup>2</sup>, Fernando Gasi<sup>2</sup>

<sup>1</sup>Center for Engineering, Modelling, and Applied Social Sciences, Universidade Federal do ABC, Brazil.

<sup>2</sup>Universidade Federal do ABC, Brazil.

**Abstract**— This work aims to develop inclined support of enamels and accessories in Polyethylene terephthalate, also known as PET, which will have the option of inclination angles through the threading of the suction cups, to allow the brush to reach the enamel, regardless of the amount of product in the packaging. The support will apply to different fitting molds and will serve both rounded and/or square packaging, which will facilitate the work of professionals, such as manicurists/pedicurists and people who make personal use of the product. Another gain when using the support will be to maintain the organization of the material used, as it will support up to four enamels simultaneously, a container for acetone, located at its base, support for pieces of cotton and support for toothpicks.

**Keywords**— Project Development, Polyethylene Terephthalate, Solidworks.

## I. INTRODUCTION

Beauty has always been a subject of interest to human beings and the quest to meet beauty standards has been on the rise for many years. The population is increasingly interested in taking care of themselves, maintaining their appearance, and concerned about their health. In this way it is possible to compare the variety of beauty products that exist on the market today, with the one that a few years ago, and realize that it is expanding and evolving, focusing on products that offer a good cost-benefit ratio (STREHLAU & CLARO, 2015). According to the company Euromonitor International (2019), with its performance in 2018, Brazil remained in the fourth position in the world consumption ranking of the sector of Personal Hygiene, Perfumery and Cosmetics (HPPC), which is led by the United States and they have China and Japan in the second and third positions, respectively. In the domestic market, the beauty sector is among the top ten retail segments and it is said that this market can grow about 2.7% each year (BERTONI, 2018).

In the study “Panorama do Setor 2019”, published by the Brazilian Association of the Perfumery and Cosmetics Personal Hygiene Industry (Abihpec), the ex-factory growth (net of sales tax) in 2018 was 1.7% when compared with the value calculated in 2017 (COSMETIC INNOVATION, 2019).

The industry pointed out that premium products, those

with higher value and generally from international brands, had an increase of 9.1% in sales, while popular products, 4.4% in 2016. Enamels, lipsticks, skin products, and sunscreens are the bestsellers of the premium line, in which the first two, being cheaper, allow customer satisfaction without compromising the budget (EUROMONITOR INTERNATIONAL, 2019). The large circulation of information about beauty products on the internet, and the growth of Digital Influencers, who work promoting product tips that are on the market, contributed to the increase in the volume of online sales of these products in Brazil (FREITAS, 2020). Another factor also taken into account is the increase in open companies in the beauty industry. According to Sebrae1 (Brazilian Support Service for Micro and Small Enterprises) (2015), the number of beauty salons and beauty clinics increased by 567% from 2010 to 2015, with approximately 482,455 people registered in the system, and for the cosmetics sector, growth of 10.2% per year is expected until 2019 (JARDIM, 2018).

Currently, customers want the companies from which they consume the products to practice sustainability, behave ethically, and be transparent. Because of this new scenario, two trends deserve special attention: sustainable technology, with a more conscious use of ingredients of natural origin, for the search for techniques that preserve the environment and earth-friendly processes for the production, transport,

and storage of products; and good products that do good (ABIHPEC & SEBRAE, 2020).

In the current market, some examples of competitors were found for the support developed in this present project (Figures 1, and 2).



Fig.1. Enamel support.  
Source: Lima (2014).



Figure 2. Enamel support.  
Source: Fine Print (2020).

From Figures 1, and 2 it is possible to verify that, although these products exist and meet the main objective (to facilitate the handling of the product when painting nails), they need some improvements. About Figures 1 and 2, there is no option to use the support at different angles and, therefore, it is not possible to solve the problem related to the quantity of product, since a very full package requires a different inclination than a product after several uses. Also, there are square and rounded enamel packaging and these supports serve only rounded packaging, thus reducing the diversity of use and reach of the public. In Figure 3, unlike Figures 1 and 2, it is articulated, so it has different angulation options, making it easier to reach the brush to the liquid regardless of the existing quantity. However, like the supports in Figures 1 and 2, it can only be used for rounded packages.

Today, the market is not aware of substitute products so comparisons can be made, because those who do not use one of the supports shown above, basically use a common table to support the enamel glass.

The purpose of the product of this project is, mainly, to be of low cost, because it is understood that it must be accessible both for manicures/pedicures and for other clients who do their nails on their own. Also, support should be light, as it can be carried on handbags, for example, by manicurists who offer home care services.

Between 2003 and 2017, the HPPC sector had an average annual growth rate (CAGR) of 4.28%. In terms of sales, there was an expansion from the US \$ 256 billion in 2003 to US \$ 464 billion in 2017, that is, an increase of 81% in the period (Figure 3).

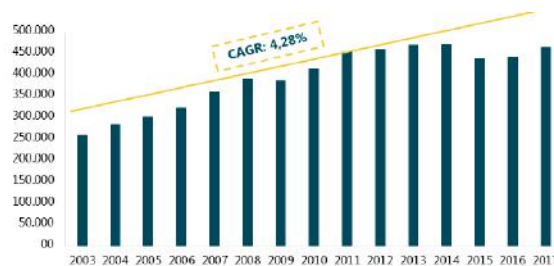


Fig.3. Evolution of the global revenue of the cosmetics industry (in millions of US\$).

Source: Euromonitor (2018). Elaborated by Finance Club.

### PROJECT DEVELOPMENT

The inclined support for enamels and accessories will have four slots on the top, which can be used by enamels of different diameters, for example, 2 cm in diameter that holds a pack of up to 8 ml, or 3 cm in diameter that tolerates a pack of up to 11 ml of enamel to meet all types of flasks, even personalized ones. A very common accident that happens to those who take care of nails is related to the use of acetone. With this information, the group developed space at the bottom for fitting bottles of up to 100 ml of product, another for storing cotton. Small spaces were also developed at the rear of the product for the storage of toothpicks. For better ergonomics, safety and the benefit of the products that will be placed on the support, “feet” were developed with adjustable height by threading (thus giving the possibility of varying the product's inclination) and with suction cups at the tips, providing greater safety and grip on various surfaces (Figure 4). When searching the base of Brazilian Patents - INPI (National Institute of Industrial Property), it was not possible to find any product that resembles the one described above

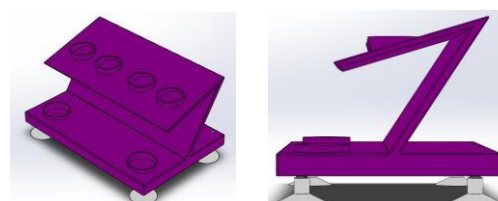


Fig.4. View of the prototype version

### 2.1 Dimensions of the Part.

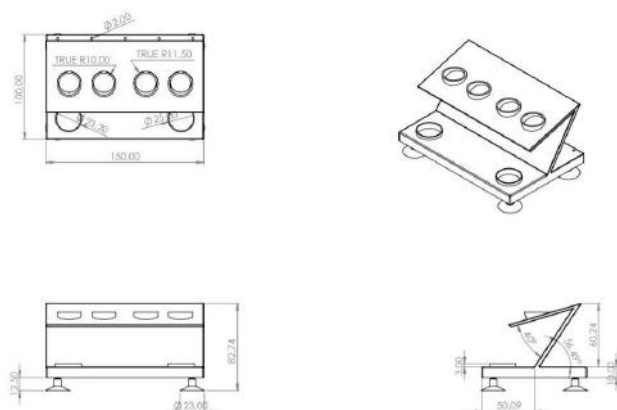


Fig.5. Views with the dimensions of the part.

## II. METHODOLOGY

Solidworks CAD software was used to develop the product in 3D.

## III. ENVIRONMENTAL IMPACT

. Vis Aiming to ensure and measure sustainability in the process of obtaining raw materials, manufacturing, consumption, transportation, and disposal, a study was carried out regarding the product, using the Sustainability module of the Solidworks tool. A module is a tool with good resources and analysis in a simple but complete way. Figure 6 shows the result of the Solidworks Sustainability module.

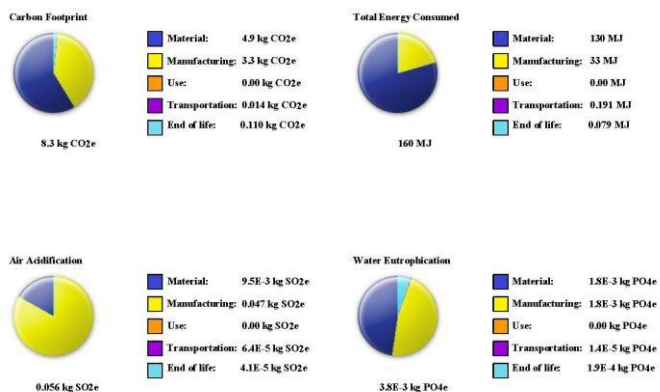


Fig.6. Environmental impact.

Air Acidification burning fuels creates sulfur dioxide, nitrous oxides, and other acidic air emissions. This causes an increase in the acidity of rainwater, which in turn acidifies lakes and soil. These acids can make the land and water toxic for plants and aquatic life. Acid rain can also slowly dissolve man-made building materials such as concrete. This impact is typically measured in units of kg sulfur dioxide equivalent (SO<sub>2</sub>).

Carbon dioxide and other gasses resulting from burning fossil fuels accumulate in the atmosphere, which in turn increases the earth's average temperature. Also known as Global Warming Potential (GWP), the carbon footprint is measured in units of carbon dioxide equivalent (CO<sub>2</sub>e). Scientists, politicians, and others blame global warming for problems like loss of glaciers, extinction of species, and more extreme weather, among others.

Total Energy Consumed measure of the non-renewable energy sources associated with the part's lifecycle in units of megajoules (MJ). This impact includes not only the electricity or fuels used during the product's lifecycle, but also the upstream energy required to obtain and process these fuels, and the embodied energy of materials that would be released if burned. Total energy consumed represents the net calorific value of primary energy demand from non-renewable resources (e.g. petroleum, natural gas, etc.). Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are also factors.

Eutrophication occurs when an overabundance of nutrients is added to a water ecosystem. Nitrogen and phosphorous from wastewater and agricultural fertilizers cause an overabundance of algae to bloom, which then depletes the water of oxygen and results in the death of both plant and animal life. This impact is typically measured in either kg phosphate equivalent (PO<sub>4</sub>) or kg nitrogen (N) equivalent.

## IV. CONCLUSION

When searching the base of Brazilian Patents - INPI (National Institute of Industrial Property, 2020), it was not possible to find any product that resembles the one described above (The search for the keyword "inclined enamel support" in the TITLE and SUMMARY) - was carried out thus, the support for enamels and accessories proposed in this present project becomes a new product. Support development proved to be viable as it is a new, innovative, and sustainable product.

## REFERENCES

- [1] ABIPET. Brazilian PET Industry Association - PET Recycling Census in Brazil - 2016.
- [2] CETESB. Environmental Company of the State of São Paulo - Chemical Emergencies - Products. Acetone Properties. 2020.
- [3] Euromonitor International. *Beauty and Personal care in Brazil*. 2019.
- [4] Freitas, Yassara Silva Soares de. Analysis of Digital Marketing Strategies Used by Digital Influencers of the Fashion and Beauty Segment. 2020.
- [5] PLASTICS EUROPE<sup>1</sup>. *How plastics are made*.

<https://www.plasticseurope.org/en/about-plastics/what-are-plastics/large-family/thermoplastics>.

- [6] Does vanity drive the consumption, cosmetics, and cosmetic surgical procedures in women? An exploratory investigation. *Administrative Review*. vol.50 no.1 São Paulo Jan./Mar. 2015.
- [7] ABIPET. Brazilian PET Industry Association - PET Recycling Census in Brazil - 2016.
- [8] CETESB. Environmental Company of the State of São Paulo - Chemical Emergencies - Products. Acetone Properties. 2020.
- [9] Euromonitor International. *Beauty and Personal care in Brazil*. 2019.
- [10] Freitas, Yassara Silva Soares de. Analysis of Digital Marketing Strategies Used by Digital Influencers of the Fashion and Beauty Segment. 2020.
- [11] PLASTICS EUROPE<sup>1</sup>. *How plastics are made*.  
<https://www.plasticseurope.org/en/about-plastics/what-are-plastics/large-family/thermoplastics>.
- [12] Does vanity drive the consumption, cosmetics, and cosmetic surgical procedures in women? An exploratory investigation. *Administrative Review*. vol.50 no.1 São Paulo Jan./Mar. 2015.