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RESEARCH ARTICLE

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DEVELOPMENT OF AN INSTRUCTION MANUAL FOR A MANUFACTURING OF A BASKET FOR BICYCLES WITH RECYCLED MATERIALS

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ABSTRACT

Among the types of waste, there are the domestic solid wastes that consist of discarded materials from domestic activities in urban residences. In this connection, recycling is defined as recover materials that would be discarded using them to produce new products. The objective of this research was to prepare an instruction manual and a Standardized Operating Procedure (SOP) for product a handmade basket from recycled aseptic carton packaging for bicycles. Firstly, the basket's material was collected and a prototype was produced. Then, was elaborated the SOP and an instruction manual for manufacturing the basket. Through this research it was possible to elaborate a spreadsheet with the SOP and an eleven-page instruction manual, that together explain in a detailed and didactic way the required procedures for the assembling of the basket, also as the possible corrections that may be necessary if some error occurs in the procedures. Thereby, it was concluded that it is possible to make a basket using solid domestic wastes, in addition, it was also possible to prove the importance of using tools such as SOP and the instruction manual to assist and standardize the processes.

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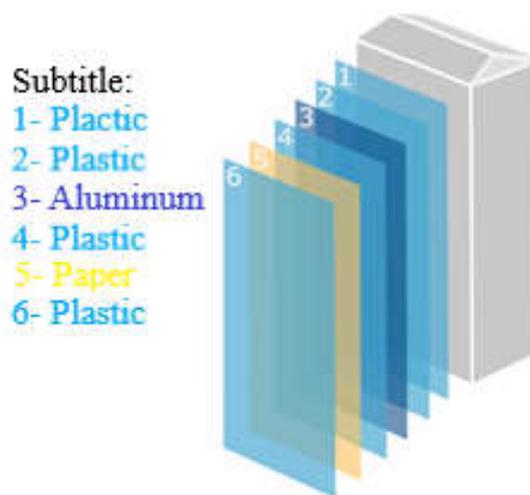
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INTRODUCTION

The word garbage is defined in the dictionary as dirt, filth, something useless, old and worthless. In technical language, the word garbage is defined as solid waste generated by man in his activities, considered as useless, unwanted or disposable (MELO et al., 2020). According to Correia et al. (2016), man produces waste from the most remote times in its history to the present day. The inadequate disposal of solid waste causes several social, environmental and economic problems. The accumulation of residues attracts disease vectors, such as rodents and insects, and facilitates the proliferation of pathogenic microorganisms and causing the primacy of soil, water and air.

Thus, to minimize repair costs to correct problems, the population should be aware of reducing waste production and encouraging material recycling. In this context, one of the different types of solid waste exists in household solid waste. According to Law No. 12,305, of August 2, 2010, of the Ministry of the Environment, solid domestic waste can be defined as discarded materials from domestic activities in urban areas. Some of these most common solid household can be listed: waste paper, cardboard, glass, clothing, biodegradable waste from kitchens and canteens, lamps, electronic products, paint, adhesive products, glues, resins, wood, plastics and metals (BRAZIL, 2012). Recycling can be defined as a means of recovering a material, which would otherwise be discarded to be used as an input for the production of new products, whether artisanal or industrial.

In this way, the residues from the activities can be reused. For this, it is necessary to use labor to perform and develop recycling techniques, generate jobs for the population, and contribute to the generation of jobs. In addition, recycling materials also reduces the accumulation of waste and environmental pollution (CORREIA et al., 2016). In this context, one of the types of solid household waste that can be recycled is the aseptic carton packs, popularly found in beverage packaging boxes such as milk, chocolate drinks and juices. These packages have the characteristic of allowing the preservation of food and beverages for long periods without the need to add preservatives, as long as the package has not been violated. In this way, aseptic carton packs ensure that the product can be transported to distant places without needing the packs to be cooled. This preservation of products without the addition of preservatives occurs due to the combination of ultra-pasteurization technology for food and beverages with aseptic filling provided by packaging (CAMARGO et al., 2016). Aseptic carton packs are entirely recyclable packaging, meaning that all the materials that make up this packaging can be recycled. However, this packaging has a complicated recycling technique, as it is composed of three different materials and with different characteristics and properties, making it difficult to separate its components (CEMBRANEL et al., 2019). Thus, according to Fensterseifer et al. (2017), the materials that make up the aseptic carton packs and their respective percentages are cardboard (75%), low-density polyethylene (20%) and aluminum (5%). These materials are arranged in six different layers, as shown in figure 1, in the following order, from the inside to the outside of the package: double layer of polyethylene, aluminum, polyethylene, cardboard and polyethylene. Therefore, each layer has a function in the packaging, as shown in figure 1. The cardboard is responsible for the strength and stability of the packaging, the polyethylene waterproofs. It allows the adhesion of the other layers, and the aluminum prevents the entry of light and oxygen.



Source: Autor, 2021

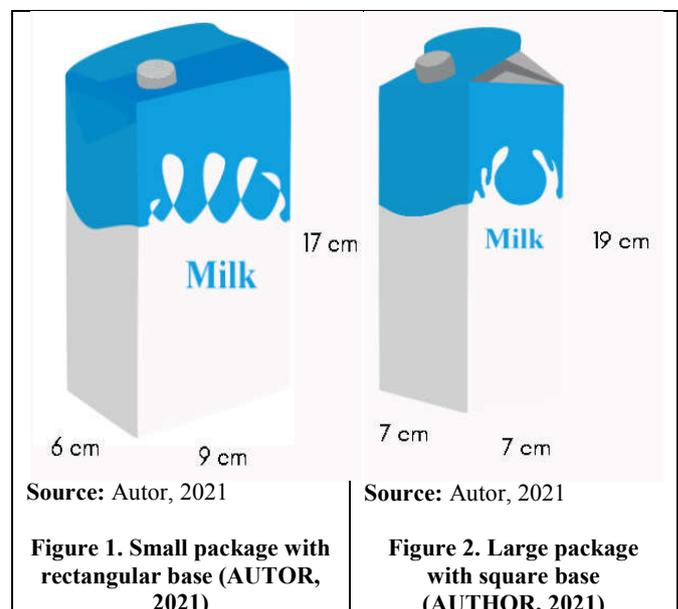
Figure 1. Aseptic carton packaging structure

In this sense, recycling by separating components from carton packs happens industrially. Therefore, the packages are taken to a specialized industry, which will carry out the necessary processes to separate the role of polyethylene and aluminum, to be later transformed into different products. Thus, cardboard, for example, can be an input for paper products such as notebooks and books; polyethylene and aluminum can be converted into frames, roof plates and others materials (FERREIRA et al., 2020). Despite this difficulty, it is also feasible to recycle the aseptic carton packs by hand by using the packaging as an input for new products without their components being separated, through painting, cutting and folding the material. The advantage of recycling by hand is the use of the material's aesthetic characteristics, such as different brightness and color and its physical and chemical properties, responsible for the high durability of the material. Thus, working correctly with the material, the product generated can be used as a decorative item (MARQUES et al., 2018).

These artisan products can have several changes depending on who handles the material due to the differences in each individual who works with the artisanal production process. Therefore, to reduce differences between the units of each product and facilitate the production process, it is essential to create manuals with the necessary instructions and Standard Operating Procedures (SOP) (NATAL et al., 2018). SOPs consist of a document explaining the inputs and processes necessary for a given activity to be carried out, minimizing the probability of errors and divergences. This type of document is essential for process standardization, as it allows the results to be the same, regardless of who is performing it. In this way, the process and the product or service will be standardized, positively influencing the quality standard of a company (SILVA, ABUD; 2016). POPs are widely used in companies in the food industry, such as restaurants and cafeterias. Thus, POPs are a way to ensure that the food served is safe, not harming customers' health (GOMES et al., 2018). Thus, organizations use POPs to standardize their culinary preparations, as well as to ensure that the standards required by Good Handling Practices (GHP) will be complied with (FERREIRA et al., 2018). In addition, POPs were also used in the industrial environment on Ford's "T" model assembly lines of the last century. However, the low variety of car colors, which were all black, was not enough to satisfy customers, leading to the need to develop new POPs for the manufacture of vehicles from different colors (VERONEZI, CAVEIÃO; 2015). This research aims to develop a manual with instructions and a Standardized Operating Procedure (SOP) for the preparation of handmade baskets from recycled aseptic carton packs that can be used as baskets for bicycles. In addition, there is also the possibility of these baskets being sold, generating a new source of income for the population.

METHODS

In this work, an instruction manual and a Standardized Operating Procedure (SOP) were elaborated for the elaboration of a basket produced by hand with aseptic carton packs from recycled milk cartons. First, the necessary material was collected, and the molds were elaborated, thinking about the assembly and design of the baskets. Then, the baskets were manufactured, and the manuals and the POP were developed. The first step in preparing the baskets was the collection of the packages necessary for the production of the baskets. Then, the templates for the sides and base of the basket were drawn on paper, taking into account the size of the milk carton that will be used. Then, the templates models were designed in the AutoCad software and then saved in PDF for easy access to any electronic device. The basket can be made with boxes of either the small model with a rectangular base (Figure 2) or boxes of the large model with a square base (Figure 3).



The third step was to sanitize and cut the milk packages in the model of the elaborate templates. Then, the cut packages were painted with black paint and, after the time needed for the paint to dry, the basket was assembled. Finally, a manual with instructions and a SOP were elaborated to describe and explain in a didactic and detailed way, what are the necessary inputs and the procedures that must be carried out for the production of the handmade basket of aseptic carton packs. The POP was created in an MS Excel spreadsheet, while the manual was developed in the Canva virtual platform, with images created in the Inkspace design software.

RESULTS AND DISCUSSION

The instruction manual for assembling the basket is a document in which all the necessary procedures for preparing the product are explained in a didactic way so that the general public can understand and reproduce the basket with as much standardization as possible and with minimal additional explanation. The first step in preparing the basket should be collecting six empty milk cartons of the same size, which can be the large model (with square base – Figure 2) or the small model (with rectangular base – Figure 3). Then, the boxes must be cut, where the material has a seam and the top (lid) and bottom (bottom) of the box must be removed. So, the boxes must be opened and sanitized to prevent traces of the liquid inside the package from promoting the proliferation of microorganisms. This contamination can impair the durability of the material, especially in the case of milk, which is a very dangerous food because it is rich in proteins, carbohydrates, fat, mineral salts and vitamins, in addition it has a neutral pH (OLIVEIRA et al., 2020). In this process, damp sponge with neutral detergent must be lightly rubbed into the material to remove milk residues. Afterwards, the box must be rinsed with running water, dried with a dry cloth or paper and placed stretched out in an airy place to dry, for approximately 24hrs, to ensure that the box will be free of water residues when the next steps are carried out. After 24hrs, the package must be opened and the markings existing in the templates present in the manual must be made, according to the size of the collected boxes.

Then, it is necessary to make cuts in the places indicated on the templates (dark blue and black lines). So, the packaging label must be painted in dark color paint to facilitate the coverage of the box label, taking care not to stain the other side of the packaging, but if this happens, one must use paint remover to remove the stains. After painting the package, it must be placed in a covered place for approximately 48hrs to paint dries. The paint used in this research was Coral Coralit Ultra Resistance synthetic enamel in black. The next step is to make correct use of the colors of the basket, black face (should be the outside) and silver (should be the outside). Thus, the basket must be assembled, following the fitting instructions in the instruction manual, using a folding system that allows the product to be assembled without the aid of glue. First, you must join the ends of base 1 with the openings in base 2. Later, after joining the two parts that form the base, it is necessary to join the base with the sides, and, finally, the sides must be lifted and joined together. To facilitate the support of the basket on the bicycle, two clamps were used, which were introduced through holes made in the materials, passing the clamps through the bicycle and the material. A poly (ethylene terephthalate) bottle - PET - 6 cm high and 10 cm wide was also used, which was perforated in the same places as the basket, to serve as support that reduced the tension in the basket. The following (Figures 4 to 13) follows the instruction manual for the preparation of the carton pack basket developed in this work:

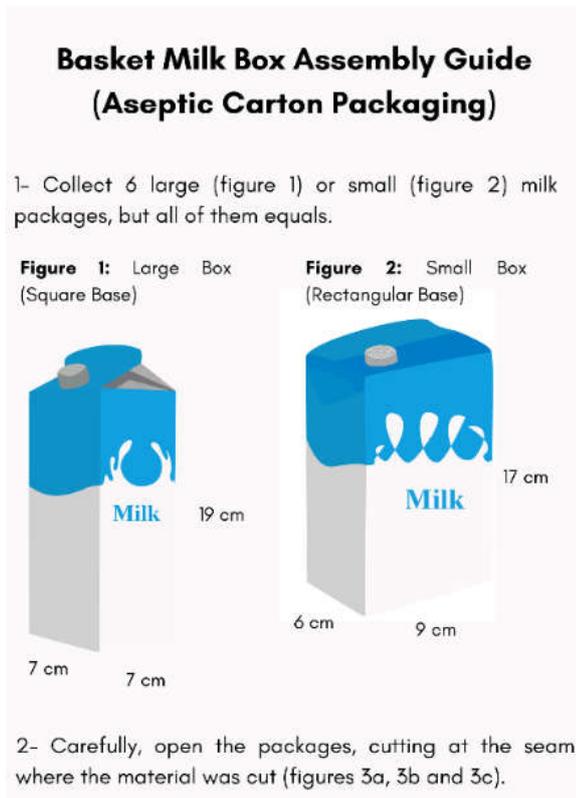
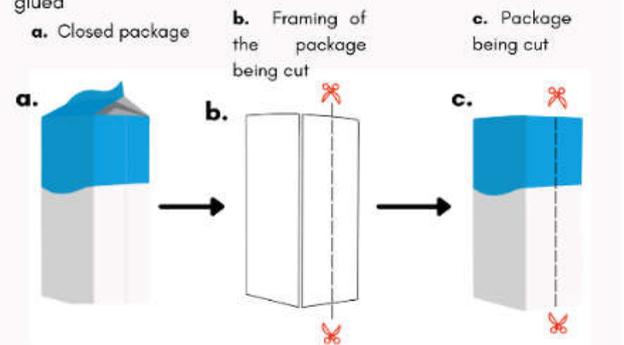


Figure 1. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 1 (AUTHOR, 2021)

Figure 3: Packaging being cut in the seam where the paper was glued



3- Remove/cut the upper (cover) and lower (bottom) tips from the carton pack (figures 4 and 5).

Figure 4: Large milk packaging

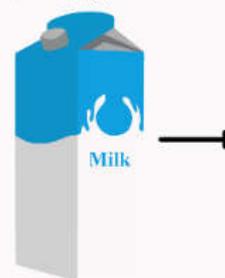
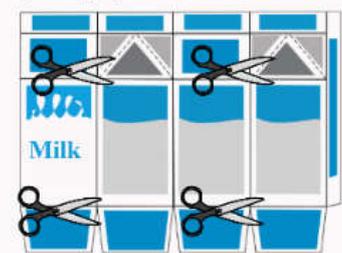


Figure 5: Opened large milk packaging



Source: Autor, 2021

Figure 3. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging)

Like the manual, the SOP (Frame 1) also contains the information needed to prepare the carton pack basket. However, the information is presented in a more technical and less didactic way than the manual in this document. In addition, at the beginning of the document, there is a list of the necessary inputs for the process, such as carton packs, scissors, pen and box cutter. At the end of the document, some corrective actions can be applied if an error is made in the process. Thus, for example, if the silver part is stained on the paint on the box label, it is recommended that a paint remover should be gently applied with a dry cloth over the stain. Once the material is dry, the basket can be assembled. Also, another fix described in POP is related to the size of the openings.

4- Sanitize the packaging with a wet dishwashing sponge, neutral dishwashing liquid and water. Lightly, rub the wet sponge with dishwashing liquid over the material to remove liquid residue (milk). Then, rinse off in a sink and dry with a cloth or paper.

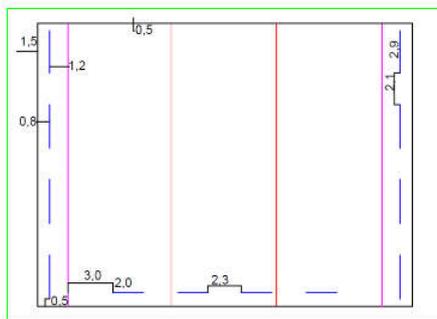
5- Put the package stretched out in an airy place for it dries for approximately 24 hours.

6- With the box stretched out, mark the package, in the label face, according to the molds (figures 6, 7, 8, 9, 10, 11, 12 and 13). The molds were measured in centimeters.

SUBTITLE

Green: edge
Blue: to cut
Pink: to fold

Figure 6: LARGE SIDE 1



Source: Autor, 2021

Figure 2. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 3 (AUTHOR, 2021)

Figure 7: LARGE SIDE 2

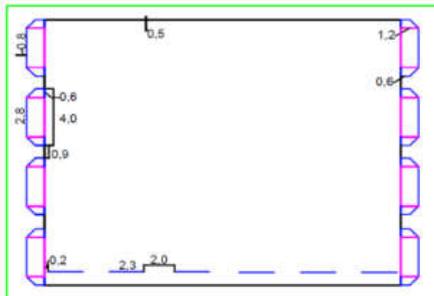


Figure 8: LARGE BASE 1

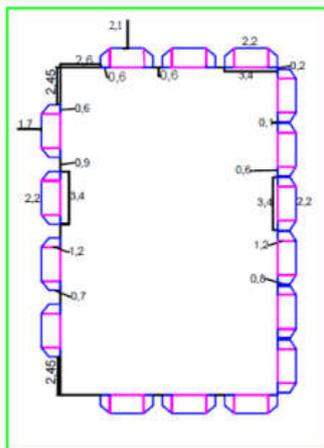


Figure 3. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 4 (AUTHOR, 2021)

Figure 9: LARGE BASE 2

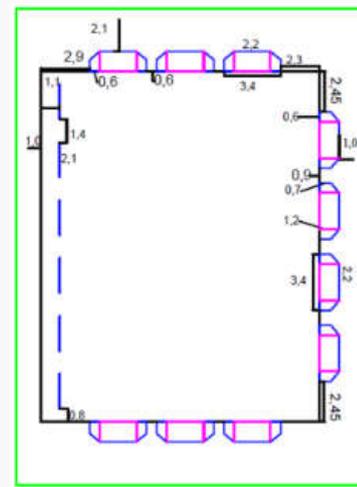


Figure 10: SMALL SIDE 1

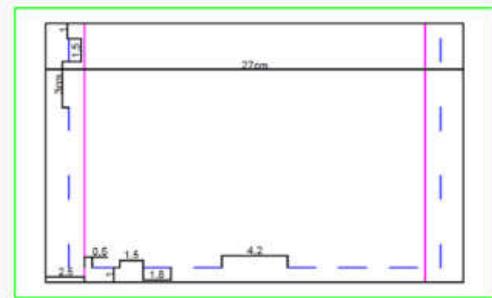


Figure 4. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 5 (AUTHOR, 2021)

Figure 11: SMALL SIDE 2

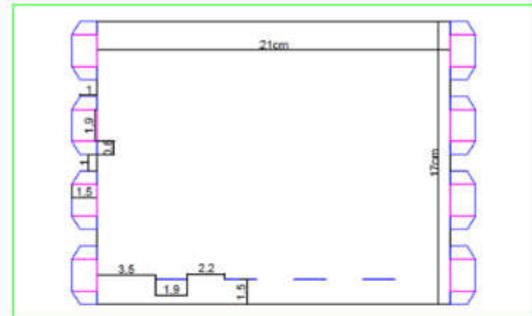


Figure 12: SMALL BASE 1

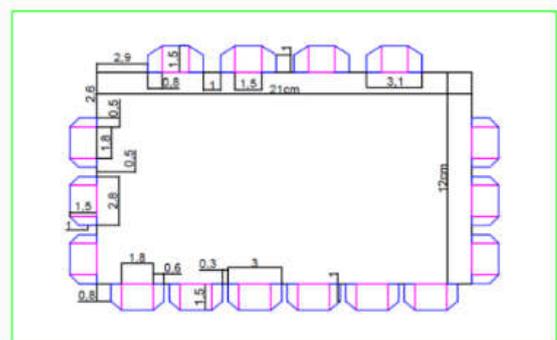
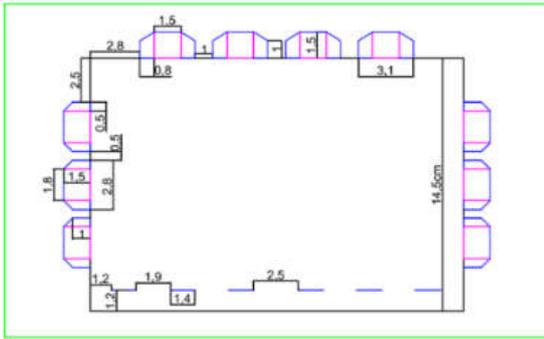


Figure 5. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 6 (AUTHOR, 2021)

Figure 13: SMALL BASE 2



7- Cut the material in the indicated marks (blue and black lines) in the molds (figure 14)

Figure 14: Mold marks of cut

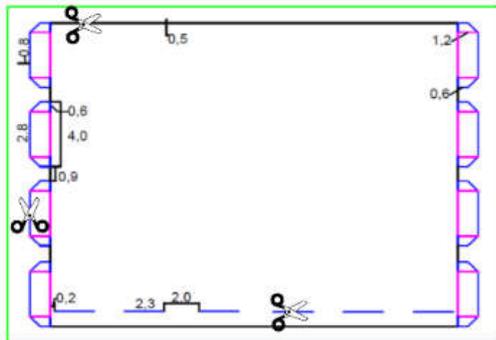


Figure 6. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 7(AUTHOR, 2021)

8- Paint the package label with a black ink, using a foam paint roller. **CAUTION! Do not stain the inside face the package with the ink.** If any packaging is stained, you can apply paint remover on the stains.

9- Place the packages to dry indoors for about 48 hours. **NOTE:** Depending on ambient temperature, the drying time may vary.

10- Choose the color you want for the basket: black (painted side, package label) or silver (inside face of the milk carton). The color of the chosen face should be on the outside of the basket.

11- Fold the far ends of the material (figures 15a and 15b). **NOTE:** Fold the ends also helps in the assembly process (figures 15b, 15c and 15d).

Figure 15: Tip bending

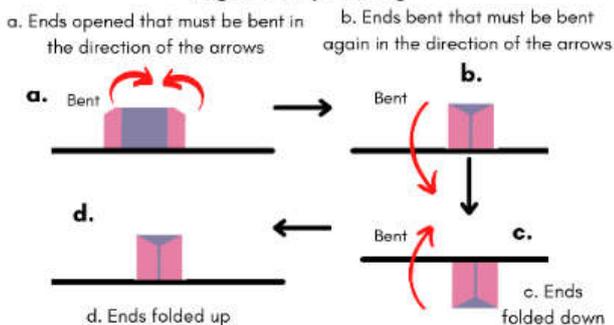
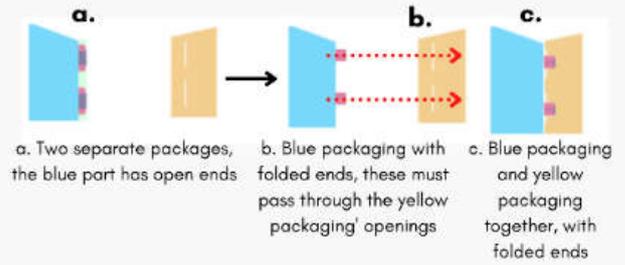


Figure 7. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 8(AUTHOR, 2021)

12- Pass the ends through the openings (figures 16a, 16b and 16c). **CAUTION! If the opening is small, increase its size with a stylet to facilitate the ends passage.**

Figure 16: Joining packages instructions for assembling the basket



13- Unfold the ends (figures 17a, 17b, 17c and 17d).

Figure 17: Packages joined with the ends folded and then with them already unfolded

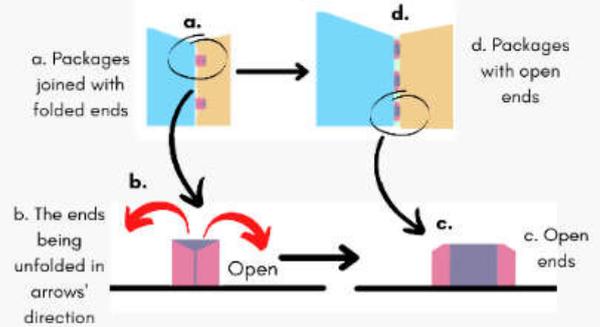
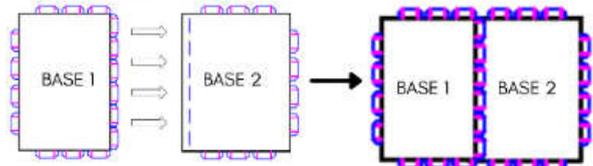


Figure 8. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 9(AUTHOR, 2021)

14- Start the assembly process joining the two parts that form the base (figures 18 and 19).

Figure 18: Bases being joined

Figure 19: United bases



15- Join the bases' sides (figure 20).

Figure 20: Sides being joined to the base

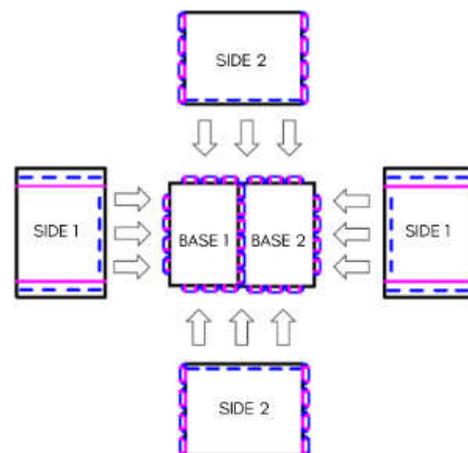


Figure 9. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 10(AUTHOR, 2021)

16- Lift the sides and join them fitting the ends into the openings (figures 21 and 22).

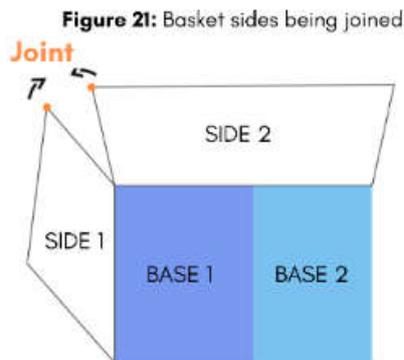
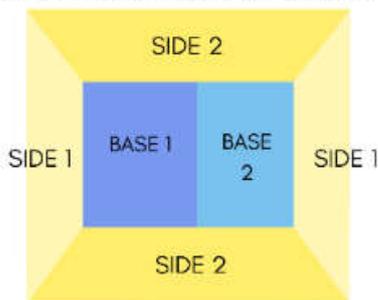


Figure 22: Finished basket with joined sides



17- It's done! The basket's assembly process is over!

Figure 12. Milk Carton Basket Assembly Instruction Manual (Aseptic Carton Packaging), page 11(AUTHOR, 2021)

Thus, if any opening is much smaller than the tip, preventing the tip from passing through the openings, the cut size can be increased with the help of the box cutter.

CONCLUSION

Due to this research, it was possible to identify that it is possible to prepare a basket of aseptic carton packs, using as few materials as possible, without the aid of glue or adhesives. In this work, the developed basket used recycled materials. The only item purchased to make the basket was finishing paint; however, as this material was used solely for aesthetic reasons, it is possible to say that it is not essential for this process. In addition, there is also the possibility of changing the paint finish for others that can be recycled, such as fabrics, or for materials that can have a lower cost, such as adhesives and paper. Furthermore, it was also shown that the use of tools, such as the POP and the instruction manual for assembling the basket could be seen as a way to standardize its assembly.

These tools help in the development of the product, being used as a guide with the necessary steps for the production of the basket, minimizing the risk of failures and ensuring the standardization of the product and the process, which, in practical terms, brings quality and adds value. In addition, the standardization of processes accelerates the learning curve, as, once the tasks are repeated, the employees involved in the production process tend to be more familiar with the stages of the process, reducing execution time and creating strategies that facilitate the tasks for whoever is developing the work. Thus, it is essential to emphasize the importance of using these tools to standardize processes and products to avoid errors. It is also necessary to address the relevance of reusing and recycling domestic solid waste to reduce damage to the environment and the population involved. In addition, it is also necessary to highlight the artisanal recycling of waste such as aseptic carton packs, as this is a simple and financially viable measure for the reuse of waste.

| STANDARDIZED OPERATING PROCEDURE | | | |
|---|---|---|------------|
| Procedure: | Preparation of a basket with carton pads (milk box) | Starting date: | 13/01/2021 |
| Accountable: | Aylla Roberta da Silva Victor Ferreira | Revisior: | |
| MATERIAIS | | | |
| Milk box (sterilized) | 6 | A4 paper sheets | 4 |
| Scissors | 1 | pencil or pen | 2 |
| 30cm ruler | 1 | Synthetic enamel (paint) for wood and metals in black color | 1 |
| Box cutter | 1 | Ink remover (remover) | 1 |
| Cloth | 2 | Small foam roller | 1 |
| Neutra detergent | 1 | Dishwasher sponge | 1 |
| Tap water (sink) | 1 | | |
| OPERATIONAL PROCEDURES | | | |
| 1-Collect six packages (milk box). Note: These packages can be the small model (P, with lower rectangular base) or the large (G, with higher square base); | | | |
| 2- Carefully open the packages, cutting with scissors at the corner where the material was glued; | | | |
| 3- Cut off the top and bottom (bottom) of the milk box; | | | |
| 4- Sanitize the packages with the aid of a damp dishwashing sponge, neutral detergent, in a sink with running water. Lightly rub a damp sponge with neutral detergent over the material to remove liquid residue (milk). Rinse the material under running water and dry with a dry cloth; | | | |
| 5- Place the package stretched out in a place with ventilation, so that it dries for approximately 24 hours; | | | |
| 6- Having the milk box opened, make the markings indicated in the template on the colored part (label) of the package; | | | |
| 7- Cut the material in the markings indicated on the template, and, if necessary, use the box cutter to finish the openings and edges. To better perform this step, print the template images on A4 paper sheets; | | | |
| 8- Paint the package label with black paint, using a brush, taking care not to stain the inside of the package; | | | |
| 9- Place the packages to dry indoors for approximately 48 hours; | | | |
| 10- Choose the color you want for the basket: black (painted side, milk box label) or silver (inside of milk box). The chosen color must be on the surface of the basket; | | | |
| 11- Fold the box ends that were previously cut into the material at the ends. Note: You will need to fold the end up and down for ease of assembly; | | | |
| 12- Pass the ends through the openings; | | | |
| 13- Unfold the ends; | | | |
| 14- Start the assembly by joining the two parts that form the base; | | | |
| 15- Join the sides to the base; | | | |
| 16- Lift the sides and join them by fitting the ends into the openings. | | | |
| CORRECTIVE ACTIONS | | | |
| 1- If the silver part is stained on the paint, apply the paint remover with a dry cloth and lightly rub the stains. Wait for the ink remover to dry to assemble the basket. | | | |
| 2- If any opening is not the proper size for the tip to pass through, increase the cut size with the help of the box cutter. | | | |
| Approval | | | |

Acknowledgment: FAPERJ

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