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Original Research Paper

Exploration of PET and HDPE Plastic Waste into the Art Creating of Lampshade with Geometric Shape

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Abstract: Nowadays, waste has become a problem faced by people worldwide, especially in Indonesia. Wastes that are difficult to process, like plastics, can disturb environmental aesthetics, environmental cleanliness, and health. They have a power that is difficult to decipher, so the researcher applied several methods to them. Through an experimental process, this research designed the products of lighting elements for cafés made of plastic bottles in the types of PET and HDPE. Several phases in the testing process must be carried out to convert the wastes. First, data collection was then continued by the experiment process to produce design synthesis. In the design process, the researcher conducted waste collection, sorting, milling, washing, forming, and finishing processes. This research involved 3 sites for case studies, namely Blimbing Village TPS, Robbries Gallery as a place to search for data on waste processing processes, and Akarating Café as a theme and also as a place to look for observation data. The experimental process yielded lights used in a cafe having a hexagon shape with 2 different color accents and having different placements, such as hanging on the roof and sticking on the wall.

Keywords: Art Creating, High Density Polyethytene, Plastic, Polyethylene Terephatalate, Waste.

1. Introduction

The environment is the unity of space with all objects, power, circumstances, and living things, including humans and their behavior, which affect the continuity of life and welfare of humans and other living creatures (Law No. 23 of 1997). The world community is currently discussing environmental issues. Environmental problems that are starting to show a significant increase are the problem of using single-use plastic items, causing a buildup of plastic waste [1].

The production of plastic waste is currently unstoppable. Society is increasingly challenging to be separated from the use of plastic. This impacts environmental pollution because plastic waste accumulates and takes a long time to decompose naturally. Moreover, because the use of plastic is almost uncontrollable [2].

Plastic waste management is a problem because plastic is a material that cannot be decomposed naturally (non-biodegradable). Hence, managing plastic waste by landfill or open dumping is inappropriate. Plastic waste management by burning can cause adverse environmental impacts in the form of air pollution, especially dioxin emissions and carcinogens. Other plastic waste management is to recycle plastic waste into different formats. Still, this recycling process will only change plastic waste into new forms instead of tackling the volume of plastic waste. When plastic recycling products have lost their function, they will return to plastic waste. Therefore, other alternatives are needed to handle this volume of plastic waste [3].

In particular, plastic bottle waste made from PET (Polyethylene Terephthalate) is a global problem that is still being refined in its processing and management. Several countries have conducted research both in terms of management and utilization [4]. European Union countries manage used plastic waste in three ways: recycling as much as 30%, converting plastic into energy 40%, and the rest (landfill) about 30%. Where 7% of all used plastic waste is PET bottles or equivalent to 3.7 million tons in 2018 [5]. European Union countries manage used plastic waste in three ways: recycling as much as 30%, converting plastic into energy 40%, and the rest (landfill) about 30%. Where 7% of all used plastic waste is PET bottles or equivalent to 3.7 million tons in 2018 [6].

Another alternative for handling plastic waste currently being researched and developed is to convert the plastic waste in the form of used plastic bottles into lighting elements. This method is included in recycling, which makes plastic bottle waste into a product with a high selling value. Light also has a significant role in the mood of a human being; one's social attitude. Therefore light is a subject of wide application in the disciplines of spatial planning and environmental design.

This research was conducted for the design needs of the cafe's lighting elements so that the resulting product has aesthetic and beauty aspects. Lighting elements are part of the overall lighting system to produce light that is following what the designer wants. In addition to helping in human activities, it turns out that lighting can also help give an aesthetic effect to a room. The use of lighting types, light colors, shapes, placements, and techniques used in lighting can provide a different atmosphere and character to the room. So it is essential to pay attention to what kind of lighting will be applied to the room to help create an atmosphere in the room [7].

Commercial places such as cafes, hotels, or places to transact products or services continuously apply lighting elements because the lighting elements have led to the aesthetics and beauty of the product rather than just the lighting function. In this case, the problem in the research is how to explore plastic waste as a lighting element, especially for lampshade artwork products in cafes.

2. Literatur Review

2.1. Reuse, Reduce, Recycle

Handling plastic waste that is popular so far is the 3R (Reuse, Reduce, and Recycle). Reuse is the repeated use of items made of plastic. Reduce is reducing the purchase or use of plastic goods, especially single-use items. Recycle is recycling items made of plastic [8] [9] [10].

2.2. PET & HDPE

PET (Polyethylene Terephatalate) PET is a polyester resin that is durable, strong, lightweight and easy to shape when hot. Its density is about 1.35 – 1.38 gram/cc, this makes it solid, its molecular formula is (-CO-C6H5-CO-O-CH2- CH2-O-)n. PET in the form of products in the form of water bottles, soda bottles, juice bottles, cooking oil bottles, food and beverage containers, food packaging. PET can be colored or colorless (transparent), depending on the additives used.

HDPE (High Density Polyethytene) HDPE is a plastic material composed of ethylene polymer and other additives that will be made. Its molecular formula is (- CH2-CH2-)n. HDPE has the advantage of being resistant to water, acids, bases, and other solvents [11] [12].

2.3. Lighting

Artificial lighting is lighting produced by light sources other than natural light. Artificial lighting is also needed when the position of the room is difficult to reach by natural lighting or when there is insufficient natural lighting. The main functions of artificial lighting, whether applied alone or in combination with natural lighting, are as follows; creating an environment that allows residents to see in more detail and carry out tasks and visual activities quickly and precisely. Make it easier for residents to walk and move efficiently and safely. Does not cause an excessive air temperature increase in the workplace. Provides lighting with an intensity that remains evenly spread, does not flicker, does not dazzle, and does not cause shadows [13].

2.4. LampShade

The lampshade is designed to minimize lighting from incandescent lamps with significant light intensity. Ornaments and color selection on a lampshade can affect the atmosphere of a particular room [14].

2.5. Café

Creative cafe designs will be more able to attract visitors. Visitors are generally more interested in a new atmosphere with an exciting and different design than the one that existed before. If the café is well laid out, using a specific theme will make visitors comfortabl [15].

3. Methodology

The research method that researchers will use is an experimental method whose research method uses action research. In this study, the material used is used plastic bottles of PET and HDPE materials. The research method used is the experimental method. Experimental research is the most scientifically reliable research (Most Valid) because it is carried out with tight control of confounding variables outside the experiment.

The locations to be investigated in this research are:

1. Cafe Akarranting which is a semi-outdoor cafe located on Jl. Kusuma Bangsa No.57, Pulo Lor, Kec. Jombang, Jombang Regency, East Java.
2. TPS and waste recycling center in Blimbing Village, Gudo District, Jombang Regency.
3. Robberies Gallery, which is an industry engaged in the creative industry to process plastic waste.

Data collection is done in two ways: primary data and secondary data. Primary data is carried out using observation. Observation is a study carried out intentionally and systematically, directed and planned at a specific goal by observing and recording phenomena that occur in a group of people regarding the terms and rules of scientific research. In this study, observations were made. Observations were made to the Akarranting cafe, Jombang. And TPS in Blimbing Village, Gudo District, Jombang Regency. Secondary data is done in 2 ways by collecting literature from journals and the Internet.

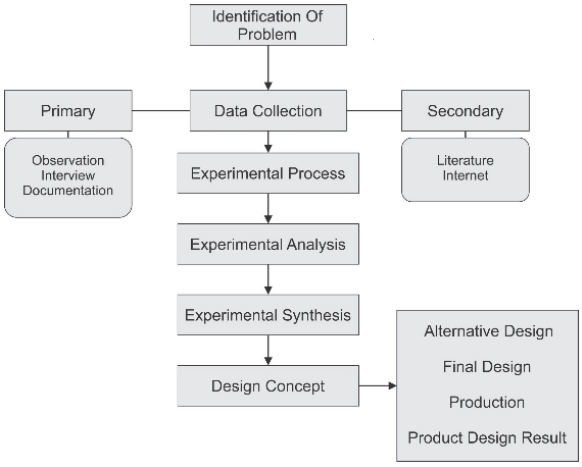

Figure 1. Research Method

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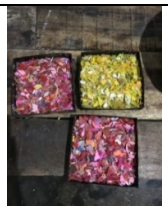
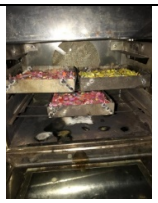
4. Finding and Discussion

4.1. Design Synthesis

Result for the design synthesis can be seen in Table 1.

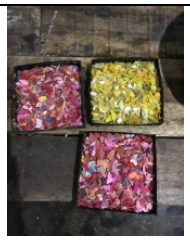
Table 1. Design Synthesis

No.	Synthesis	Discussion
1.	 Sorting	The results of the analysis carried out by researchers for the sorting process used are divided into bottles and colors: 1. The parts used are the bottle cap and the bottle body 2. For colors, researchers use color mixing because, in the mixture of colors, there are unique color patterns and motifs
2.	 Washing	The researcher's washing process uses detergent because it is cleaner because there are remnants of dirt that settle in the bottle
3.	 Drying	The drying process requires direct sunlight for approximately 8-10 hours. This process aims to dry the water and detergent from the remnants of the washing process.
4.	 Pattern Forming	Researchers determine the results of the pattern formation process that will be used, namely on bottle caps using a crushed pattern through small pieces because it makes it easier for researchers to make small patterns and smooth and non-porous results; on the bottle body, researchers use patterns with how to cut using scissors with a pattern like the thread.
5.	 Setup	The arrangement process on the media used is an iron pan. It used the plastic can melt into and form a pattern on the media, namely a square.
6.	 Heating	The heating process that researchers will use for product design is: Heating using an oven with a duration of 5 minutes because, in the oven process, the material will melt according to the available pattern so that the shape remains neat, as well as for the material on the bottle cap and bottle body

4.2. Production Process

Result for the production process can be seen in Table 2.

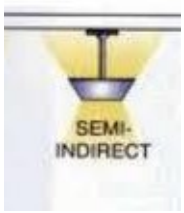
Table 1. Production Process

No.	Process	Discussion
1.		The result of plastic bottle waste that has been processed, washed, chopped, and dried in the hot sun. This process is included in the material exploration process described above, which forms the final RAW material sheet
2.		The following process is to arrange the material into a container which will then enter the heating process
3.		The following process smooths the results of the heating process using a grinding grinder
4.		The following process is continued by making the lamp frame using iron material and making brackets to the wall and the lamp itself.
5.		The following process is to install the Joining on the framework and continue installing auxiliary materials, namely acrylic. The researchers here use clear or clear-colored acrylic
6.		The following process is to install the primary material using size 8 screws with space using brass with a length of 1 cm, followed by installing lights and cables.

4.3. Production Result

Result for the production result can be seen in Table 3.

Table 3. Production Result

No.	Figure	Lighting Effect	Discussion
1.			When placed on the wall, the light that comes out of the product is in the form of Semi Indirect
2.			In the product laying hung on the roof, the direction or effect on the lighting leads to semi-indirect.

The experimental mapping proposed by researchers is following Figure 2.

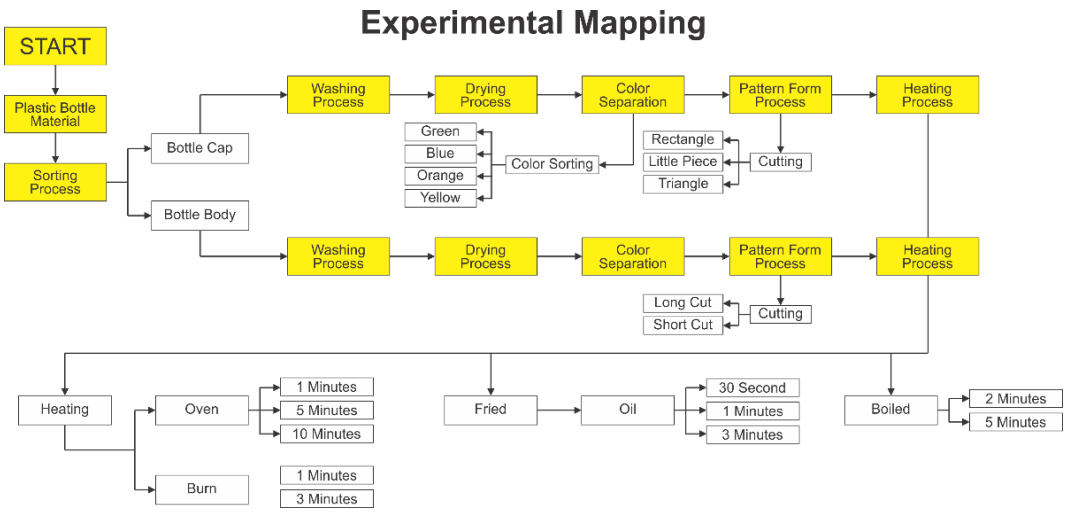


Figure 2. Experimental Mapping Proposed

5. Conclusion

Experimental mapping is a stage carried out by researchers in processing materials, to find out the characteristics of the material to be experimented with, mapping also has the aim of making the experimental process or material exploration process more focused, and organized.

There are five steps in experimental mapping, inculiding: washing process, drying process, color separation, pattern form process and heating process.

References

[1] A. Priliantini, K. Krisyanti, and I. V. Situmeang, "Pengaruh Kampanye #PantangPlastik terhadap Sikap Ramah Lingkungan (Survei pada Pengikut Instagram @GreenpeaceID)," *Jurnal Komunikasi, Media dan Informatika,* vol. 9, no. 1, pp. 40, Jun. 2020, [Online] Available: doi: 10.31504/komunika.v9i1.2387. [Accessed: Jan. 2, 2022].

[2] A. P. Sunandar, R. Q. C. Chahyani and F. Z. Farhana Sunandar, "ECOBRICK Sebagai Pemanfaatan Sampah Plastik di Laboratorium Biologi dan Foodcourt Universitas Negeri Yogyakarta," *J. Pengabdian Masyarakat MIPA dan Pendidikan MIPA*, vol. 4, no. 1, pp. 113–121, 2020.

[3] J. Wahyudi, H. T. Prayitno, A. Dwi, A. B. Perencanaan, P. Daerah, and K. Pati, "The Utilization Of Plastic Waste As Raw Material For Producing Alternative Fuel," Jurnal Litbang, vol. 14, no. 1, 2018.

[4] G. Fitriyano, D. A. Rahim, "A Short Review on Potential of Utilization Used Bottle Made from Polyethylene Terephthalate (PET) in Indonesia," Eksergi, vol. 16, no. 1, 2019.

[5] K. H. Foerster, "Plastics Europe Annual Review," 2018. [Online]. https://issuu.com/plasticseuropeebook/docs/annualreport2018_plasticseurope_web. [Accessed: March. 5, 2022].

[6] Nurwati, "Pemanfaatan Sampah Plastik Menjadi Kerajinan Tangan Guna Meningkatkan Kreatifitas Warga Sekitar Institut Teknologi dan Bisnis Ahmad Dahlan (ITB-AD) Jakarta," *Jurnal Abdimas*, vol. 5, no. 2, 2019.

[7] R. R. Wulandari and T. Isfiaty, "Peran Pencahayaan Terhadap Suasana Ruang Interior Beehive Boutique Hotel Bandung," Jurnal OJS Unikom, 2021. [Online]. Available: https://ojs.unikom. ac.id/ index.php/divagatra [Accessed: March. 5, 2022].

[8] A. D. Radityaningrum, J. Caroline, D. Dyah and K. Restianti, "Potensi Reduce, Reuse, Recycle (3r) Sampah Pada Bank Sampah`Banksampah`Bank Junk for Surabaya Clean (Bjsc)," 2017.

[9] A. R. Singkam and M. F. Putri, "Analisis Penerapan 3r (Reduce, Reuse, Recycle) Pada Masyarakat Di Sepanjang Aliran Siring Kelurahan Pondok Besi Kota Bengkulu," 2022, [Online] Available: doi: 10.21009/PLPB.222.03. [Accessed: March. 5, 2022].

[10] R. D. Arisona, "Pengelolaan Sampah 3r (Reduce, Reuse, Recycle) Pada Pembelajaran Ips Untuk Menumbuhkan Karakter Peduli Lingkungan," *Al Ulya: Jurnal Pendidikan Islam*, vol. 3, no. 1, 2018.

[11] A. Rahmawati, "Pengaruh Penggunaan Plastik Polyethylene (Pe) Dan High Density Polyethylene (Hdpe) Pada Campuran Lataston-Wc Terhadap Karakteristik Marshall, Semesta Teknika, vol. 18, no. 2, 2015.

[12] S. Suyadi, "Pembuatan Model Produk Palu Plastik Dari Bahan Daur Ulang Plastik Pp, Pet dan Hdpe," *Rekayasa Mesin*, vol. 10, no. 3, pp. 10, Jan 2015.

[13] S. Rettob, "Persepsi Tingkat Kenyamanan Pengunjung Terhadap Desain Pencahayaan Alami Pada Jacob Koffie Huis Depok," *Jurnal Ilmiah Desain & Konstruksi,* vol. 17, no. 2, pp. 86–96, 2018.

[14] J. Viter, L. Perdhana, and B. Jauhari, "Perancangan Kap Lampu Yang Memiliki Nilai Budaya Tangerang Selatan Dengan Menggunakan Material Pipa Pvc," *Inosains*, vol. 12, no. 1, 2017.

[15] T. Agustiawan, M. Rahmat, and U. Muslim, Nusantara Al-Washliyah Medan, "Pengaruh Desain Cafe Untuk Menarik Para Pengunjung Terhadap Peningkatan Pengunjung Study Kasus Pada Cafe Rahayu & Resto Di Sei Rampah Kabupaten Serdang Bedagai," *Jurnal Ekonomi*, Keuangan dan Kebijakan Publik, vol.3, no. 1, 2021.