

Up-Cycling Plastic Bags Waste Into Lifestyle Products by Direct Heating Method

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Abstract Today plastic waste is one of the largest waste contributors in the world, with approximately 10 percent of the total waste in the world. Most of the plastic waste comes from households, it is plastic bag waste. Already many efforts have been made to reduce the amount of waste and its effects. One of them is the up-cycling method. Up-cycling is a method of reusing waste into products that have more values or new use. Using this method, besides being able to reduce the amount of plastic waste that exists while creating new products with new selling values and functions. The results of this method produce lot of variation of fashion products, furniture, household appliances, etc. The up-cycling method that will be used is the direct heating method of plastic bag waste. This process will change the structure and characterization of plastic waste material. The next process is forming the material with the simple pressing machine into shape of product. The results of plastic bag waste treatment in this study are trendy color ring products. In the future, further development and refinement is still needed in the next research which focuses on finishing techniques and product range variations.

Keywords : plastic waste, direct heating, lifestyle products

1. Introduction

The issue of environmental damage, global warming, deforestation, excessive consumption capacity of the community to climate change that harms the earth is the background of the emergence of the concept of sustainable design. In general, the concept of sustainable design refers to the human mindset and actions that harmonize and respect the ecology of the environment. In the concept of sustainable design, three important factors support the creation of the concept, which is environmental, economic and social factors

At present, the concept of sustainable design is growing faster in all world communities, in industrialized countries the application of the concept of sustainable design has begun from the level of individual societies to related industry actors. Many actions can be taken by all the world community to participate in applying the concept of sustainable design, not only to consume environmentally friendly

products but also to participate directly in preserving the ecology of the surrounding environment, such as processing household waste

One of the biggest contributors to household waste is plastic. Based on Eco Watch data, 10 percent of the total amount of waste in the world is a plastic waste. Indonesia is ranked second as the world's largest producer of plastic waste [1](Jambeck, 2015), with a total waste of 187.2 million tons of waste produced. By looking at these conditions, efforts need to be made from all lines. One solution that is not only able to reduce waste but also able to create new products from waste with new values and functions is by up-cycling

1.1. Plastic Waste

Based on data from [2]UNEP (United Nation Environment Program) in 2017 there are an estimated 8 million tons of plastic waste that pollutes the environment, in particular,

the worst is pollution of the ocean. Approximately 80% of plastic waste comes from household use. Most of it is plastic bag which is usually obtained from household spending. Plastic bags become the biggest plastic waste because only one function is used, after that, it is not used again for other functions and ends up being waste only.

Indonesia ranks second as the largest waste producing country in the world, with 187, 2 million tons of plastic waste thrown into the sea of [3](Jambeck, 2015). Based on data from the Ministry of Environment and Forestry that the total amount of waste that is predicted in Indonesia will reach 67, 1 million tons. The composition of the 3 largest sequences of waste producers is an organic waste (38.4 million tons), plastic waste (8.96 million tons) and paper (5.76 million tons).

The biggest source of waste producers in Indonesia is households, which is 48% of total waste. Of the total plastic waste, there are plastic bags that are the most produced type of plastic waste, which is around 265 thousand kilograms per month. Whereas what happens in the field of waste management especially plastic waste is still not optimal. About 69% of the waste is only piled up in the landfill without proper processing.

2.1. Plastic Bag

Plastic bags that are common in the market have several types, namely HDPE, LDPE, and PP. All three are the types of plastic bags that are most widely used in household needs. The following is an explanation of each characteristic of a plastic bag based on the type of plastic.

HDPE plastic bags have a stronger, more solid material and a more dark color. More resistant to high temperatures so that when it has to be melted it requires more energy. The thickness is between 0.015mm and 0.150mm. Usually used for packing oil or plastic bags to accommodate hot liquid food.

LDPE plastic bags are flexible than HDPE and PP. better known as "Kantong Kresek". Usually used as a container to carry groceries, food, and garbage bags. This type of plastic bag is the most commonly found in the landfill. Most of it is household waste.

PP plastic bags are transparent but not clear. Light and strong, resistant to penetrating steam and fat. Usually used for wrapping dry food, syrup, ice cubes and other drinks.

3.1 Up-cycling

Upcycling, also known as creative reuse, is the process of transforming waste products or products that are no

longer used into new materials which will be used to make a new product with functional value and a higher selling value than the previous waste. This concept was later developed by William McDonough and Michael Braungart in their book [4](2002), *Cradle to Cradle: Remaking the Way We Make Things*. They stated that the purpose of upcycling is to prevent waste of materials that have the potential to be reprocessed into new raw materials and products. This will reduce the consumption of new raw materials when making new products to help reduce energy use, air pollution, water pollution, and even greenhouse gas emissions.

In its application, up-cycle material will provide greater benefits compared to only recycling material. The following is a comparison between the up-cycle and recycle material:

-Recycle material:

- a. Reducing the impact of environmental pollution
- b. Changing material waste into new material raw materials
- c. Limited types of waste that can be processed into new raw material
- d. Requires a lot of energy to process it

-Up-cycle material:

- a. Reducing the impact of environmental pollution
- b. Changing material waste into new products
- c. There is no limit to the type of material that can be processed into a new product
- d. Able to produce products of good quality
- e. Produce products with unique designs
- f. Produce functional new products
- g. Produce products with a higher selling value than the previous material.

2. Up-cycling Plastic Bag

2.1. Research Method

The research that will be conducted is qualitative. Qualitative research is methods for exploring and understanding the meanings that individuals or groups of people think are derived from social or humanitarian problems. This process requires important efforts, such as asking questions collectively, collecting specific data from participants, analyzing data inductively and interpreting the meaning of the data obtained.

The results of this study are usually flexible [5] (Creswell, 2010: 5).

The qualitative research strategy that will be used is the material exploration approach, the research strategy is to conduct material exploration by up-cycle the waste to be processed into a new product. Material exploration is limited by the type of plastic bag material waste produced by household waste, the up-cycle method used is direct heating material using a tool such as a heat gun.

2.2 Plastic Bag Waste Assortment

The process of sorting waste is carried out to obtain the quality of cracked plastic waste with materials that are capable of being processed by heating techniques. The following criteria for sorting waste plastic bags that are feasible to use in this study:

1. Not biodegradable type plastic
2. Not a biomaterial plastic
3. Plastic with bright colors
4. There is no burning plastic condition
5. Plastics do not mix with the rest of cooking oil or fuel

From the sorting process, the results will be continued with the cleaning process.

2.3.Cleaning of Waste Plastic Bags

Plastic waste material that has been collected must go through a cleaning process first. The purpose of this process is to remove the remaining dirt or residue from the plastic material on the plastic bag. The steps taken are as follows:

1. Prepare enough water and soap
2. Soak the dirty plastic first
3. After soaking, use a water spray to clean the plastic surface
4. If there are any remaining stains, use clothes brush to clean them.
5. After that spray with clean water
6. Dry it in an open place, do not get exposed to direct sunlight.

The results of the cleaning process of crackle plastic waste are ready to be processed as needed.

2.4.Heating Process

The next process is the heating process. Heating that we do with direct heating techniques without being coated by any media. The tool used for heating is heat gun, with specifications of heat temperature produced between 50 - 550 degrees Celsius. The heat produced is enough to melt the plastic bag.

The following is a sequence of heating processes in plastic bag waste using a heat gun:

1. Prepare the tools to be used, namely: heat gun, the container can be a bowl or pan made of metal or ceramic, anti-heat gloves, spatulas to lift the results.
2. Prepare plastic waste to be heated, place it in a container that has been provided, if the plastic waste is too large, cut into pieces first so that it can be placed in the container.



Figure 1. Pieces of the plastic bag that will be melted

3. Prepare heat gun, set temperature between 200 - 300 degrees, so that heating can be fairly distributed.
4. After the heat gun reaches the appropriate temperature, aim the heat gun directly at the piece of plastic waste.



Figure 2. The process of heating plastic using a heat gun

5. Move the heat gun thoroughly to the surface of the plastic, slowly
6. Repeat the process until the plastic melts completely.
7. After the plastic melts, immediately transfer it to the mold for the pressing process.

2.5 Pressing Process

After plastic waste is melted by a direct heating technique using the heat gun, the pressing process will then be carried out. This process is used to compact the melted plastic waste material. Also, if we use several different types of colors when melted, we will get results that are similar to the natural stone texture and interesting combination of colors.

The following are the sequences and equipment needed in the pressing process :

1. Prepare tools to be used: the mold container to be used, can be a rectangular profile metal or metal pipe, small size clamp, and wooden base.
2. Immediately place the melted plastic in the mold.
3. Then cover the top of the mold with wood.
4. Press the mold lid to the maximum limit



Figure 3. Pressing process on plastic waste after heated

5. After that, use the clamp to press and lock the mold to make it even more solid.

6. Leave it for about 2 hours until the surface solids and dries

7. For maximum results until the material is ready to be formed, leave it for up to 12 hours.



Figure 4. The result of pressing process

8. After 12 hours, the finished material is ready to be shaped into accessories

5.2 Form Process

The results of the plastic press that is already solid then begin the process of forming product accessories. In this study, examples of accessories to be made are rings. The following is the equipment and process of forming materials:

1. The equipment is a mini drill which is used for handi-crafts, burrs, sandpaper from size 400 - 1000 grits.
2. The first process is to make the inner ring hole first. Use a mini drill to make a small hole first, to avoid cracking the material.



Figure 5. The process of making inner ring hole

3. After making a small hole, then use a mini drill with a tuner to enlarge the diameter of the circle in the ring as needed.

4. After forming the outer diameter of the ring, use grinding to gently scrape the outer side of the eye to be removed.

5. After the outer ring and inner circumference are formed, the next is the detailing and refinement of the ring shape. Use a mini drill with sandpaper, use it gradually from starting from rough to smooth.

6. The results of this process will then proceed to the finishing process.



Figure 6. The result is a ring that is still rough surface

5.3 Finishing Process

In this finishing process, the aim is to give a smooth and glossy impression on the ring that has been created. This process is needed to disguise the original material made from plastic bag waste, to approach visually like gemstone .

The process and equipment to be used in this process are:

1. The tools to be used are polishing machines, polished fabrics, cream polishes.
2. The process starts with polishing the inside with a cylindrical polishing machine, this polishing uses polished cloth and cream polish
3. Then the outside of the ring is also polished with a polished cloth and cream polish



Figure 7. The result after finishing



Figure 8. The ring after finishing process

4. This process is done repeatedly to get maximum results as desired.

3. Conclusions

Based on the results of research that has been carried out on the application of direct heating methods to treat plastic bag waste, it can be concluded:

1. Plastic bags are the most widely produced household plastic waste.
2. Waste plastic bag processing is still not maximal, only burned or melted in the landfill area.

3. One creative method for treating plastic waste is upcycling material. Kualitatif, Kuantitatif, dan Mixed. (diterjemahkan oleh: Achmad Fawaid). Yogyakarta: Pustaka Pelajar.
4. The choice of type and number of plastic bags will affect the results of this method.
5. Application of direct heating methods using a heat gun Facts and figures regarding the true cost of plastik bags diakses dari www.reusablebags.com
6. Open opportunities for craftsmen or the community to open new jobs from processing plastic waste into a selling value product.
7. The results of processing waste with this method can produce products that are varied and valuable for new uses. *World Watch Institute's Good Things? Guide* diakses dari <http://www.worldwatch.org/taxonomy/term/44>

Suggestions for research and development of the technique of direct heating of plastic bag waste based on this research are as follows:

1. Further research is needed on how to apply additional methods to produce products that use them more strongly.
2. Development and combination with other processing techniques are needed to create variety and increase product quality.

Facts and figures regarding the true cost of plastik bags diakses dari www.reusablebags.com

REFERENCES

- [1] Jenna R. Jambeck,¹ * Roland Geyer,² Chris Wilcox,³ Theodore R. Siegler,⁴ Miriam Perryman,¹ Anthony Andrady,⁵ Ramani Narayan,⁶ Kara Lavender Law⁷.(2015). Plastic waste inputs from land into the ocean. VOL 347 ISSUE 6223. sciencemag.org
- [2] UNEP (United Nation Environment Program) . 2017. UN Environment Programme Annual Report 2017.
- [3] Jenna R. Jambeck,¹ * Roland Geyer,² Chris Wilcox,³ Theodore R. Siegler,⁴ Miriam Perryman,¹ Anthony Andrady,⁵ Ramani Narayan,⁶ Kara Lavender Law⁷.(2015). Plastic waste inputs from land into the ocean. VOL 347 ISSUE 6223. sciencemag.org
- [4] McDonough, William and Braungart, Michael. (2002). *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press
- [5] Creswell, John W. (2010). Research Design: Pendekatan