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Composition of Anthropogenic Waste and Efforts to Manage it on the Waters of Tegal City-Central Java

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ABSTRACT

One thing that can change water quality is the presence of marine debris caused by anthropogenic activities. In addition to the potential of natural resources that are widespread on the coast of Indonesia, the potential for pollution of the coastal and marine environment also has considerable opportunities. The purpose of this study was to determine the type, weight, composition of anthropogenic waste, and its management on the coast of Tegal City. This research was carried out on March 2-30 May 2020 at the Tegal City Environment Service/DLH, Central Java. Data collection consisting of waste composition data is then analyzed and used in waste management planning.

The stages of work carried out are: the calculation of the characteristics of the waste in the form of specific gravity is obtained from the generation measurement using waste weight data. Based on the results of the research that has been carried out, it is concluded that the types of marine debris that are generally found at the research site are organic waste and inorganic waste. However, the most common type of waste is plastic waste. The most severe level of damage was found in the coastal area of Mintaragen Beach. The low level of awareness of environmental hygiene in the community is due to the fact that there are still some people who have not disposed of their garbage in its place, especially for tourists, and there are still some industrial managers who override industrial waste management before being dumped into irrigation streams or canals to the beach. There are still many traders who build tents on the beach. Other factors include environmental and socio-economic physical characteristics, culture, attitudes, and community behavior. In the operational technical aspect, starting from the storage, sorting, collection, transfer, transportation and management of waste. However, what has been realized is mostly only the transfer from the waste disposal site collection point, while the transportation and final processing of waste to be processed at the landfills has not been carried out optimally.

One of the factors is the limited tools so that the waste is managed according to the ability of the community. However, what has been realized is mostly only the transfer from the waste disposal site collection point, while the transportation and final processing of waste to be processed at the landfills has not been carried out optimally. One of the factors is the limited tools so that the waste is managed according to the ability of the community. However, what has been realized is mostly only the transfer from the waste disposal site collection point, while the transportation and final processing of waste to be processed at the landfills has not been carried out optimally. One of the factors is the limited tools so that the waste is managed according to the ability of the community.

KEYWORDS- Anthropogenic, Marine Garbage, Tegal City Beach, Waste Management

1. INTRODUCTION

The sea is very important for human life and also a habitat for marine life. Humans take advantage of marine resources where the human population who activities in coastal areas is 33% of the world's human population (Small & Nicholas, 2003). The coastal area which is a potential resource in Indonesia is a transitional area between land and sea. This resource is very large which is supported by the existence of a coastline of about 81,000 km. This long coastline holds the potential for a large wealth of natural resources. These potentials include non-biological and biological potentials (Dahuri, et.al. 2002).

The coastal area is the meeting place between land and sea. Towards the land, the coastal area covers the land area, both dry and submerged in water, while towards the sea it is still influenced by human activities that occur on land such as deforestation and pollution as well as natural processes that occur such as sedimentation and fresh water flow (Slamet, 2007). One that can change water quality is the presence of marine debris caused by anthropogenic activities (Hetherington, et.al. 2005). In addition to the potential of natural resources that are widespread on the coast of Indonesia, the potential for pollution of the coastal and marine environment also has considerable opportunities. Waste problems are common in urban areas in Southeast Asian countries, as the population increases, followed by an increase in income, changes in consumption patterns, economic growth, as well as urbanization and industrialization, resulting in an increase in the potential for waste generation per capita and the various types of waste produced (Nguyen & Schnitzer, 2009).

Marine debris, popularly known as marine litter or marine debris, is a non-natural solid material left or dumped into the sea by humans either intentionally or unintentionally, as well as objects that are discharged into the sea through rivers and household waste disposal channels and industry (NOAA, 2007). Various kinds of problems arise due to marine debris such as the reduced beauty of coastal areas, causing various kinds of diseases, affecting the food network, reduced productivity of fish resources, and can affect the balance of ecosystems in coastal areas. If this happens and continues, the impact on the food chain, economy, and public health in the area cannot be avoided (Citasari et al., 2012). This opportunity can be caused by Indonesia's dense population, high tourism activities including transportation and large developments, as well as areas filled with various activities, mainly from residential areas. These activities contribute to waste pollution that enters the coast through rivers.

Marine debris can be distributed to the mangrove ecosystem so that it accumulates in the sediment and mangrove roots. Garbage pollution can affect the quality and function of the mangrove ecosystem. The potential effects of chemical marine debris tend to increase as the size of plastic particles (microplastics) decreases, while the physical effects increase as the size of macrodebris increases (UNEP, 2011). Macrodebris has a physical impact such as covering the sediment surface and preventing the growth of mangrove seeds (Smith, 2012). This research focuses on macrodebris and microplastics (one type of microdebris).

The potential for waste is the main problem of coastal pollution, but there is little quantitative information about marine debris pollution in the mangrove ecosystem. In addition, the problem of marine debris has not become a concern in determining ecosystem management strategies. The distribution of marine debris in the mangrove ecosystem is quantitative information in determining the mangrove ecosystem management strategy. Based on the Environmental Law no. 32 of 2009 article 1 (14) states that pollution is the entry or inclusion of living things, substances, energy, and or other components into the environment and or changes in environmental arrangements by human activities or by natural processes, so that the quality of the environment decreases to certain level that causes the environment to become less or can no longer function with its designation.

Furthermore, the City of Tegal is one of the areas in Central Java Province that has quite large fishery potential. This is influenced by the geographical location of Tegal City which is located on the north coast of Java Island at coordinates 1090 08' - 1090 10' East Longitude and 6050' - 6053' South Latitude. The problem of waste in Tegal City is due to the geographical location of Tegal City which is in a coastal area and is bordered by rivers with almost flat land slope conditions and is exacerbated by reduced water catchment areas due to land conversion. So that the water flowing from the river carries water and garbage that is dumped indiscriminately by the community into the river has a very large capacity and it is estimated that if the condition of the water level rise is predicted to increase over time, it is feared that the puddle of garbage will cause widespread flooding river silting. The impact that will be caused is directly proportional to the area of the garbage pool, including changes in the coastal ecosystem and disruption of population activities in residential and industrial areas.

For years people did not care about marine pollution because of the large volume of sea water and its ability to dilute all kinds of foreign substances so that it almost does not cause any impact at all. Therefore, the sea is considered a dumping ground for waste. However, that view began to gradually change. This is due, among other things, to the fact that more and more waste is discharged into the sea and in high concentrations, resulting in environmental pollution on a local scale. Every human being has different behavior depending on how humans or individuals interact with their environment. In relation to the environment, human behavior can determine the sustainability of environmental conditions. Environmental management behavior aims to meet the needs of today's life without destroying or reducing the ability of future generations to meet their needs. Various environmental problems are related to human knowledge, attitudes, behavior, and assessments of the environment.

Tourism activities in coastal areas have the potential to be developed both related to natural and artificial tourism. However, the coastal area is an area that is vulnerable to damage due to tourism activities. That coastal tourism is the most developed type of tourism in various parts of the world but has the opportunity to have a greater impact on environmental damage also involves various attractions and destinations that are able to change coastal characteristics. Tourism only prioritizes economic benefits, not the environment, so there needs to be guidance for local communities on how to manage tourism so that it is environmentally sustainable. The purpose of this study was to determine the type, weight, composition of anthropogenic waste, and its management on the coast of Tegal City.

2. METHOD

Time & Place

This research was carried out on March 2-30 May 2020 at the Tegal City Environment Service/DLH, Central Java. The map of the location of the Tegal City Beach can be seen in Figure 1. In the picture, the blue dots as the waste research locations include Muarareja Beach which is in the west bordering Brebes Regency, in the middle there is Mintaragen Beach which is half the area of Muarareja Beach in the form of the Tegalsari area as shown in the image below, and in the east and south there is the Stage Beach which is located bordering the Tegal Regency area. The three locations are a balanced regional division and are adjusted to the calculation of the sub-district division of the entire area in Tegal City.

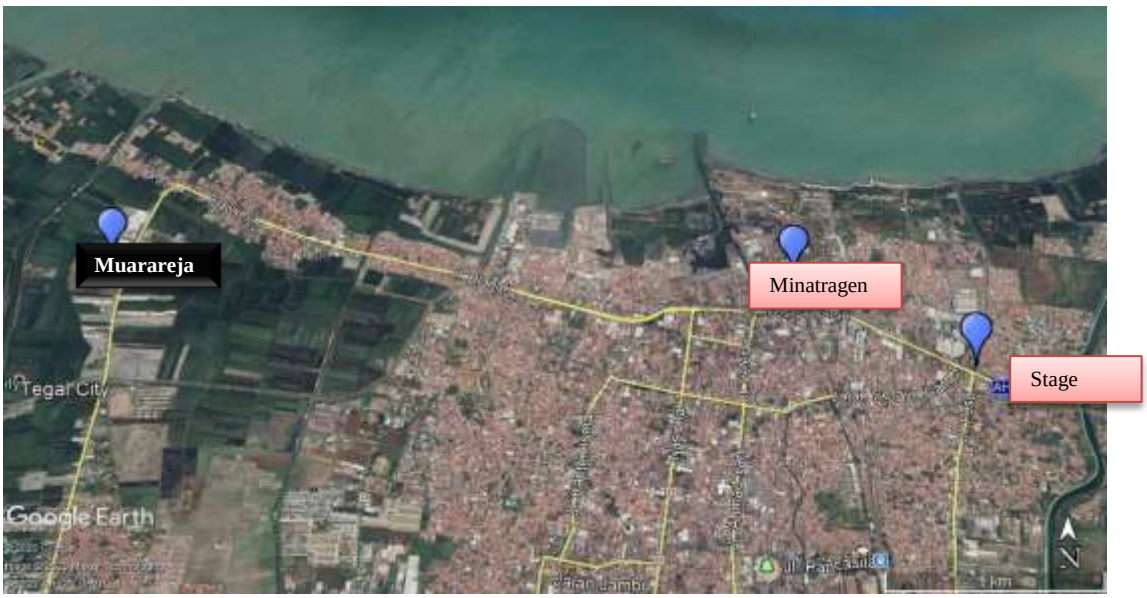

Figure 1. Location of Beaches in Tegal City

Method of Collecting Data

The data collection methods carried out include: (a) primary data obtained from observation parameters including waste management observation methods, and (b) dsecondary data obtained from the collection of literature and materials related to the topic of writing which includes journals, text books, and data from the Environmental Service.

Work Scheme

Based on the description above, one of the frameworks of the work process in this research can be seen in the following scheme (Figure 2):

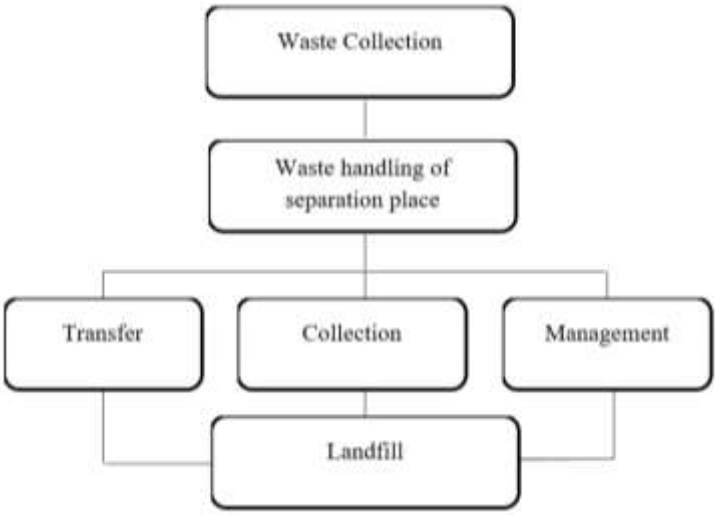

Figure 2. Work Scheme

Garbage Collection Technique

Determination of the location for taking marine debris is based on the length of the coastline, this is to determine the landscape so that in determining the area to represent the entire observation location. Observing the limits of the range of garbage collection, for example the beach boundary, so that at the research location, garbage collection is obtained from the lowest low tide shoreline. After collecting the waste, it is separated by type and then weighed. After that, all the waste is collected and then sorted by type and the last is the waste management process based on its type and use. The data on the type and amount of waste obtained are presented descriptively using tables and graphs. The first is to look at the difference in the average weight of marine debris for each location. Second, look at the difference in the average composition of marine debris based on size at each location.

Data Analysis

Data collection consisting of waste composition data is then analyzed and used in waste management planning. Stages of work carried outnamely: calculation of waste characteristics in the form of specific gravity obtained from generation measurements using waste weight data.

Calculating the Density of Waste

In calculating the density of waste using the following formula:

$$\text{Density of Waste} = \frac{\text{trash weight (kg)}}{\text{trash volume } (m^3)}$$

Determination of the weight of the waste of each component by weighing the components that have been sorted are weighed. So the percent composition is obtained from the weight percent of each component divided by the total weight of the entire waste. The composition of the waste can be calculated using the formula:

$$\%\ \text{Component} = \frac{\text{component weight}}{\text{trash total weight}} \text{ x } 100\%$$

3. RESULTS AND DISCUSSION

Density of Garbage

Based on the observations made, marine waste found in the research area is obtained, where there are two categories of marine waste types, namely organic waste consisting of plant and animal constituent materials taken from nature or produced from tourist activities, fishermen, agriculture, fisheries, or else. This waste is easily decomposed in natural processes. Most of the household waste is organic material.

Including organic waste, such as waste from the kitchen, leftover flour, vegetables, fruit peels, and leaves. Inorganic as a whole can not be decomposed by nature while others can only be decomposed in a very long time. This type of waste at the household level, for example in the form of bottles, plastic bottles, plastic bags, and cans. Paper, newspaper and cardboard are exceptions. Based on their origin, paper, newspaper, and cardboard are organic waste. But because paper, cardboard, and newspapers can be recycled like other inorganic waste (eg glass, cans, and plastic), they are included in the inorganic waste group. The data that has been obtained shows that there is a difference in the total weight of the waste at each location. Muarareja Beach has a coastline area of about 2.31 km with a total weight of 240 kg/m organic waste and 560 kg/m inorganic waste. organic waste is 405.6 kg/m with a weight of inorganic waste is 946.4 kg/m, while for waste at Panggung Beach has a coastline area of about 1.75 km, the total weight of organic waste is 159, 9 kg/m with inorganic waste weight 76.1 kg/m. The weight of each location as can be seen in Figure 3.

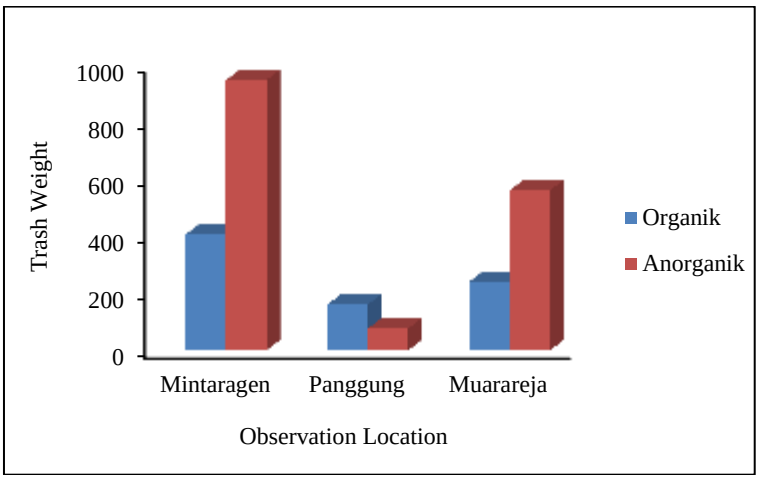

Figure 3. Calculation of the weight of waste at each location.

The explanation of the axis in the graph above is that on the (y) axis there are results of the calculation of the weight of organic and non-organic waste and on the (x) axis there is an explanation or information regarding the location of the sampling. The percentage density of organic and inorganic waste in coastal mangrove ecosystems where inorganic waste is the most waste found on the coast of Mintaragen. Inorganic marine debris is dominant because inorganic is a pollutant that has been globally distributed in all waters due to its durable and easy to float nature and some of the waste found is thought to come from the activities of people living close to the coast and some of it is carried away by currents from rivers. The distribution of marine debris in coastal areas is strongly influenced by the movement of currents and winds.

Marine Garbage Composition

The results determine the composition value for each location. The values in the three observation locations after interviews and direct observations were made to obtain a value for each location including the Muarareja area with the result that the organic waste value was 33% and for the inorganic value was 70%, for the Mintaragen area with the result value of organic waste is 300% and inorganic waste is 700% the last is the Panggung area with the result of organic waste value of 67.7% and inorganic waste of 32.2%. Mintaragen Beach is the largest producer of waste, characterized by very dense and active tourist activities. The high level of marine debris in Mintaragen Beach is assumed because the area has a greater tourist attraction than the other two locations, more complete tourist sites including a water boom, museum, mangrove forest. So that garbage from tourists is one of the factors causing the density of garbage and also garbage from the city can be carried away by the current to the area through the river. The movement of waste from other areas is very possible because the current at high tide moves from north to south and from east to west which will later accumulate in the area because the position of Mintargen Beach is in the middle between Muarajera Beach and Panggung Beach. Comparison of the value of each location for the three locations can be seen in the comparison graph of each location which is very visible the difference. So to show the comparison is presented in the form of a comparison chart for each location can be seen in Figure 4.

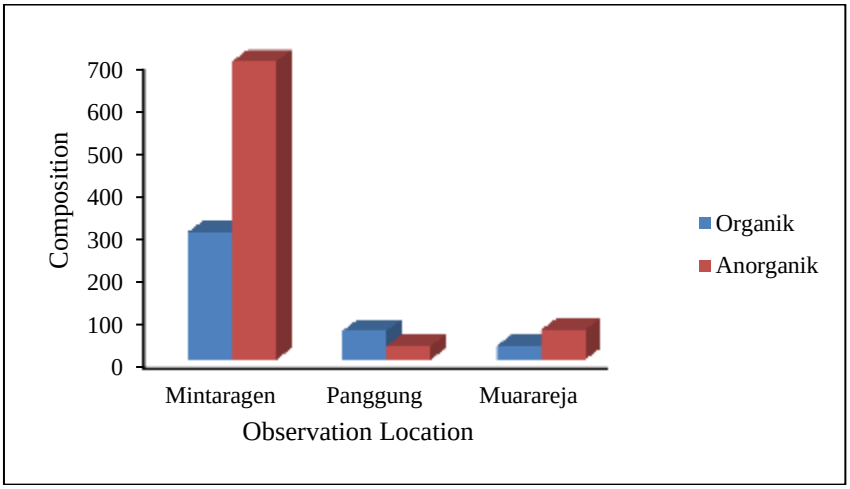

Figure 4. Calculation of waste composition.

The (y) axis in the graphic above shows the value of the waste composition of each variable obtained from the results of questionnaire calculations and direct observations and the (x) axis in the graphic above shows the location of observations. The lowest value was found at the Pantai Panggung location characterized by tourism activities. The low mass of marine debris on Panggung Beach compared to other beaches is possible because Panggung Beach is a research location that has only recently been exposed to tourism sources and has not been visited by many tourists, so that there is less trash and garbage first stops in areas closer to the river such as at the beach. Mintaragen because there is a large-scale irrigation flow from various areas in the city.

Garbage on the Coast

Garbage that exists on the coast of Tegal City Beach can be classified into several categories, the classification of waste is based on the source of the waste. The classification of this type of waste will make it easier for us in the recycling process or the process of utilizing waste, because this is where we recognize the characteristics and content contained in the waste that we will process or recycle.

a. Natural waste is waste that is produced in the wild through natural recycling processes, such as dry leaves in the forest that break down into soil. Outside of wildlife, this waste can be a problem, for example dry leaves in residential areas;
b. Human waste is waste that is commonly used for the products of human digestion, such as feces and urine. Human waste can be a serious hazard to health because it can be used as a vector (means for development) of diseases caused by viruses and bacteria. One of the main developments in human dialectics is the reduction of disease transmission through human waste through a hygienic and sanitary way of life. This includes the development of the theory of plumbing. Human waste can be reduced and reused for example by turning it into a kind of gas for cooking;
c. Household waste is waste generated from activities in the household, the waste generated by most households is paper and plastic. The characteristics of this household waste, most of which is organic waste which has a fast-rotting nature. The accumulation of waste by households is the discharge in the trash cans in front of each house or in plastic bags, in a mixed state;
d. Consumption waste is waste that is produced by humans from the process of using goods, in other words, waste that is disposed of in this trash, for example consumption waste is cassava stalks/leaves, papaya, kale, spinach, eggplant skin, carrots, chayote, sweet potatoes, cassava, fruit peel, pineapple, banana, jackfruit, banana leaf, watermelon, coconut dregs, vegetable waste/side dishes, and garbage from the garden. This type of waste is a type of waste that is commonly thought of by humans, this is due to human habits in the process of daily life as waste producers. However, the amount of waste in this category is still much smaller than the waste generated from mining and industrial processes;
e. Garbage from trade and offices. Waste originating from trading areas such as: shops, traditional markets, stalls, supermarkets consists of cardboard, wrapping, paper, and organic materials including food and restaurant waste. Waste originating from educational institutions, government, and private offices usually consists of paper, writing utensils (pens, pencils, markers, etc.), photocopy toner, printer ribbons, printer boxes, batteries, chemicals from the laboratory, ribbons. typewriters, movie cliches, broken computers, and so on. Used batteries and chemical waste must be collected separately and must receive special treatment because they are dangerous and toxic;

f. Industrial waste can be grouped into two, namely general waste and liquid or solid hazardous waste. General trash, usually placed in the trash. Simple sorting is usually done by industry, as plastic, paper, and parts of leather are usually stored in different containers for sale. Meanwhile, waste that is considered worthless is disposed of in a separate place. For liquid waste and hazardous waste, if the company does not have adequate facilities or facilities for liquid waste management, then the waste must be taken to a facility owned by the waste management department in the Tegal City government for further processing before being disposed of. Waste from medical facilities has been separated between medical and non-medical waste. Non-medical waste is collected using plastic bags and collected in waste containers owned by medical facilities. The medical waste must be taken to the hospital;
g. Tourist waste is one of the problems faced by the City of Tegal at this time, namely the large number of various kinds of garbage that exist around the coastal areas, especially coastal tourism areas, due to garbage that often occurs every year, especially during the new year season where most beach visitors from various regions who is on New Year's Eve. One of the tourist sites on the coast of Tegal City which is most frequently damaged is the tourist area in Mintaragen Village, while in the east there is mangrove ecotourism which is a heavily polluted area with the most common type of waste found is plastic waste. It is suspected that this plastic waste is trapped in the mangrove roots and is garbage from other tourist sites.

Waste Management Condition

The stages of waste management consist of: collection, transportation, and destruction, each of which greatly influences the success of waste management in a city. In the Tegal City area, the problem of waste management cannot be separated from the three stages, including:

a. Garbage collection system by dividing tasks with the community who have been assigned or janitors to sweep, collect, and clean garbage on the beach but not optimally because the garbage that is there every day comes in large quantities while the existing janitors are not very so that it is possible that not all of the waste can be transported or cleaned cleanly every day (left over). After the garbage is collected and put into the waste disposal site where the garbage is collected it will be easily transported by a garbage truck. For areas that are easily accessible by garbage trucks. This condition is almost found in all areas in Tegal City Beach. The number of trash containers is still very limited, even though the beach waste generation is very large;
b. The waste transportation process starts from the waste disposal site and ends at the landfills. The means for transporting waste from the Tegal City Sanitation Service are very limited in number and not proportional to the waste generated by the beach. Garbage transportation time is often carried out from 07.00 to 09.00 where the activities of the residents/beach conditions are not too crowded so that the transportation process is not disturbed and is maximal;
c. Management in the form of handling waste that is carried out before the waste is placed at the final disposal site is in the form of recycling waste, including: household-scale composting and recycling of inorganic waste;
d. Garbage Destruction. The main waste disposal is carried out at the landfills, with the waste being sorted before entering the landfills. Minimizing the volume of waste that goes to the landfill will extend the life of the landfill. Making compost and handicrafts in the form of bags, accessories, home decorations, etc., as a form of the economic value of waste and significantly reduces the volume of waste in the landfill.

Waste Management or Sorting Method

There are 4Rs to realize a form of concern for the environment, the 4Rs are Reduce, Reuse, Recycle, and Replace. By imitating the 4R steps, what we can do is:

a. Reduce or waste reduction is an effort to reduce waste generation in the source environment and can even be done before waste is generated. Each source can make efforts to reduce waste by changing consumptive lifestyles, namely changing habits from wasteful and producing a lot of waste to being efficient/efficient and with less waste. However, it takes awareness and willingness to change this behavior. By minimizing the goods or materials we use as much as possible. The more we use materials, the more waste is generated. For example, when shopping, try to bring your own shopping bag so you don't need to use plastic bags anymore.
b. Reuse means reusing materials or materials so they don't become waste (without going through a processing process), such as using back and forth paper, reusing used beverage bottles for water containers, filling milk cans with refilled milk, and so on. Reusable materials include paper, cardboard, plastic, glass, metal, and others. Avoid using disposable items (disposable). This can extend the time the item is used before it becomes trash. For example, make it a habit not to throw away plastic bags and reuse them, you can also re-

decorate used cans into pencil cases, plant pots, piggy banks, and so on, if used clothes can be made other creations such as blankets, napkins, tablecloths, bags, or wallets. One of the pictures of making bags from used T-shirts, by preparing all the tools and materials needed, then washing the used T-shirts that have been selected so that they are clean and not smelly, fold the sleeves of the shirt right in the middle for easy cutting, after both arms are evenly cut from top to bottom. Cut the collar to make the handle strong and durable, try to leave the neck and sleeves. Determine the length of the bag as desired if you have taken the shirt and draw a horizontal line on the shirt, you can use a ruler or meter, then add decorations to make it more interesting, you can also draw a series of vertical lines at the bottom of the shirt, the width of this bag variant can be adjusted according to individual tastes. respectively. After making a pattern line for decoration on the bag, then cut the vertical line slowly;

c. Recycle is recycling a material that is no longer useful (garbage) into other materials after going through a processing process, such as processing the remaining patchwork into blankets, rags, foot mats, and so on, or processing used bottles/plastics into plastic seeds to be reprinted into buckets, hangers, pots, and so on, or processing waste paper into paper pulp and re-printing it into slightly lower quality paper, and so on. Items that are no longer useful can be recycled. Not all goods can be recycled, but now there are many non-formal industries and home industries that use waste into other goods, such as composting. One way to make compost is to separate organic waste (food scraps or leaves);
d. Replace or replace is intended to examine the items we use every day. Replace items that can only be used once with more durable items. Also be careful that we only use items that are more environmentally friendly. For example, by using a drinking bottle that can be used by a bear or a bottle made of aluminum, the strofoam rice box is replaced by bringing your own lunch box, and don't be shy about using a bag made of patchwork or used detergent plastic as payment for your bag. attractive, specifically environmentally friendly. Making a bag from the first detergent pack, cut the top and the bottom, then clean using running water and dry, after it's dry, cut it into two equal parts so that in one pack it becomes two pieces, then fold the detergent wrapper by folding 1 cm inward at the top and bottom ends, so that the width of the fold becomes 2 cm, then weave the detergent wrap into propellers. combine make sure to make vertical vertical angles. If the frame of the bag is finished, the next step is just to sew it so that the webbing doesn't come off easily. You can add furing cloth or plain cloth on the inside of the bag, make sure the cloth used is not too thin, unite the cloth with the bag from the detergent wrap using a sewing needle and thread, make sure the stitches and threads used are strong and neat, add a zipper and rope to beautify the bag,

Countermeasures

In order to provide protection and management of coastal areas from damage, various efforts have been made by the government, both central and local governments, including:

a. Car free day (CFD) to clean waste by exchanging waste for plant seeds and waste management education which is held every Sunday in the Tegal City square area, as well as distribution of stickers for the National Waste Protection Day (HPSN);
b. Socialization of the three-month waste clean-up movement and the national waste protection day (TBBS and HPSN) through billboards or banners;
c. Waste bank management and operational training;
d. Training on composting and organic waste;
e. Clean and healthy environment competition (LBS) between sub-districts throughout Tegal City;
f. Mass community service cleaning the environment;
g. Socialization of waste management for saka kalpataru, namely the Tegal City Scout Studio, which was attended by high school students;
h. Mayor's circular letter regarding the three-month clean-up of waste (TBBS) movement;
i. Socialization to the community members of each village regarding the sorting of waste from households;
j. Continuous and sustainable development and assistance of waste banks and integrated waste management sites;
k. Clean waste disposal site action, implementation of Regulation of Mayor No. 66 of 2012 concerning the regulation of waste disposal and transportation to ensure that the condition of the waste disposal site is always clean;
l. Demo and training of waste recycling craft during CFD;
m. Require employees of the Environmental Service (DLH) to deposit waste once a month to DLH as an education and model for waste management;
n. Movement socialization (TBBS) through mass and electronic media such as Suara Merdeka newspapers, Radar Tegal, Wartabahari.com;

o. Actions for pulling nails from each tree and cleaning up trash activities;
p. Competition for creativity and waste awareness through the media of trash cans.

4. CONCLUSION

Based on the results of the research that has been carried out, it is concluded that the types of marine debris that are generally found at the research site are organic and inorganic waste. However, the most common type of waste is plastic waste. The most severe level of damage was found in the coastal area of Mintaragen Beach. The low level of awareness of environmental hygiene in the community is due to the fact that there are still some people who have not disposed of their garbage in its place, especially for tourists, and there are still some industrial managers who override industrial waste management before being dumped into irrigation streams or canals to the beach. There are still many traders who build tents on the beach. Other factors include environmental and socio-economic physical characteristics, culture, attitudes, and community behavior. In the operational technical aspect, starting from the storage, sorting, collection, transfer, transportation and management of waste. However, what has been realized is mostly only the transfer from the waste disposal site collection point, while the transportation and final processing of waste to be processed at the landfills has not been carried out optimally. One of the factors is the limited tools so that the waste is managed according to the ability of the community.

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