



Quantity and Physical Composition of the Marine Debris on Phetphoom Beach, Ban Koh Siray, Muang District, Phuket Province, Thailand

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Abstract

The objectives of this research were to study the quantity and physical composition of the marine debris on Phetphoom beach, Muang District, Phuket Province. This area is important for fishery of fishermen. Marine debris is an important problem causing destructions of marine resources or marine ecosystems. The period of collecting samples is 2 months from April to May 2020. The samples were collected 4 times a month from the beginning to the end of the beach. It stretches along the beach for a distance of 760 meters. The survey method is International Coastal Cleanup. The beach waste is classified into three categories, which are general waste, recyclable waste and hazardous waste. Organic waste was not collected because it can decompose naturally. The quantitative and physical composition of marine debris were analyzed by descriptive statistics in percentage values. The results were found that there was no statistical difference between the types and amounts of beach waste on Phetphoom beach in April and May in each survey. Because it was beach waste caused by daily consumption and fishery. Regardless of the change in monsoon winds, all types of marine debris were always found in the sampling, but in varying ratios. Among all types of marine debris found, general waste was the highest amount at 62.45 percent, followed by recyclable waste at 34.63 percent and hazardous waste at 2.97 percent, respectively. The composition of marine debris that were found the most were general wastes in large pieces such as food packaging/bags (potato chips), spoons, forks, knives, plastic bags, plastic glasses, foam floats and beverage boxes (paper). Whereas the hazardous waste was found the least such as batteries, lighters, and light bulbs. According to the study of marine debris composition, the results showed that marine debris had to be disposed in order to reduce the pollution effects towards marine lives and other creatures including with marine ecosystem affecting marine food chain and quantity of marine lives. The fishermen would have less income because they could harvest less marine lives. The recommendation should be that beach regulations and laws are strictly enforced down on the beach and in the sea. Public relations on marine debris and prevention of waste for people, fishermen, tourists and beach residents. Marine debris is everyone's business and the importance of marine debris prevention is more important than solving marine debris problems. Regulations on garbage collection and disposal systems should be set up at the beach and communities nearby the beach in collaboration with the local administrative organization.

Keywords : Physical Composition; Marine Debris; Beach

Introduction

The problem of marine debris is an important issue that has been paying attention to all over the world. It affects the abundance of ecosystems and marine resources [1]. Global estimates show that 80% of marine wastes is sourced from the land-based activities, especially improperly managed wastes and residual wastes; and another 20 percent comes from marine activities [2]. In 2021, Thailand is ranked as the 10th country as for the highest amount of plastic waste discharging to the sea [3].

At present, the trend of using plastics and synthetic materials reflects 60-80% of the marine litter, consisting of plastic, and in many areas plastics can be accounted for 90-95% of the total waste. Commonly, it is known that microplastic is very small and difficult to be stored and disposed. In addition, microplastic has the property of being hard to decompose which is easy to contaminate, distribution, accumulation and residual in the environment [4]. The current increase of marine debris is due to a number of factors, including economic expansion, marine tourism to increase the number of stores and marine accommodation [5].

Phetphoom Beach is the place consisting of restaurants, Abalone Farm and a small jetty for traveling to various islands. There is a problem of marine debris hitting the beach caused by human activities. Therefore, this study is necessary to survey the quantity and type of marine debris around Phetphoom Beach, Muang District, Phuket Province in order to collect the information for planning and managing marine debris.

Methodology

Study Area

Petchphoom beach locates in the East of Village 1, Ban Koh Sirey, Ratsada Subdistrict, Muang District, Phuket Province, where is about 4 kilometers away from the downtown, the distance of Petchphoom beach for researching trash problems is 760 meters. GPS was used to determine the survey location and to show the map of the survey points for collecting beach

waste samples at Phetphoom beach, as shown in (Figure 1).



Figure 1 Study Area at Phetphoom beach

Survey Method, According to International Coastal Cleanup, and Required Rules

According to the International Coastal Cleanup, and Required Rules, the sampling points were set along the beach of about 100-metre distance away from the river or the canal without cleaning around.

Time Period

The quantitative and physical composition of marine debris for 2 months, from April 2020 to May 2020, 4 sampling times for each month as stated in Table 1. in order to the correct information according to ICC standard, factors depend on tidal currents.

Table 1 Record date of beach waste sampling

No.	April sampling date	No.	May sampling date
1	Saturday, April 4, 2020	1	Monday, May 4, 2020
2	Sunday, April 12, 2020	2	Tuesday, May 12, 2020
3	Monday, April 20, 2020	3	Wednesday, May 20, 2020
4	Monday, April 27, 2020	4	Tuesday, May 26, 2020

Sample

This is the survey research aiming for the quantity and physical composition of marine debris along the Phetphoom beach, which was divided into 3 categories; mixed,

recyclable and hazardous wastes, with an exception of organic trash, eg. seaweed, as this type of trash can decompose naturally.

Sampling Area Observation

Methods used in this quantitative and physical composition of Phetphoom marine debris were as follows.

1) Extract the exact sampling spots from the whole beach distance, collect all pieces of trash, divide the trash into different categories using physical and quantitative composition, record the results, and mark all pieces of trash that were unable to be relocated.

2) Divide the trash into different categories using physical composition, weigh the trash and record the results in the result form.

Equipments

Equipment include measure tape of 50 meters, trash sacks, GPS device, rubber gloves, sanitary masks, balance, camera and a pair of trash pliers.

Analysis

The quantity and physical composition of the marine debris were calculated with descriptive statistics and the percentage.

The percentage of the trash = (The trash amount of each type x 100)/The total amount of the trash

Results and Discussions

Type, quantity and physical composition of beach wastes around Phetphoom Beach

The survey taken place during April-May 2020 discovered totally 3,715 pieces of marine debris, being equivalent to 104.44 kilograms in total. All marine debris pieces were divided into 3 different categories: general wastes, recyclable wastes and hazardous wastes. The general wastes contained 2,311 pieces as of 48.99 kilograms estimated as 62.20%, producing as the largest number among such 3 categories. Next, the recyclable wastes contained 1,291 pieces as of 51.18 kilograms estimated as 34.75%. Lastly, the hazardous wastes contained 113 pieces as of 4.27 kilograms estimated as 3.04%. These results are displayed in Figure 2.

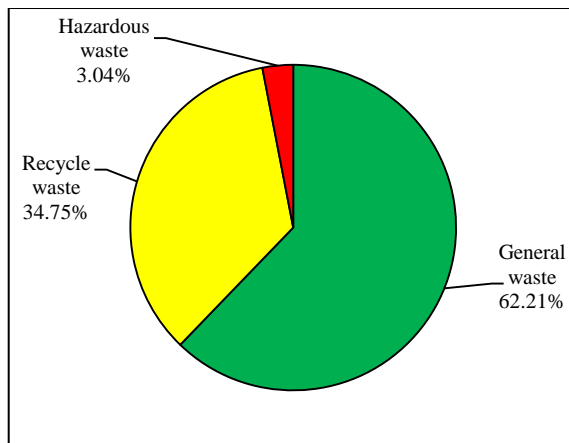


Figure 2 Percentage of marine debris type along Phetphoom Beach

From the results of the study, it was found that the composition of the waste can be classified as follows as shown in Table 2.

Table 2 The waste composition of Petchphoom Beach waste

Type	Physical Composition of Waste
General waste	Cigarettes, Food snacks (including potato chip snacks), Lunch boxes made of foam and Plastics, Straws made plastic, Cups made of plastic, Utensils, plastic bags for food containing, Paper dishes, Paper cups, Dishes and cups made of foam, Buoys, Fishing tools, Plastics bottles, Driving tools, Balloons, Beverage packages made of paper, Construction material, Tires, Clothes, Shoes, ornaments, Toys, Dolls, Coat hanger, Toothpaste tubes, Earwax pickers, etc.
Recycle waste	Lids made of plastics and metal, Plastics bottles, Glass bottles, Beverage cans, Pieces of paper, etc.
Hazardous waste	Batteries, Lighters, Diaper, Syringes, Medical tools, Sanitary masks, Chemical pens, etc.

Type and quantity of wastes along Phetphoom beach, April 2020

Collection of marine debris on April 5, 12, 20 and 27, were made depending on the tidal occurrence. On April 5, 12, 20, 27 the quantity of wastes were 544 pieces, 559 pieces 338 pieces and 321 pieces, respectively, total

amount of wastes was 1,764 pieces. The largest numbers of pieces was from the general waste category, followed by the recyclable wastes and hazardous waste, respectively, as displayed in Table 3.

Table 3 The marine debris quantity collected of April, 2020

Marine debris type	Marine debris quantity (number of pieces)				Total (pieces)	Weight (Kg)	Percentage (by pieces)
	April 4, 2020	April 12, 2020	April 20, 2020	April 27, 2020			
General waste	357	235	364	228	1,186	29.18	67.23
Recycle waste	183	114	161	82	540	18.35	30.61
Hazardous waste	4	10	13	11	38	2.37	2.16
Total	544	359	538	321	1,764	49.90	100

Analysis results of waste types studied in April 2020, it was found that general wastes had the highest volume accounted as 67.23%, followed by recyclable wastes accounted as 30.61%, and hazardous wastes, accounted as 2.15%, as shown in Figure 3.

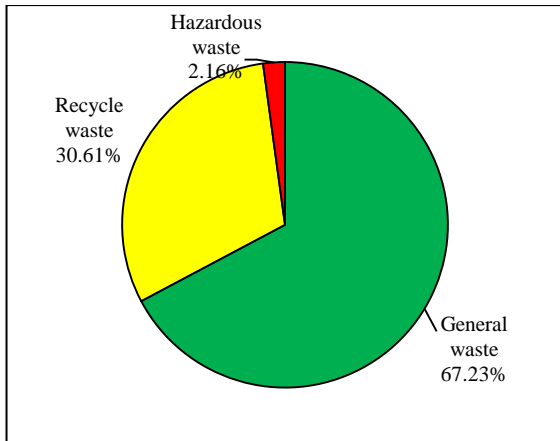


Figure 3 Quantity of marine debris in April 2020

Based on the study of marine debris existed along Phetphoom beach in April 2020; 1,764 pieces of marine debris which was the most general waste accounted as 67.23%, followed by recyclable wastes accounted as 30.61%, and hazardous waste. accounted as 21.6%. Composition of marine debris along Phetphoom beach in April is shown in Figures 4-6.

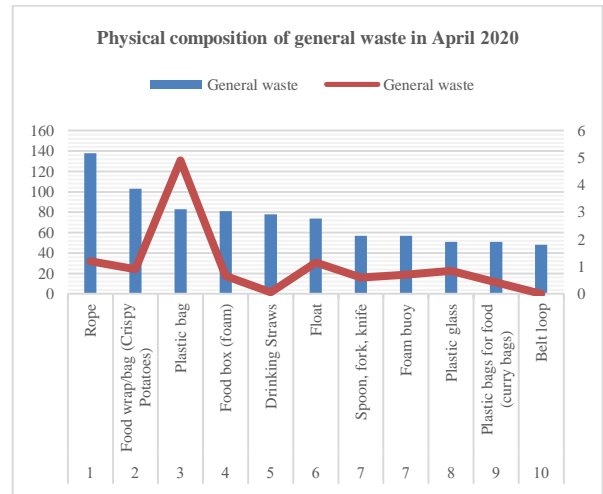


Figure 4 Physical composition of general waste in April 2020

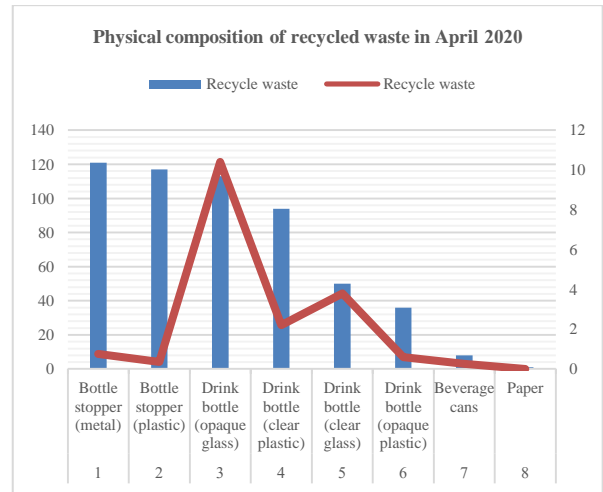


Figure 5 Physical composition of recycled waste in April 2020

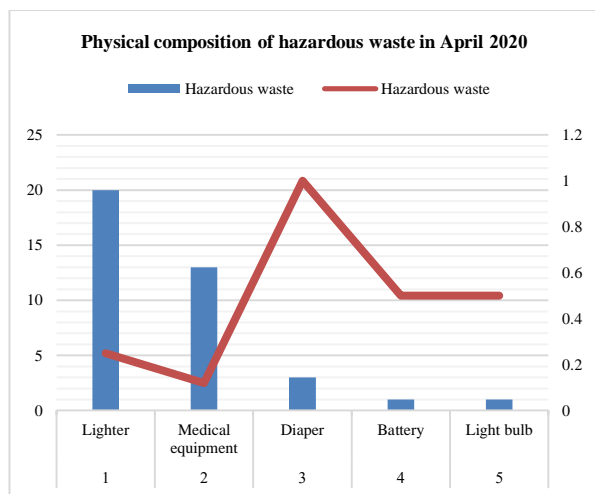


Figure 6 Physical composition of hazardous waste in April 2020

Figures 4-6 show that general wastes had the highest amount of rope, followed by food wrappers/bags (chips), copied bags, food boxes (foam), straws, floats, spoons, forks, knives, foam buoys, plastic glasses, plastic bags for food (curry) and fasteners, respectively. The most common recyclable wastes were bottle caps (metal), followed by bottle caps (plastic), beverage bottles (opaque glass), bottles, beverage bottles (clear plastic), beverage bottles (clear glass), beverage bottle (opaque plastic), beverage cans and paper. Hazardous waste consisted the largest volume of lighters, followed by medical equipment, diapers, batteries and light bulbs.

The analysis of waste composition in April 2020, it was found that the most common types of waste were rope, followed by food wrappers (chips), plastic bags, food boxes (foam), beverage straws, and buoy. In addition, the study by Jayla M. Blanke et al. (2561 most of the waste is plastic followed by foam, rubber, glass, metal and aluminum) [7]. Noting that most of the waste is linked to activities; industry and fishery, respectively, and others. Recyclable waste was the most bottle caps (metal), followed by plastic bottle caps. and beverage bottles (opaque glass). Hazardous waste was found for lighters at the most, followed by medical equipment and diapers.

Type and amount of beach rubbish along Petchaphum, May 2020

The study of marine debris in May 2020, beach wastes were collected four times a month, on 4, 12, 20 and 26 May 2020, taking into account for tidal times. The study on May 4, 12, 20 and 26 were marine debris 663 pieces, 614 pieces, 391 pieces and 283 pieces, respectively; in total amount of 1,903 pieces of marine debris, collected along Petchaphum beach. The most common types of beach waste of four sample collections were general waste, followed by recyclable waste and hazardous waste, as shown in Table 4.

Table 4 The marine debris quantity collected of May sample collection

Marine debris type	Marine debris quantity (number of pieces)				Total (pieces)	Weight (Kg)	Percentage (by pieces)
	May 4, 2020	May 12, 2020	May 20, 2020	May 26, 2020			
General waste	356	348	206	215	1125	19.81	57.66
Recycle waste	273	245	171	62	751	32.83	38.49
Hazardous waste	34	21	14	6	75	1.90	3.84
Total	663	614	391	283	1951	54.54	100

Analysis results by types of waste studied in May 2020, general waste was the highest quantity of 1,951 pieces, represented as 57.66%, followed by the recyclable wastes represented as 38.65% and hazardous waste represented as 3.84% as shown in Figure 7.

The study of marine debris existed along Petchaphum beach in May 2020, a total of 1,951 pieces of marine debris were found represented as the most general waste for 57.67%, followed by recyclable waste represented as 38.49% and hazardous waste represented as 3.84%. Composition of beach rubbish along Petchaphum beach in May 2020 is shown in Figures 8-10.

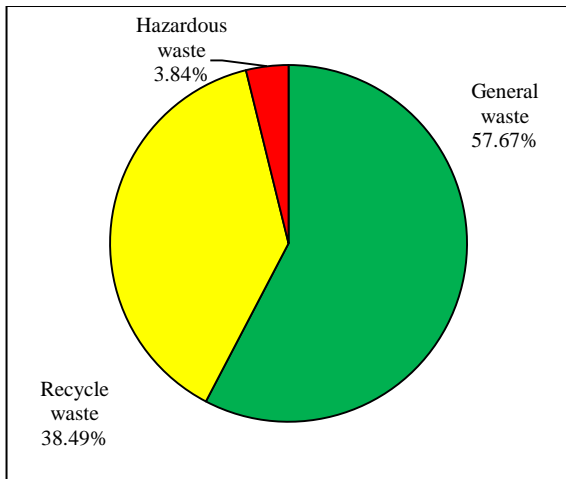


Figure 7 Quantity of marine debris in May 2020

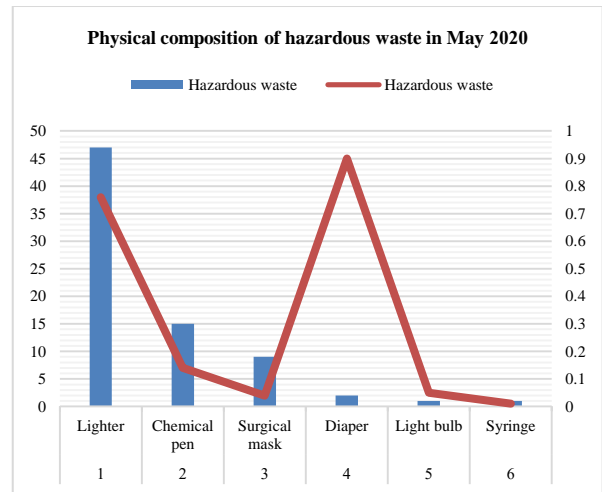


Figure 10 Physical composition of hazardous waste in May 2020

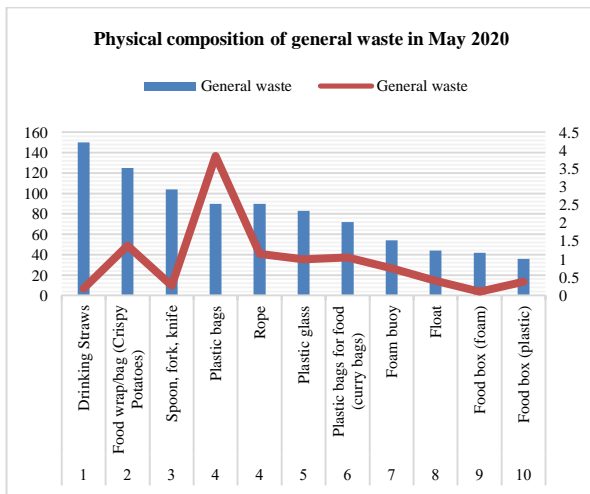


Figure 8 Physical composition of general waste in May 2020



Figure 9 Physical composition of recycled waste in May 2020

From Figures 8-10, general wastes consisted of straws/drinks at the most, followed by food wrappers/bags (chips), spoons, forks, knives, plastic bags, ropes, plastic cups, plastic bags for food (curry), foam buoys, floating buoys, food boxes (foam) and food boxes (plastic), respectively. For the recyclable wastes, bottle caps (plastic) was found at the most, followed by bottle caps (metal), beverage bottles (opaque glass), beverage bottles (clear glass), beverage bottles (opaque plastic), beverage bottles (clear plastic) and can lids (plastic), respectively. For the hazardous wastes, the most found was lighters, followed by other medical equipment, diapers, light bulbs and syringes.

Compositions of marine debris in May 2020, general wastes most commonly found were beverage straws, food wraps/bags (chips), cutlery (plastic), plastic bags, ropes, plastic glasses. According to the study of Lisbeth Van Cauwenberghe et al (2013), assessment of the marine debris on the Belgian continental shelf, plastics were found to be the dominant category of small marine debris recorded, with more than 95% of the debris in all three marine sample compartments being plastic. In addition, the study by Yong ChangJang et al (2018) [9], composition and abundance of marine debris washed up on Sri Lanka's beaches, an average of 4.1 large (>25 mm) of marine debris and 158 small (5–25 mm) of marine debris were found per square meter of beach; packaging materials (55%) by application, followed by consumer goods (25%) and fishing

gear (20%) in terms of materials. For this study, plastics contributed the most (93%) of marine wastes, with the most common recyclable wastes were plastic caps, metal caps and beverage (opaque glass) bottles. Hazardous wastes found were lighters, followed by medical equipment, diapers, syringes and bulbs.

Wastes along Petchphum Beach were found the most in May 2020 about 1,951 pieces/month, and 1,764 pieces/month in April, 2020. The study by Bilal Mghili et al. (2020) present a total of 7,839 pieces of marine debris from five beaches. Polymers, followed by paper/cardboard, metals, lumber, fabrics/textiles and glass/ceramics [10]. Based on the marine debris studied in April and May 2020, the large amount of rubbish was found at the beginning of the beach due to the existence of villas, residences, frozen fish and aquarium companies, and the occupation of the people in the community.

Conclusion

The study of type and amount of marine debris along Phetphoom Beach in April and May, 2020; marine debris classified as general wastes presented as the highest volume of 62.45%, followed by the recyclable wastes (34.63%), and hazardous wastes (2.97%), respectively. Composition of the general wastes were large pieces of marine debris such as food wrappers/bags (chips), spoons, forks, knives, plastic bags, plastic glasses, foam buoys. For the recyclable wastes consisted of beverage boxes (paper). The composition of hazardous wastes were batteries, lighters, light bulbs. Recommendations should issue the strictly enforced beach regulations and laws in order to manage inappropriate behavior of individuals who dump different types of waste on the beach and in the sea. Public relations on marine debris and prevention of wastes for people, fishermen, tourists and beach residents. This research provides a way to develop marine waste such as ropes, nets or fisheries waste. There are entrepreneurs who have developed it into pieces such as bags for everyday use.

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