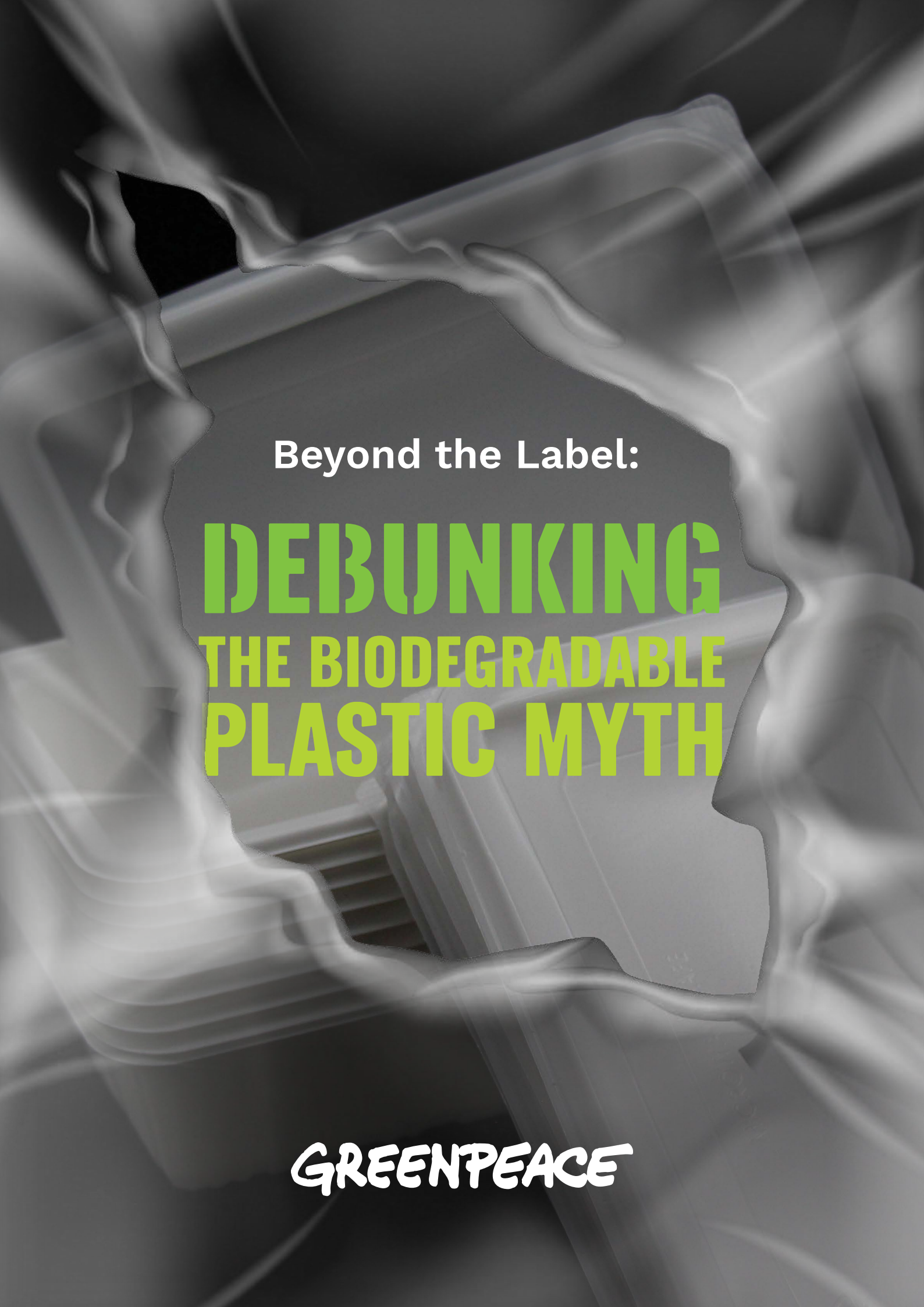

Beyond the Label:

DEBUNKING THE BIODEGRADABLE PLASTIC MYTH

GREENPEACE

DISCLAIMER

This report has been produced by Greenpeace Thailand in the interest of public awareness and advocacy for environmental protection. It is intended solely to present factual information derived from research on plastic packaging made from natural raw materials and biodegradable plastics. There is no intent to cause harm to any individuals, companies, or entities referenced in this report.

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WHY DO WE NEED TO RESEARCH BIODEGRADABLE PLASTIC PRODUCTS AND PACKAGING?

Thailand has launched a campaign to stop giving out single-use plastic bags in department stores, supermarkets, and convenience stores since January 1, 2020, following the Cabinet Resolution of November 12, 2019. This initiative is part of a broader effort to phase out plastic bags and ultimately eliminate their use, aiming to reduce their significant environmental impact. The campaign is under the Roadmap of Plastic Waste Management during 2018 – 2030 submitted to the Cabinet by the Ministry of Natural Resources and Environment and has been determined to be the policy of collaboration between government, private sectors, and the public in moving, publicizing, creating awareness, and understanding to customers and entrepreneurs about reducing the use of plastic bags. Moreover, additional policies have been implemented to support entrepreneurs in adopting technology and innovation for developing alternative materials to plastics. These efforts also include raising public awareness on reducing plastic consumption and promoting sustained waste-sorting behaviors to minimize plastic waste.

As plastic production continues to rise and is projected to increase annually[1], the production of polyethylene terephthalate (PET), widely used in food containers such as water bottles and packaging, is also growing.[2] Meanwhile, plastic packaging labeled as 'biodegradable' or 'made from natural materials' is becoming more prevalent in the market.

The second phase of Thailand's plastic waste management plan (2023-2027)[3] highlights the promotion of compostable plastics through various policy measures, including tax incentives for producers, funding support for eco-friendly plastic production, and lifecycle impact assessments of bioplastics such as polylactic acid (PLA) derived from cassava. Additionally, efforts are being made to facilitate the transition of businesses toward the bioplastics industry.

Furthermore, the Board of Investment of Thailand (BOI) has positioned the country as a global hub for bioplastic production, with Thailand projected to become the world's second-largest bioplastics producer.[4]

While plastics labeled as **'biodegradable'** or **'made from natural materials'** have been promoted as **eco-friendly**[5] alternatives to conventional plastics, it is essential to conduct thorough studies and testing to verify whether these materials can truly decompose naturally.

If decomposition is delayed or if microplastics are generated during the process, these alternative plastics may not effectively reduce plastic waste.

Moreover, the plastic waste problem could worsen if consumers mistakenly believe that these substitutes are entirely waste-free, leading to continued reliance on single-use plastics instead of reducing their consumption.

To address concerns about plastic pollution, Greenpeace Thailand has conducted research on the decomposition rates and potential microplastic formation of 11 products labeled or symbolized as biodegradable by their manufacturers. This study focuses specifically on single-use products and packaging and is carried out in collaboration with the Bachelor of Science in Marine Technology program at Burapha University, who conducted the experiments to assess the decomposition rate and potential for microplastic formation of these materials.

Researchers used distilled water to wash out any residues from the product for examination to assess the presence of microplastics.

RESEARCH OBJECTIVES

Researchers are lining up biodegradable plastic products and packaging to be buried beneath the soil.

The report, **Beyond the Label: Debunking the Biodegradable Plastic Myth**, presents research findings on products labeled as biodegradable or made from natural materials. This study evaluates their actual decomposition rate and potential for microplastic formation, focusing on two key aspects:

1. **The decomposition rate of biodegradable plastic products and packaging.**
2. **The density and quantity of fragments that break away from these materials, potentially contributing to microplastic pollution.**

The study was conducted with the following objectives:

1. To provide consumers with information that enables informed decisions in purchasing goods and products that result in reducing plastic footprints.
2. To encourage brand owners and modern retailers to acknowledge their responsibility as manufacturers in addressing the plastic pollution crisis at its source through sustainable practices.
3. To raise consumer awareness about responsible consumption, emphasizing the social and environmental impacts of their choices, as well as the significance of green labels and other certifications on eco-friendly products and packaging.
4. To promote effective and appropriate solutions to plastic waste pollution.
5. To safeguard public interests by providing information on modern retail trade practices, empowering consumers to make well-informed decisions.

PRODUCT SELECTION AND RESEARCH SCOPE

Greenpeace Thailand has selected products labeled or marked with terms such as 'Biodegradable',' Wood Pulp', 'Special BioPlastic Made of Plants that can be decomposed and returned to nature,' as well as plastics identified with BIO Mat. Technology (100% Environmentally Degradable Plastic), Polylactic Acid (PLA), and Polybutylene Succinate (PBS) since 2023, thus there might be the alteration in selected products on the date the report is published.

Polylactic Acid (PLA) is a plant-based plastic derived from raw materials such as corn, cassava, and sugarcane. The production process begins with grinding or milling these plants into starch, which is then broken down into sugar and fermented using microorganisms to produce lactic acid ($C_3H_6O_3$), a process similar to beer fermentation. The lactic acid undergoes chemical processing to form a ring-structured compound called lactide, which is then distilled in a vacuum system and polymerized into long-chain polylactic acid.[6]

PLA plastics have similar mechanical properties to polyethylene terephthalate (PET) and polystyrene (PS), which are transparent and can be molded into various shapes and can be sourced easily.[7] According to estimates by the European Bioplastics Association[8], PLA currently holds the largest market share among bioplastics at 31% and is projected to account for nearly 50% of production by 2028.[9]

Polybutylene Succinate (PBS) is a synthetic polyester produced through the synthesis of succinic acid and 1,4-butanediol, both of which are derived from petrochemical sources. As a result, PBS has a slower degradation rate compared to polylactic acid (PLA) and other bioplastics synthesized from natural raw materials. PBS is primarily used in packaging, which accounted for 57.5% of its applications, followed by agricultural uses at 15% in 2020.[10]

Table 1:

Information concerning the products that have been tested and the materials used that are specified by the manufacturer

Products	Information and materials specified by manufacturers	Product Labels
All Café Paper Cups	Laminated with Polybutylene succinate (PBS)[11]	
Inthanin Plastic Cups	Polylactic Acid (PLA)[12]	
Smart-R Handle Bags	Specified as “Biodegradable”	
Rak Lok Handle Bags from Advance BIO	Made with BIO Mat technology (Environmentally Degradable Plastic 100%) Can decompose in the landfill without degrading into microplastic[13]	
Mitrphol Sugar Bags	Made from kraft paper, the inside is moisture-proof with a special bioplastic made from plants that can decompose and be returned to nature in a compost state[14]	
MILO Paper Straws	Wood Pulp	

Products	Information and materials specified by manufacturers	Product Labels
Amazon Plastic Straws	Bio PBS + PLA that was 100% made from plants such as sugarcane and corn that can decompose in soil in 180 days[15] Straws made from plants 100% compostable material	
UNI-WARE Plastic Box	Made with integrated materials and natural fiber that is reusable and composable Marked as “PP”	
Smart-R Plastic Box	Bio Plastic Food Box Square Degradable and made from Bio-Mat materials that are naturally degradable with no toxic residues Marked as “PP”	
Watsons Wet Wipes	100% plant-based wipes and biodegradable wipes[16]	
Lotus’s Bagasse Plates	Made from sugarcane pulp	

** The Bio-Mat technology is the combination of natural minerals and agricultural crops and the products are molded by polymer that are degradable within 5 years under controlled conditions.

RESEARCH DESIGNS

Each type of product sample were tested for decomposition under these 3 testing circumstances.

1

Simulated seawater environment
Products were submerged in a fish tank with a salinity of 30 ppt (parts per thousand), placed outdoors under direct sunlight, with continuous aeration through an air tube for 161 days.

2

Under the actual circumstance
Products were submerged in seawater for 135 days.

3

Soil burial test
Products were buried in soil for 178 days.

There are two subsets of the packaging used to be soaked in seawater and under the soil: one was put in filtered fabric bags with a 198-micron pore size to ease taking out the decomposed packaging and the other was directly touched with the environment to show the actual decompose situation.

Before the experiment took place, all samples have been pictured and weighted for the dried weight of each package. When bags had been filled with the package samples, the bag ends were sewed to close. Triplicate analyses were used in this experiment and each sample was collected once a month during 4-6 months to test for decomposition rate of those package samples in different circumstances. The samples had been cleaned and dried at room temperature before they were pictured and weighted again. The filtered bags were also washed with distilled water. Subsequently, the rising water from the fabric bags is examined to analyze the fragments that have detached from the tested samples.

METHODOLOGY

1

Submersion in Simulated Seawater Environment

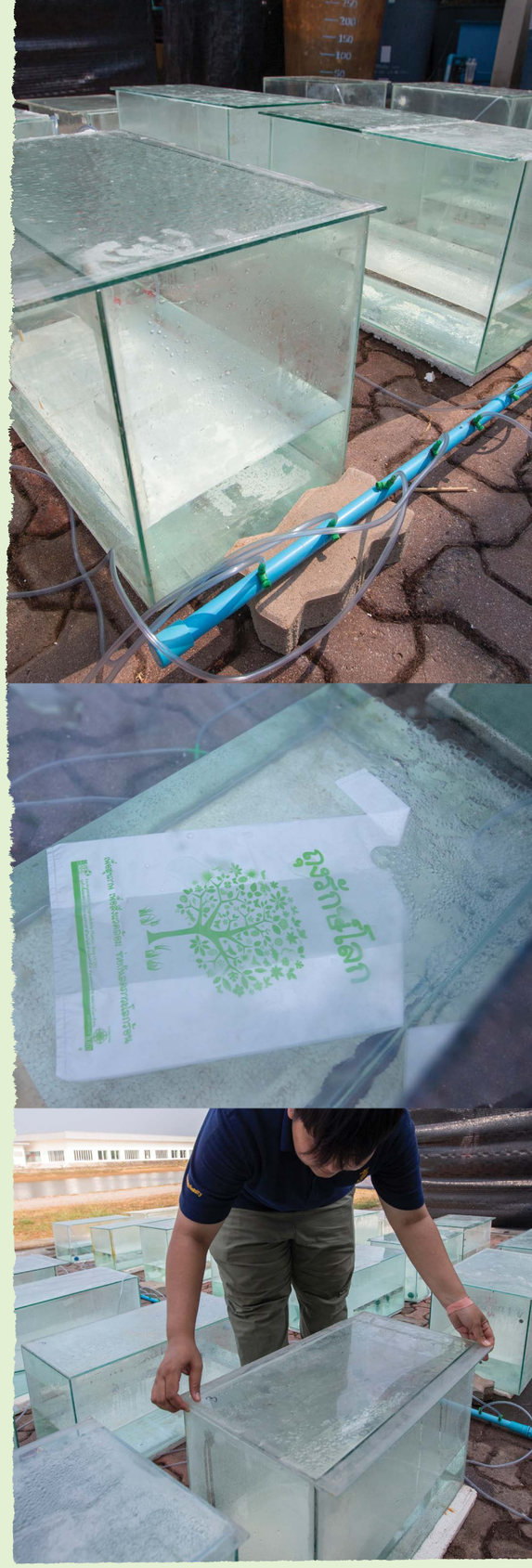
1. Ten liters of seawater with a salinity of 30 PPT were filtered and added to 42 fish tanks (each measuring 30 x 60 x 30 cm). Air pumps were used to supply oxygen continuously to the water through oxygen hoses and air stones, while the air pumps were covered by 198-micron filtered cloth.

2. The samples were placed in the fish tanks, covered with a glass sheet, and positioned in an area exposed to sunlight to simulate real-world seawater submersion (Picture 1).

3. Included a 198-micron filtered cloth in a separate tank under identical conditions to verify whether the cloth itself generated microplastics during the experiment.

4. At the end of each month's submersion period, water was drained from all tanks, filtered through a 98-micron mesh cloth to capture particles released from the samples, and tested for microplastics.

5. The fish tanks were refilled with filtered water and the samples were submerged for another month.



Picture 1:
Layout of Samples in the Fish Tanks

2 Submersion in Actual Seawater

1. Four sets of samples were prepared for submersion in the sea, with inspections conducted at four intervals over 4–6 months. In each set of samples, triplicate analyses were prepared to check for decomposition.

2. For decomposition rate testing, the samples were placed in polyethylene net bags, and secured with polyethylene ropes.

3. To study the potential for microplastic formation, the samples were enclosed in 198-micron filtered cloth bags and sewn closed with thread.

4. The filtered cloth and mesh bags were tied to a bamboo stick, maintaining a 5 cm spacing between each attachment point. Floating buoys were also attached to both ends of the bamboo stick to secure the samples.

5. The sticks with the samples were positioned 50 meters from the shore, where the sea water was approximately 5-7 meters deep. (see picture 2)

6. The samples were retrieved at the designated inspection intervals (2 days) and lightly rinsed. The degradation conditions were documented via photographs. These conditions were marked as “before” conditions.

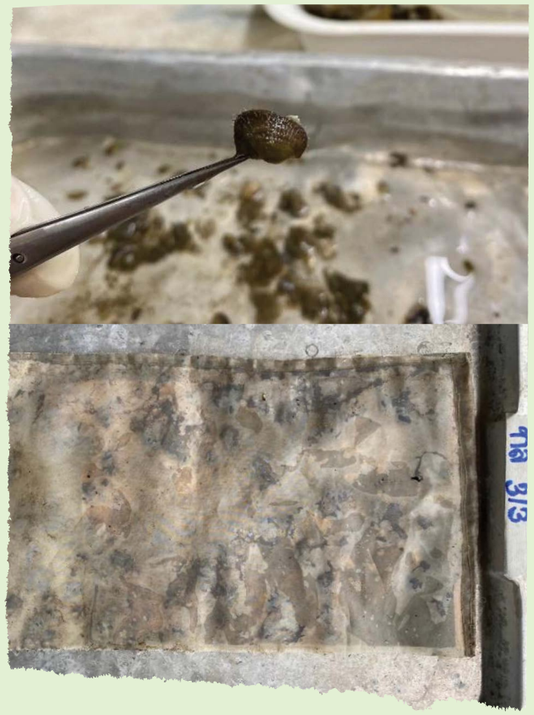
7. The samples underwent a second round of cleaning, where all sediments and fragments were removed, and then air dried. The degradation conditions were documented via photographs. These conditions were marked as “after” conditions.

▲

Picture 2:
Laying out the samples in the sea

▲

Picture 3:
Product samples were submerged in the sea before cleaning



▲

Picture 4:
Living things are attached (above) and living things have been inside the filtered bag since early ages and grown up in the filtered bag (below)

3 Buried Under Soil

1. Four sets of samples were prepared and then buried in soil at the Marine Technology Research Center, Faculty of Marine Product Technology. The experiment was conducted over 4–6 months, with results examined at four intervals. Each set included:
   - Three replicates for studying the decomposition rate
   - Three replicates for assessing the potential formation of microplastics
2. Four holes with a depth of 5-10 cm. were created to bury the samples for a period of 1 month, 2 months, 3 months, and 4 months, respectively.
3. Two sets of samples were prepared: one set where the samples were placed in filter bags, and one set that were buried on their own. (Picture 5)
4. Shovelled to remove the soil to a depth of 5 cm. after the designated burial period for each hole, used a hand shovel and a paintbrush to remove the soil to take the samples up before picturing them.
5. The samples were rid of the soil and then air dried.
6. The dried samples were then photographed.
7. The dried samples were weighed using a 4-digit analytical balance to determine the different weights of the samples before and after being buried in the soil.

▶
Picture 5:
Laying out of the samples in the holes

▼
Picture 6:
Samples extracted from the soil after 1 month

▼
Picture 7:
Package samples under the buried circumstance before cleaning

RESEARCH FINDINGS

This study aimed to determine the decomposition rate and potential for microplastic formation in 11 plastic products and packaging samples labeled as biodegradable. The samples were tested under three different conditions:

1. Immersion in seawater
2. Burial in soil
3. Submersion in fish tanks with simulated seawater

The findings provide insights into the actual biodegradability of these materials and their potential impact on the environment.

▶ **The samples were washed on 198-micron filtered cloth** after the oxidation had been completed. Then, the plastics were separated from other contaminants depending on different specific gravity.

Table 2:

Greenpeace Thailand presents the findings from the research as follow:

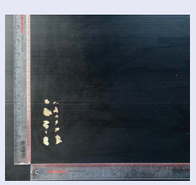
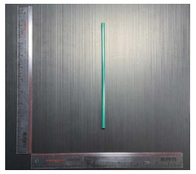
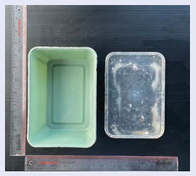
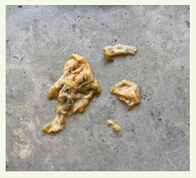
Products	Information and materials specified by manufacturers	Pre-test Packaging and Materials	Submerged in Simulated Seawater Environment (after 161 days)	Submerged in Actual Seawater (after 135 days)	Buried Under Soil (after 178 days)	Decomposition Rate	Potential for Microplastic Formation
All Café Paper Cups	Laminated with Polybutylene succinate (PBS) GO GREEN...SAVE THE WORLD *Environmentally Friendly* Made from natural materials, composable					Slightly degraded 92% degraded 95% degraded	Not Found Found Not Found
Inthanin Plastic Cups	Polylactic Acid (PLA) 100% composable					Not degraded – the color shedding from the packaging Not degraded Not degraded	Found – the color shedding from the packaging Not found Not found
Smart-R Handle Bags	The products are specified as “Biodegradable” Made by BIO Mat. Technology The bags are biodegradable.					Not degraded Not degraded Not degraded	Found Not Found Not Found
Rak Lok Handle Bags from Advance BIO[17]	Made with BIO Mat technology (Environmentally Degradable Plastic 100%) that can be decomposed in the dump soil and will not turn into microplastics The bags are biodegradable.					Not degraded – faded packaging print Not degraded – torn Not degraded	Not found Not found Not found
Mitrphol Sugar Bags	The packaging is biodegradable. Made from kraft paper, the inside is moisture proof with a special bioplastic made from plants that can be decomposed and returned to nature in a compost state[18]					Not degraded 90% degraded 42% degraded	Not found Found Found
MILO Paper Straws	Paper Pulp			No product fragments were detected	No product fragments were detected	Not degraded 100% degraded 100% degraded	Not found Not found Not found

Table 2: (continued)

Greenpeace Thailand presents the findings from the research as follow:

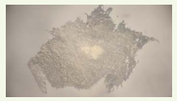
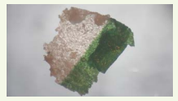
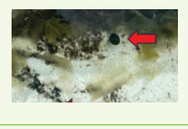
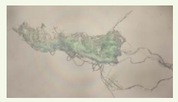
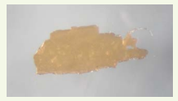
Products	Information and materials specified by manufacturers	Pre-test Packaging and Materials	Submerged in Simulated Seawater Environment (after 161 days)	Submerged in Actual Seawater (after 135 days)	Buried Under Soil (after 178 days)	Decomposition Rate	Potential for Microplastic Formation
Amazon plastic straws	Bio PSB + PLA that was 100% made from plants such as sugarcane and corn and can be decomposed in soil in 180 days Straws made from plants 100% compostable material					Not degraded – faded product color 90% degraded 2% degraded	Not Found Found Found
UNI-WARE plastic box	The product is identified with “the product was made with integrated materials and natural fiber that is reusable and composable”. The letter “PP” is identified.					Not degraded Not degraded Not degraded	Found Not Found Not Found
Smart-R Plastic Box	Bio Plastic Food Square Box The box is degradable and made from Bio-Mat materials that are naturally degradable without having toxic residues and eco-friendly with “PP” identified.					Not degraded Not degraded Not degraded	Not Found Not Found Not Found
Watsons Wet Wipes	The product is identified as 100% Plant-based wipes and biodegradable wipes.			The products were not found	The products were not found	Product fragmented 100% degraded 100% degraded	Not Found Not Found Not Found
Lotus’s Bagasse Plates	Made from sugarcane pulps			The products were not found	The products were not found	Product fragmented 100% degraded 100% degraded	Not Found Not Found Not Found

Remarks

- Calculation of degradation rate is based on the “weight” of the packaging.
- The tested biodegradable products and packaging that identified a degradation time frame are handle bags Rak Lok from Advanced BIO and handle bags Smart-R, which specified that they were made from BIO Mat. Technology, and Amazon plastic straws only. For other products, no information on the degradation period is provided. However, products and packaging that are labeled or advertised as “biodegradable” often have criteria that must be considered in terms of temperature, humidity, oxygen, and microorganisms.

Table 3:

Microplastics found in the study:

Products/ Packaging	Environments	Pictures of Samples split fragments	Number of pieces of material packaging smaller than 500 microns from each sample collected after leaving in 3 environments
All Café Paper Cups	Submerged in actual seawater		25 pieces
	Buried under soil		1,505 pieces
Inthanin Plastic Cups	Submerged in simulated seawater environment		1,389 pieces
Smart-R Handle Bags	Submerged in simulated seawater environment		The fragments were found with splattered green paints, which were expected to be green color on the bags.
Mitrphol Sugar Bags	Submerged in actual seawater		10,055 pieces
	Buried under soil		27 pieces
Amazon Plastic Straws	Submerged in actual seawater		460 pieces
	Buried under soil		4 pieces
UNI-WARE plastic box	Submerged in simulated seawater environment		43 pieces

Results of the decomposition under 3 environments

Submerging products in simulated seawater environment:

- The products and packaging that were not decomposed were Inthanin plastic glass made from PLA plastic, handle bags Smart-R, UNI-WARE plastic boxes, Rak Lok handle bags from Advance BIO[19], Mitrphol sugar bags, MILO paper straw, Amazon straws, and Smart-R Boxes. Watsons wipes and Lotus's bagasse plates were torn into fragments.
- Only All Café was slightly decomposed.

Submerging in actual seawater:

- The products and packaging that were not decomposed are Inthanin plastic glass, Smart-R handle bags, Rak Lok handle bags from Advance BIO, UNI-WARE plastic boxes, and Smart-R boxes.
- The products and packaging that were 100% decomposed are MILO paper straws, Watsons wipes, and Lotus's bagasse plates.
- The products and packaging that were partly decomposed are All Café paper cups, Mitrphol sugar bags, and Amazon plastic straws.

Burying under soil:

- The products and packaging that did not decompose are Inthanin plastic glass, Smart-R handled bags, Rak Lok handle bags from Advance BIO, UNI-WARE plastic boxes, and Smart-R boxes.
- The products and packaging that partly decomposed are All Café paper cups and Mitrphol sugar bags.
- The products and packaging that fully decomposed are MILO paper straws, Watsons wipes, and Lotus's bagasse plates. Amazon plastic straws only decomposed by 2%.

Samples that have been treated with a 30% hydrogen peroxide solution. 50 ml. samples each were left for 3 days to let hydrogen peroxide dissolve organic substances contaminated in the samples.

Results of microplastics found under 3 environments

Submerging products in simulated seawater environment:

- The packaging found to **contain microplastics** are Inthanin plastic glass, microplastics found in faded packaging print, Smart-R handled bags, and UNI-WARE plastic boxes.

Submerging products in actual seawater:

- The packaging found to **contain microplastics** are All Café paper cups, Mitrphol sugar bags and Amazon plastic straws.

Burying products under soil

- The packaging found to **contain microplastics** are Mitrphol sugar bags and Amazon plastic straws.

Results according to package characteristics:

- The study showed that All Café cups coated with polybutylene succinate slightly degraded in simulated seawater but demonstrated over 90% degradation in marine environments and soil. Microplastics was identified following the degradation process. Mitr Phol sugar bags identified that they were made from natural degradable materials by the manufacturers remains undegraded in simulated seawater, but exhibited 90% degradation in seawater and 42% in soil. Microplastics were detected post-degradation.
- Amazon straws made with BIO PBS + PLA can have a decomposition rate of 90% in seawater, and 2% when buried under soil, along with the formation of microplastics. Inthanin plastic glasses made from PLA plastic are not degradable and microplastics were detected from glass print.
- The results indicated that UNI-WARE plastic boxes labeled as "Keep the earth, Keep the environment" and "Biodegradable and Recyclable" are not degradable and break down into microplastics. Microplastics found in the Smart-R handled bags, which identified as "Biodegradable", were discovered on faded color of Smart-R handled plastic bags and scraps from UNI-WARE covers.
- Handle bags screened with "Rak Lok" and from BIO Mat. (Environmentally Degradable plastic 100%) and Smart-R degradable plastic boxes were not decomposed, plus no microplastics were found.

FALSE SOLUTIONS

The study suggests that the terms **"biodegradable, bio-plastic, or bio-based plastics"** are not the solutions to tackle the plastic pollution crisis.

The results revealed inconsistencies between the manufacturer label and actual results:

- **MitrPhol sugar bags** are identified as "biodegradable packaging made from kraft paper, with a moisture-proof inside made from special plants that are biodegradable to the compost form."[20] However, after testing the plastic-coated parts of the bag by using Raman Spectroscopy, the results indicate that the plastics are mostly made up of low density Polyethylene (HR Aldrich Raman) which is inconsistent with the specified labels. Polyethylene, low density or LDPE, has only 9-25% of collection rate and 75-91%[21] of leavings in the landfill. According to the results, MitrPhol sugar bags have a decomposable rate at 42% and microplastics were detected.

- The manufacturer producing **Amazon plastic straws** specifies that the straws are Bio PBS and PLA types, which can decompose in the soil in 180 days. However, the decomposition of Bio PBS and PLA plastics generally is industrial composable where the decomposition will only take place in an industrial digestion system with regulated temperature, oxygen, and decomposed microorganism.[22] Therefore, burying PLA and PBS plastics in a natural environment still shows that the straws are in a non-degradable state even after being buried in the soil for 178 days.

- The label on **UNI-WARE plastic boxes** specifies that "the products contain integrated raw materials and natural fiber that are reusable and degradable", but the boxes are labelled with "PP", which means the products are made from Polypropylene plastics. This is consistent with the examination using Raman Spectroscopy and this type of plastic is strong and durable. After testing the product by immersing it in the fish tanks, microplastics were found. Therefore, if the UNI-WARE plastic boxes are released into the environment and exposed to sunlight for a long period of time, the plastic will deteriorate, break down, and turn into microplastics.

- During the time of research, **Advance BIO Rak Lok handle bags and Smart-R handle bags** submerged in seawater and buried beneath the soil did not decompose. There were only some sediments and organisms attached to them. If Advance BIO bags and Smart-R bags are released into the environment, they will float in the sea and environment for more than 135 days and 178 days, according to the research period, without losing quality.

- The label of **Smart-R plastic boxes** specifies that they are "Bio Plastic Food Box Square" "Degradable" which are identified as made from Bio-Mat., biodegradable, and eco-friendly". However, after testing a piece of Smart-R plastic box with Raman Spectroscopy, the results showed that the characteristics of Raman light scattering intensity are consistent with Polypropylene (PP). The research results are in accordance with the specification on the box, stating that the product is made from Polypropylene, yet inconsistent with the label. As presented in the results, Smart-R boxes did not decompose in all circumstances during the period of the research.

Biodegradable products and packaging that have been prepared for the research.

There is a growing consciousness among consumers to buy environmentally friendly products, leading to many brand owners and manufacturers to switch from single-use plastics, which are derived from fossil fuels, to bio-based and biodegradable plastics. But even though using plastics derived from plant feedstocks agricultural waste may **"sound better"** than using plastic made from fossil fuels, using alternative materials may just shift environmental issues from one issue to another, instead of actually fixing the global plastic crisis.

These biodegradable plastics have been known to break down into microplastics that are difficult to deal with because they are too small to be seen; and the production process produces air pollution in the form of toxic smoke and dust.[23]

Plastics derived from cassava, corn, sugarcane, bean protein, plant cellulose etc., may have a reduced decomposition time, but **still contain petrochemical components and have qualities that are very similar to traditional plastics.** Biodegradable plastics tend to degrade when exposed to sunlight (photo-degradable), oxygen (oxo-degradable), and moisture in water (hydro-degradable)[24] as degradation variables.

This type of plastic are mostly made from the same raw materials as traditional petrochemical-based plastics, but with more additives that accelerate degradation of plastics[25], resulting in a huge number of microplastics that could kill an abundance of wildlife when the microplastics are released into the human food chains. **What's dangerous is the impossibility of a solution for the management and elimination of microplastics that are released into the environment.** According to Greenpeace East Asia's research, 85% of microplastics were found in mammals' feces[26] and some microplastics were found in the remote habitats in Taiwan[27] which are the homes of preserved animals.

Ultimately, bio-based plastics can pollute the planet just as much as fossil-based plastics. Nearly half of bio-based plastics are not biodegradable.[28] The degradation of this type of plastic requires the right amount of heat and humidity for the decomposing microbes to thrive, which are extremely rare conditions in nature, both on land and in the ocean. In addition, bio-based plastics have the same external characteristics as fossil-based plastics, which cause more difficulties in sorting and make the leakages into recycling processes that reduces[29] the quality of plastics at termination. Furthermore, Thailand currently does not have the regulations in collecting this type of waste and appropriately disposing of it in industrial settings.

3 ACTUAL SOLUTIONS
THAT SHOULD BE PRIORITIZED

Deposit Return Scheme and Reuse System

Refill System: Consumer practices of Bring-Your-Own-Containers to be refilled

Innovative Investment

Greenpeace Thailand supports manufacturers and brand owners to find effective solutions for the problems including managing single-use plastics at the production and handling the overflown plastic waste all over the world directly, without focusing on the wrong solutions or causing other problems. What is needed is a truly circular economy, such as reuse and refill, and **to eliminate the "throwaway" culture in order to move towards effective problem management and sustainable lifestyle designs.**

Deposit Return Scheme and Reuse System

It is a system where customers borrow containers from the store or the product owner and pay a sum of deposit for the containers which will be then returned to the drop-off point specified by the store. The containers will be cleaned and reused. **The product Deposit Return Scheme is a system that supports sustainable "reuse" for the environment** because plastics are reduced at sources and resources are continually reused until the containers reach their life. Entrepreneurs in Thailand are currently turning to create **"reuse systems"** to manage plastic problems at sources, such as Eco Crew, a service for containers borrowing/returning in events where glasswares and utensils are provided for customers to be used for serving food and drink in their events and the customers will be charged only 10 Baht deposit. When all the utensils have already been used, they will be returned at the drop-off point and deposit will be returned to the customers.

Refill System: Consumer practices of Bring-Your-Own-Containers to be refilled

An in-store refill system refers to a system where customers bring their own containers to refill food, beverages, dry food, and cleaning products at the store.

It is a product weight-based pricing. Customers are required to bring their own containers for their purchase, preventing waste generation at the source because customers can only buy the products they want without taking unnecessary packaging with them. **It is important to allow customers to bring their own containers to purchase products.** An example of a packaging-free store is the shop called Less: PLASTIC:ABLE, where customers can bring their own reusable containers to refill their soap and cleaning products.

Innovative Investment

Manufacturers and brand owners can **develop innovative alternatives to replace their reliance on single-use plastics by focusing on redesigning systems and packaging to reduce unnecessary plastics** such as non-labelled drinking water; applying technology to create a container circulation system such as applications for monitoring containers throughout the process of borrowing and returning at the return point. Reuse and refill systems have now been introduced worldwide to reduce the costs of packaging and transportation. In addition, the system will assist to reduce carbon emission and it is a sustainable solution for plastic crisis e.g. Returnity[30], the service that provides refillable packaging for E-Commerce companies where the packaging are delivered to customers in reusable boxes, or RePack[31], a startup company from Finland who uses reusable packaging that is made from recyclable materials where the online customers are required to pay a deposit for RePack delivery and after the customers purchase products from online shops who join in the campaign and receive the products, they can fold packaging as small as a letter and return to the shops without any expenses, each package can be reused at least 20 times.

By utilizing a reuse and refill system that will not cause plastic wastes with modern technologies, we could create exciting possibilities that can change the world for the better.

POLICY RECOMMENDATIONS

Government sector

The government should have standard criteria for biodegradable, bio-based, and bioplastic products and packaging and a mandatory standard for specific definitions or terms printed on packaging labels, including the management of packaging collection after use with proper management system, so that manufacturers and brand owners can follow appropriate procedures. These measures would help consumers make informed decisions about packaging efficiency and prevent misconceptions about biodegradability. However, the most sustainable solution to plastic pollution is to prioritize reducing plastic production—especially single-use plastics—to mitigate the environmental crisis, protect biodiversity, and limit global temperature rise to within 1.5°C.

Consumers

The inconsistency between label texts and the reality of biodegradable and bio-based plastics has made it necessary for consumers to be aware of information and have to double-check on labels/advertisements and public relations that state as “biodegradable plastics”, “Biodegradable,”, “pulps”, “Biodegradable Made of Special Bio Materials from Plants”. The plastics specified as “Made from Special Technology”, PLA, and PBS plastics are not always decomposed in natural circumstances, and those types of plastics can possibly be sources of microplastics in natural environment. **It is therefore essential for consumer rights to carefully consider and examine the use of marketing terms before making a purchase decision.**

Manufacturers and brand owners

The key to effective sustainable pollution management is targeting the root cause of the problem, just as turning off the tap instead of using a spoon to remove overflowing water from the sink. Manufacturers and brand owners must focus on **reducing the production of Problematic, Unnecessary, and Avoidable plastics, supporting the culture of reuse, creating the refill system, and inventing** innovation and systems to get as close to zero waste as possible. They should not divert to false solutions that could lead to other environmental problems in the future.

Manufacturers and brand owners need to **prioritize the principle of Extended Producer Responsibility (EPR),** which corresponds to the Polluter Pays Principle (PPP). The owner must take responsibility by reducing the use of single-use plastics in their packaging to prevent negative impacts on human health, society and the environment, creating new packaging designs to reduce problematic, unnecessary and avoidable plastics, distributing products, **emphasizing on creating a reuse system, and collecting packaging for the efficient management system,** including the responsibility for the restoration of natural resources and communities affected by plastic pollution problems, etc.

BIBLIOGRAPHY

[1] Krungsri (1 พฤศจิกายน 2566). Industry Outlook 2024-2026: Plastics. Available at: https://www.krungsri.com. Accessed 30 ตุลาคม 2567

[2] The Deutsche Gesellschaft fÜr Internationale Zusammenarbeit (GIZ) (2566). Analysis of Markets and Technologies for Plastic Material Circularity in the Packaging Sectors in Thailand. Available at: https://www.thai-german-cooperation.info. Accessed 29 พฤศจิกายน 2567

[3] กรมควบคุมมลพิษ, กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม (2566). แผนปฏิบัติการด้านการจัดการขยะพลาสติก ระยะที่ 2 (พ.ศ.2566-2570). Available at: https://www.pcd.go.th. Accessed 25 พฤศจิกายน 2567

[4] The Standard (18 สิงหาคม 2566). โอกาสใหม่เมืองเกษตรกรรม! ไทยขึ้นแท่นฮับไบโอพลาสติก หลัง ‘Braskem’ และบริษัทระดับโลกแห่ตั้งโรงงานที่ จ.ระยอง. Available at: http://www.Thestandard.co. Accessed 10 พฤศจิกายน 2567

[5] กรมควบคุมมลพิษ, กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม (2566). แผนปฏิบัติการด้านการจัดการขยะพลาสติก ระยะที่ 2 (พ.ศ.2566-2570). Available at: https://www.pcd.go.th. Accessed 25 พฤศจิกายน 2567

[6] มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าพระนครเหนือ (2561). บทที่ 4 รายละเอียดข้อมูลพลาสติกชีวภาพประเภทพอลิแลคติคแอซิด (Poly(Lactic Acid)).โครงการเพิ่มศักยภาพฐานข้อมูลอุตสาหกรรมฐานชีวภาพ. Available at: http://asp.plastics.or.th. Accessed 10 พฤศจิกายน 2567

[7] ผศ.ดร.ศุภกิจ สุทธิเรืองวงศ์ (ม.ป.ป.). จากเปราะสู่เหนียว Toughed to Super Toughed PLA. Available at: https://www.researchgate.net. Accessed 30 ตุลาคม 2567

[8] European Bioplastics (2023). Bioplastics Market Development Update 2023. Available at: https://www.european-bioplastics.org. Accessed 10 ตุลาคม 2567

[9] Renewable Matter (23 มกราคม 2567). The “Sustainable” Bioplastic that Pollutes Bangkok’s Air. Available at: https://www.renewablematter.eu. Accessed 15 ตุลาคม 2567

[10] มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าพระนครเหนือ (2561). บทที่ 8 รายละเอียดข้อมูลพลาสติกชีวภาพประเภทพอลิบิวทิลีนซัคซิเนต (Polybutylene succinate). Available at: http://asp.plastics.or.th. Accessed 15 ตุลาคม 2567

[11] บริษัท ซีพี ออลล์ จำกัด (มหาชน) (2566). การจัดการบรรจุภัณฑ์ที่ยั่งยืน.ผลการดำเนินงานที่สำคัญปี 2566. Available at: https://www.cpall.co.th. Accessed 30 ตุลาคม 2567

[12] The Standard Team (8 ตุลาคม 2561). ‘แก้วของคุณ เพื่อโลกของเรา’ ภารกิจสีเขียวจากอินทนิลที่ตั้งใจกู้โลกด้วยแก้วไบโอพลาสติก 100% และฝาใหม่ ไม่หลอด ย้ำภาพ Eco Brand อันดับหนึ่งของไทย. Available at: https://thestandard.co. Accessed 22 ตุลาคม 2567

[13] แอดวานซ์ไบโอ (ม.ป.ป.). ทำไมพลาสติกถึงย่อยสลายได้ อะไรคือ BIOMat.?. Available at: https://www.advancebio11.com. Accessed 9 พฤศจิกายน 2567

[14] Marketing Oops!. (19 มกราคม 2562). “มิตรผล” ตอบรับกระแส รักษ์โลก กับบรรจุภัณฑ์น้ำตาลย่อยสลายได้ตามธรรมชาติ! (Online). Available at: https://www.marketingoops.com. Accessed 24 ตุลาคม 2567

[15] Positioning Mag (8 กรกฎาคม 2562). Cafe Amazon โกกรีน ลดขยะพลาสติก “แก้ว-หลอด” เปิดร้านใหม่-รีโนเวต 2,600 สาขาใช้เฟอร์นิเจอร์รีไซเคิล. Available at: https://positioningmag.com. Accessed 24 ตุลาคม 2567

BIBLIOGRAPHY

[16] วัตสัน (ม.ป.ป.). วัตสัน คลีนซิ่ง ไวพ์ ไฮจีนิค 10 แผ่น x 3 แพ็ค (Online). Available at: https://www.watsons.co.th. Accessed 24 ตุลาคม 2567

[17] แอดวานซ์ไบโอ (ม.ป.ป.). ถุงหูหิ้วรักษ์โลก 100% ย่อยสลายได้. Available at: https://www.advancebio11.com. Accessed 24 ตุลาคม 2567

[18] Marketing Oops!. (19 มกราคม 2562). op. cit.

[19] แอดวานซ์ไบโอ (ม.ป.ป.). ถุงหูหิ้วรักษ์โลก 100% ย่อยสลายได้. Available at: https://www.advancebio11.com. Accessed 24 ตุลาคม 2567

[20] Marketing Oops!. (19 มกราคม 2562). op. cit.

[21] The World Bank Group (2564). Market Study for Thailand: Plastic Circularity Opportunities and Barriers. Available at: https://documents1.worldbank.org. Accessed 30 ตุลาคม 2567

[22] Royal Society of Chemistry (ม.ป.ป.). Compostable and biodegradable plastics. Available at: https://www.rsc.org. Accessed 30 ตุลาคม 2567

[23] Renewable Matter (23 มกราคม 2567). The “Sustainable” Bioplastic that Pollutes Bangkok’s Air. Available at: https://www.renewablematter.eu. Accessed 15 ตุลาคม 2567

[24] The Biodegradable Plastics Association (ม.ป.ป.). What Other Types of Biodegradable Plastics Exist?. Available at: https://www.biodeg.org. Accessed 8 ตุลาคม 2567

[25] Vroman, I., & Tighzert, L. (2009). Biodegradable Polymers. Materials, 2(2), 307-344.

[26] Greenpeace East Asia (29 พฤศจิกายน 2567). First Evidence in Hong Kong Found Microplastics in Feces of Wild Mammals; Scholar Urges Upstream Reduction for Plastic Pollution. Available at: https://www.greenpeace.org. Accessed 10 ธันวาคม 2567

[27] Greenpeace East Asia (24 สิงหาคม 2566). Microplastics Found in Feces and Natural Habitat of Taiwan’s Protected Species. Available at: https://www.greenpeace.org. Accessed 10 ธันวาคม 2567

[28] Jia, M. Z. (2020). Biodegradable Plastics: Breaking Down the Facts. Greenpeace Southeast Asia. Available at: https://www.greenpeace.org/static/planet4-eastasia-stateless/84075f56-biodegradable-plastics-report.pdf

[29] BIO-TEC ENVIRONMENTAL(8 กันยายน 2567). Blending Biodegradable Additives with Traditional Plastics: Extending Usability While Reducing Waste. Available at: https://goecopure.com. Accessed 13 ธันวาคม 2567

[30] Returnity(ม.ป.ป.). Reusable Shipping and Delivery Packaging Systems for Forward-thinking Brands and Retailers. Available at: https://www.returnity.co. Accessed 10 ธันวาคม 2567

[31] Repack(ม.ป.ป.). Packaging for the Circular Era. Available at: https://www.repack.com. Accessed 10 ธันวาคม 2567

The researchers are preparing product samples to test the decomposition of bioplastics in seawater.

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