Stop Global Warming with Bioplastiscs

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Today, the phrase "stop global warming" which refers to the environmental conservation by reducing the emission of greenhouse gas (GHG) and "go green" which refers to conservation of the world's natural resources through sustainable consumption. In doing so, the international 3R's rule must be followed: Reduce (use raw material as little as possible), Reuse (use the product again and again) and Recycle (convert used materials into new product).

In logistics and supply chain management, the words "green logistics" and "green packaging" are also used. Big corporations that focus on their images, in particular, will have such a policy to show their social and environmental responsibilities. For example, Walmart has a campaign on packaging made of compostable bioplastics.

Therefore, designing or preparing packaging to suit the global situation and trend cannot be overlooked, and there should be a good understanding of bioplastic products, which come in different types, including the compostable and the non-compostable ones, in order to compete in the world stage.

History of Bioplastic Development for Plastic Waste Disposal

In the past 15 years, many western countries have attempted to produce degradable plastics that are made from petroleum by mixing in corn starch. But there were many problems with such method, so it was suspended. Instead of helping to reduce waste, it created difficulties in managing small plastic debris that cannot be degraded at the same time as the corn starch.

Since then there has been an attempt to find a new method that can break down all components by using additives to expedite the degradation process of the microorganism. The degradation of the plastics that are mixed with an additive relies on the sunlight; however, the degrading process is still

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not entirely effective because it solely depends on the sunlight. If the waste materials are buried underground, it will not decay. Such method is known as "photodegradation," which is suitable for developing countries that use solid waste disposal by landfill. It's done by leaving the waste on the ground; therefore, plastic waste that is on the outside of the pile will disintegrate. And it may look as if it has degraded completely while it's actually still not being decomposed.If those remainders are consumed by human or animals and there's an excessive amount of toxins left in their bodies, it could be harmful.

Since then, there has been continuous development to improve the method so that it doesn't rely on the sun. In this method, additives with heavy metal are used to speed up the process under a high temperature and with enough oxygen or "oxodegradation," in which plastics can break down and eventually completely disintegrated by microorganism; the process is called "biodegradation." However, the method is still far from perfect because there are still traces of toxins that are harmful to living things.

At present, there is an advance method in which heavy metals are not used as an additive to speed up the chemical reactions. Figure 1 shows a comparison of the degradation process for conventional plastics and those mixed with additives.

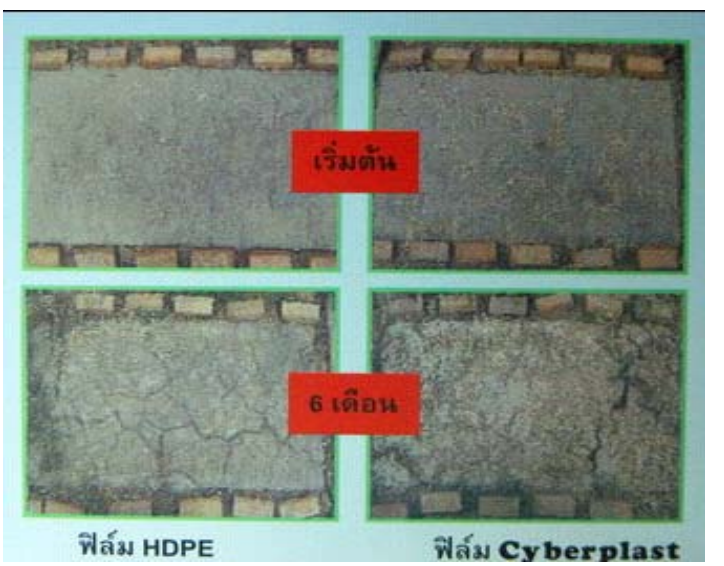


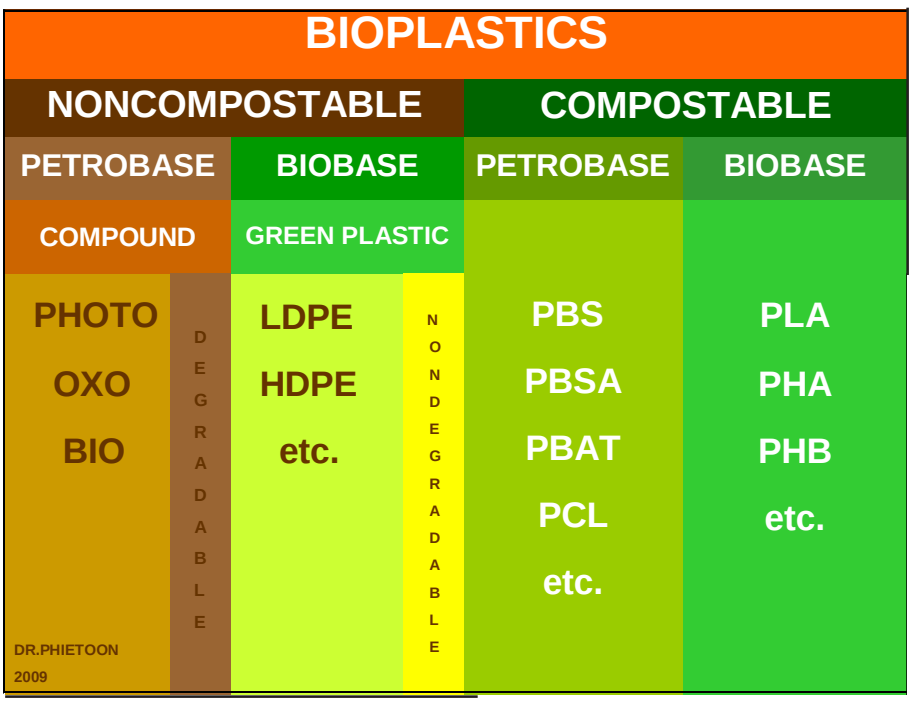
Figure 1 Degradation of HDPE film strip that has no additives and Cyberplast film strip with biodegradable additives.

However, there is still being a problem. If the remaining components are consumed before they are completely degraded, they can be harmful to living things. Thus, for safety, the method in which waste materials are buried and sealed tightly is introduced to make sure that there's no harmful residue left in the environment. This method is allowed to use and is suitable for large countries with huge size of land such as the United States, Canada, Australia, and China; however, it doesn't help reduce global warming effects because GHG comprised of carbon dioxide (CO_2) and methane (CH_4) etc. are still emitted to the atmosphere.

Having been developed Bioplastics

There are two main types of bioplastics: non compostable and compostable. Both types can be divided further into petrobased and biobased plastics, depending on the raw materials used, as shown in Table 1.

Table 1 Classification of Bioplatics



The petrochemical-based plastic is conventional plastics or "compound plastic" that is mixed with additives to enable the breakdown for degradation. The process is known as "biodegradation". However, this process still has flaws and can be harmful to the environment as described above.

The other type is made from plants and cannot become compost because it is not compostable. It is as durable as other types of conventional plastics and is also called "green plastic." It is environmental-friendly and has carbon credit value, which is in demand for future market.

Table 1 shows that compostable plastics are also classified into petro-based and bio-based plastics that are compostable. The petro-based plastic is made from upstream materials derived from petroleum by producing bio polymers PBS PBSA PBAT PCL, and there have been efforts in producing those from plants in the future. For thebio-based plastics that are made from plants with starch or glucose as upstream materials such as corn starch, potato starch, cane sugar, etc, and can produce compostable polymers such as PLA PHA PHB.

Therefore, these bioplastics have carbon credit value and can later become compost, which is used for planting. And plants use carbon dioxide generated from the compost in the photosynthesis process, which converts carbon dioxide into oxygen and releases it back to the atmosphere. Figure 2 shows an example of the compostable biopolymer compound names of an EcoAbsolute film strip during a period in which the bio plastic becomes compost.

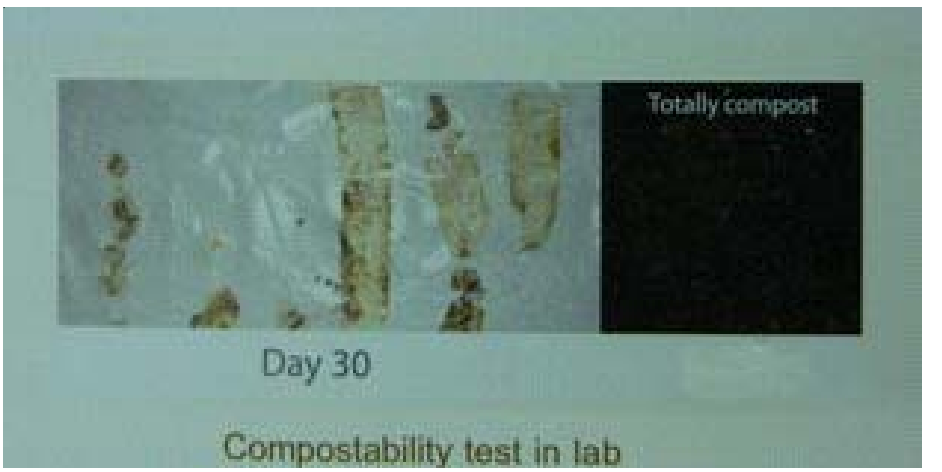
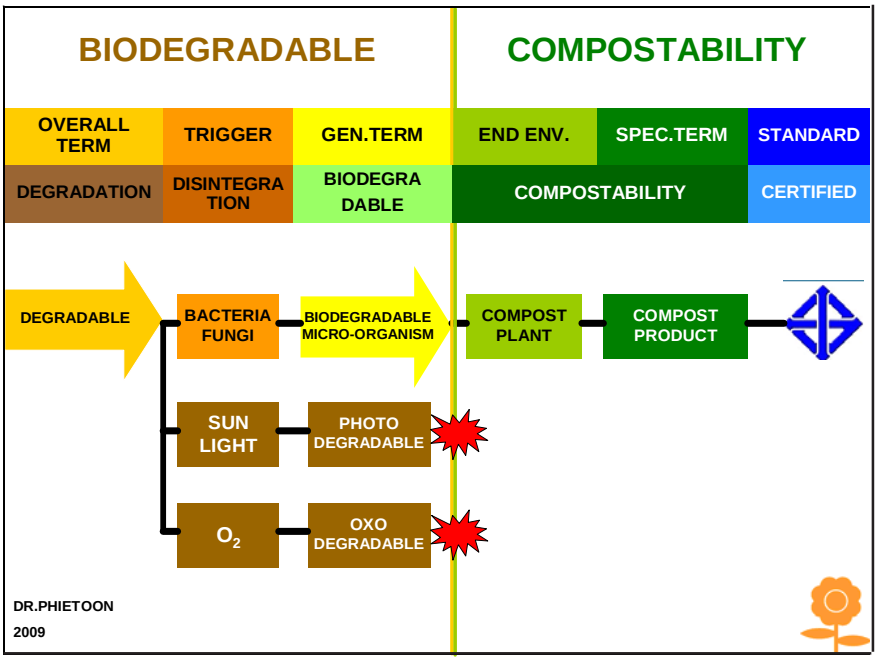


Figure 2 Biodegradation process of EcoAbsolute film strip until the completion of composting process

Not only does the data above offer a good understanding of the classification of bioplastics, it also helps to understand the differences of the biodegradation process and the compostability process more clearly, as summarized in Table 2.

Table 2 Comparison of the Biodegradation and Compostability



The data in Table 2 can be summarized as follows: "The compostable plastics undergo the biodegradation process first, then completed at the composting process."Plastics that are made by using additives to speed up the break-down process will end at this point and cannot decompose further because they are non-composable." In other words, plastics that are biodegradable do not need to be compostable but those that are compostable must be biodegradable.

Bioplastic Standard

At this point, the difference between the terms bioplastics, compostable bioplastics, and biodegradable plastics should be clear already.

These bioplastics have an impact on nature and the environmental balance. In order to manage and eliminate plastic waste efficiently and resourcefully, it is important to have a good understand of the meaning and the standard of practice.

Therefore, a standard for compostable plastics has been established, on a global level, because it is a flawless innovation and the answer to environmental conservation as well as it will not emit GHG excess to the atmosphere. It is called "Standard Specification for Compostable Plastics," which is adopted by organizations in Europe, the United States, Japan, Australia, etc. and is being developed to become a global standard or ISO 17088 in the future. In Thailand, an ISO-based standard is adopted and will soon be implemented to show the country's ability in meeting the world standard as the total value of the country's exporting goods is higher than 65 percent of the GDP.

Recommendations for Suitable Plastic Waste Management

One of the big environmental issues nowadays is "waste". Domestic waste has increased rapidly, at about one kilogram-per-person-per-day rate. And there is more than 30% of plastic waste in the landfill, of which 60% is contaminated with wet garbage. Therefore, it is almost impossible to separate waste efficiently by using the old method as it is hard to clean plastic waste from the oilly from food scrap for recycling to make profitable, quality and safe resin.

The perfection of compostable plastic disposal process enables us to use a new method to manage "waste," as shown in Figure 3

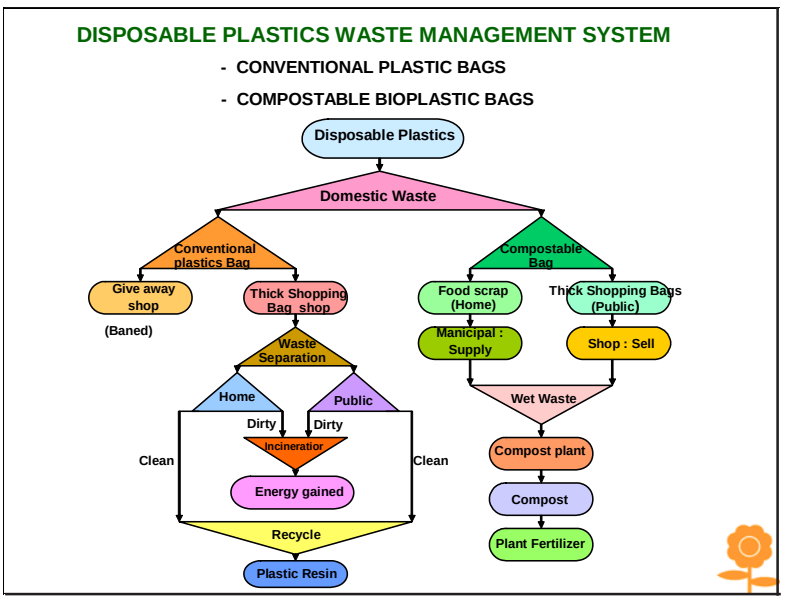


Figure 3 Flow chart of Disposable Plastic Packaging Management

Figure 3 shows domestic waste collection including wastes from homes, shops, schools, hospitals, etc.

1. Use compostable bioplastic bags for wet garbage and have it collected 2–3 times a week. The bag should be placed outside of the house to keep off unpleasant smell and to make it easier for the collector to separate and transport it to a composting plant, which uses aerated systems.

2. Use regular plastic bags that are recyclable for other types of dry garbage: one for paper/plastics; one for cans/bottles; and the other for hazardous wastes (if available);

Those bags do not have to be outside the house. The collector will pick them up every 10–15 days and take them to the recycling site.

The waste management systems discussed above need to be promoted to the public through all types of media to create a good understanding. At the beginning, a big budget may be needed to achieve the goal until the practice has been adopted and followed appropriately. Separating garbage will result in quality recycle product of high value economically and environmentally.

If compostable bioplastics can be used without flaws in the future, waste management will become more efficient as a result. And if disposable food packaging is more widely used, they should only made from compostable bioplastics, sothat the regular plastic garbage will not be contaminated with oil from food any more and can be recycled afterward.

Marketing Limitations and Obstacles

Limitations in marketing compostable plastic include:

1. It is an innovative product that has not yet been used widely.

2. Its price is three times as high as a regular plastic, but if there is more demand price should be lower.

3. There is still a small supply in the market because it is an emerging market, and consumers do not have enough knowledge or good understanding about it.

The marketing trend today should not only focus on quality and design but also corporate social and environment responsibility (CSER); compostable bioplastic products will serve such purpose perfectly. Developed countries that give high importance to compostable bioresins include the European Union nations and Japan. For the United States and Australia, biodegradable plastics are still being used because they are large countries and can still use solid waste disposal by sealed landfill. Therefore, additives for oxobiodegradation are still allowed as long as there are no heavy metal and the bury site is securely closed.

Thailand is a biomass resource country that produces a lot of agricultural products. More than 50% of the garbage in landfill is wet garbage; therefore, it is suitable for waste separation method discussed earlier by using compostable bioplastic bags, especially for food packaging.

Encouraging more bioplastic productions from cassava will benefit farmers economically. When being a surplus, also the price will not be affected. It seems freezing potatoes by converting them into polymers for exporting. In the future, it is predicted that there will be more demand of cassava because there is still a big market for them. The overall production of bioplastics in global market is only 1: 1,000 of regular plastics.

Summary of Economical, Social and Environmental Benefits

Compostable bioplastic has several benefits for many sectors as follows:

1. Enables efficient domestic waste management and recycle products of good value.

2. If waste separation is practised, the environment will be better because the bad smell from the landfill / open dump will be eliminated.

3. Helps reduce global warming effects by not producing excessive GHG to the atmostphere.

4. Helps cassava farmers economically with more stable price.

5. Increases exporting value because there is still demand in the world market to increase trade balance.

6. Thailand is abundant with biomass resources; therefore, it should position as a bioplastic production hub for Asia and attract investors to increase economic value

7. In the future, the value of carbon credit produced from bioplastics will increase, and Thailand will greatly benefit from it.

Need to Know 1

There are biobased and petrobased bioplastics. They resemble polymer like regular plastics and can be melt and manufactured using the same extraction machine used for the regular plastics that might require some small modifications as needed.

There are two types of bioplastics : compostable bioplastics and non-compostable bioplastics.

- Compostable bioplastics means plastics that are made from plants or petroleum that can be converted into many products like regular plastics. But the most important feature is to be compostable through the process of biodegradation, in which carbon dioxide and compost are given back to the soil that plants can be used in photosynthesis and growth processes respectively. They

are therefore certified this products under worldwide standard.

- Non-compostable bioplastics are only made from plants, which is a renewable substituting resource. They have the same durability as the regular conventional plastics but cannot compostable into biomass/compost. They are called "green plastics," which have a lot of benefits because they help conserve oil resources, and a small amount of carbon dioxide released less in the production process than that of the conventional plastics. Because the fermentation process does not require a lot of energy, it is also made from plants, so it is renewable be reused and can help to reduce carbon emissions or what's known "carbon credit."

Need to Know 2

Oxobiodegradable or biodegradable (some time) plastics are made by adding additives in conventional plastics to break polymer structure down into small fragments that can damaged by microorganism. However, they end up leaving some residues that is not compostable and are not certified by any worldwide standard since on the other hand, plants that grow with compostable bioplastics should be able to grow as well as those grown in natural soil.