INTRODUCTION

Biodegradable plastics or Bioplastics are the types of plastics that are made from biomass. The raw materials used in making bioplastics are different from the ones used to make general plastics. A few examples, Sugarcanes and corn. Including these, bio-wastes are also used to make new products.

Now, the first question we have to ask is, why? Why are these types of plastics necessary?

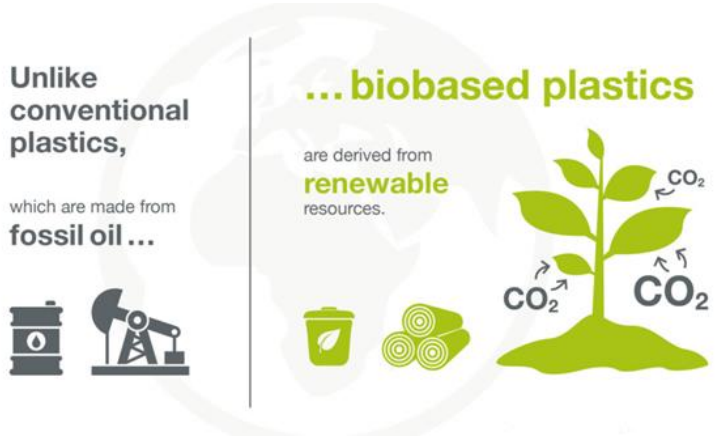
The answer being, that general plastics cause a lot of the pollution currently prevalent on earth and its usage is only growing. Without a better alternative, pollution will keep increasing and end up destroying the earth as we know it.

So, naturally the best possible option would be to find something that performs exactly the same task but does not pollute the environment. Presenting, Bioplastics. They are capable of being decomposed by microorganisms into water, carbon dioxide and other by-products.

TYPES OF BIODEGRADABLE PLASTICS:

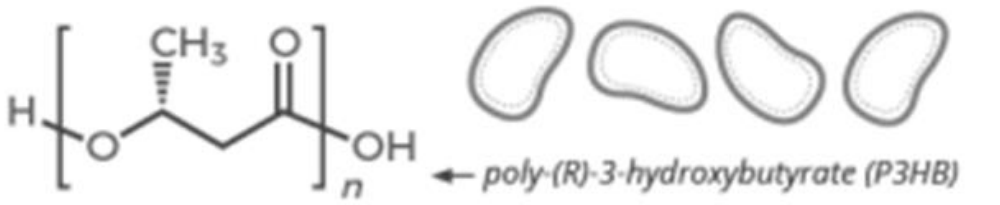
1) Bio-based plastics:

Biologically synthesized plastics are plastics produced from natural origins, such as plants, animals, or micro-organisms. Not all are biodegradable.



2) Polyhydroxyalkanoates (PHAs):

Polyhydroxyalkanoates are a class of biodegradable plastic naturally produced by various micro-organisms. Specific types of PHAs include poly-3-hydroxybutyrate (PHB), polyhydroxyvalerate (PHV) and polyhydroxyhexanoate (PHH). The biosynthesis of PHA is usually driven by depriving organisms of certain nutrients and supplying an excess of carbon sources. PHA granules are then recovered by rupturing the micro-organisms.



Extracted from bacteria, which produce it via the fermentation of sugar or lipids.

3) Polylactic acid (PLA):

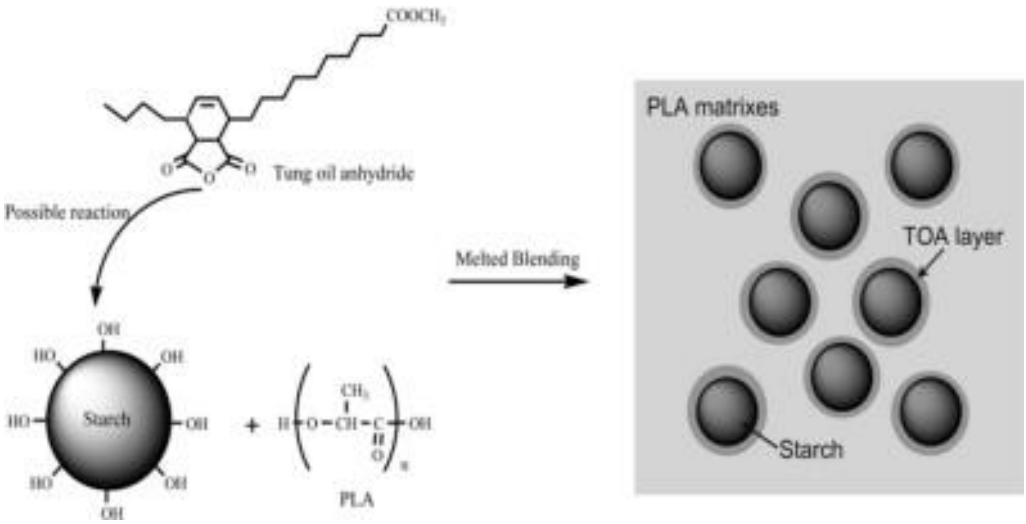
Polylactic acid is thermoplastic aliphatic polyester synthesized from renewable biomass, typically from fermented plant starch such as from corn, cassava, sugarcane or sugar beet pulp. In 2010, PLA had the second-highest consumption volume of any bioplastic of the world. But it does not biodegrade outside of artificial composting conditions .

4) Starch blends:

Starch blends are thermoplastic polymers produced by blending starch with plasticizers. Because starch polymers on their own are brittle at room temperature, plasticizers are added in a process called starch gelatinization to augment its crystallization. While all starches are biodegradable, not all plasticizers are. Thus, the biodegradability of the plasticizer determines the biodegradability of the starch blend.

Biodegradable starch blends include starch/polylactic acid, starch/polycaprolactone, and starch/polybutylene-adipate-co-terephthalate.

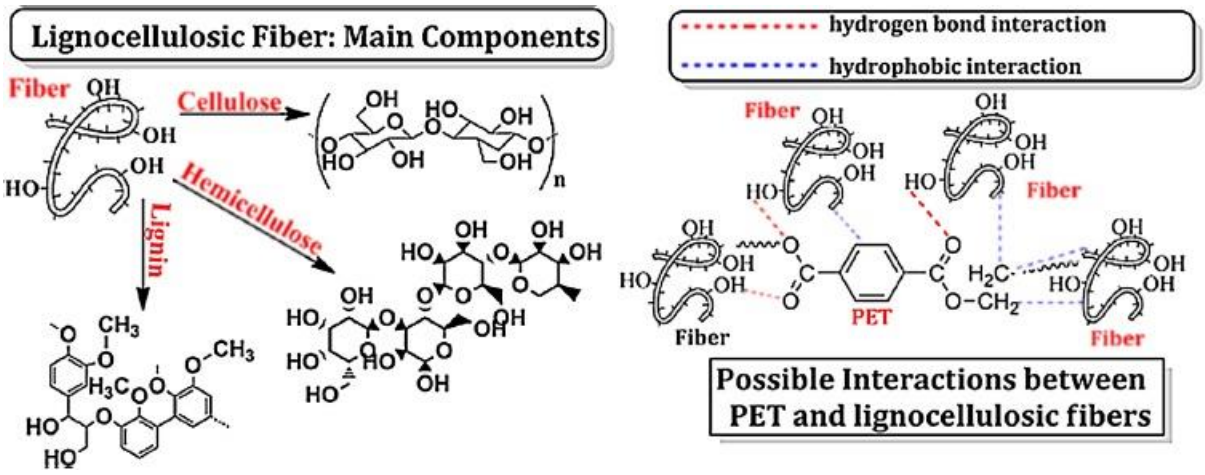
Others blends such as starch/polyolefin are not biodegradable.



5) Lignin-based polymer composites:

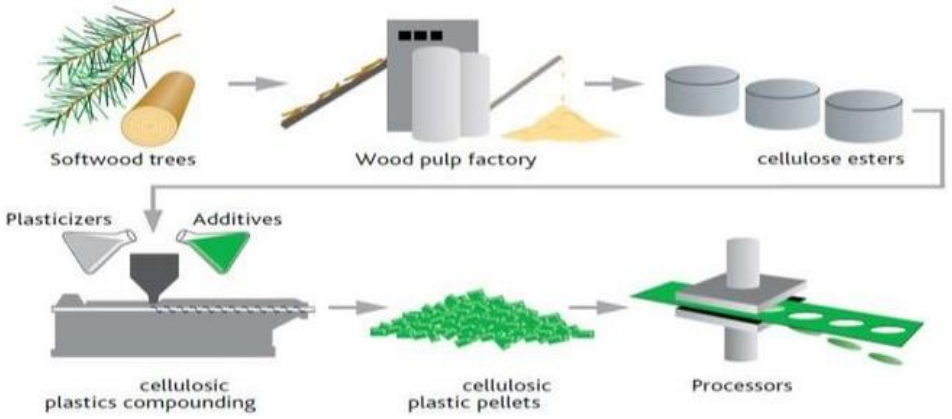
Lignin-based polymer composites are bio-renewable natural aromatic polymers with biodegradable properties. Lignin is found as a byproduct of polysaccharide extraction from plant material through the production of paper, ethanol, and more. Lignin is useful due to its low weight material and the fact that it is more environmentally friendly than other alternatives. Lignin is neutral to CO_2 release during the biodegradation process. Other biodegradable plastic processes such as polyethylene terephthalate (PET) have been found to release CO_2 and water as waste products produced by the degrading microorganisms.

Lignin contains comparable chemical properties in comparison to current plastic chemicals, which includes reactive functional groups, the ability to form into films, high carbon percentage, and it shows versatility in relation to various chemical mixtures used with plastics. Lignin is also stable, and contains aromatic rings. It is both elastic and viscous yet flows smoothly in the liquid phase. Most importantly lignin can improve on the current standards of plastics because it is antimicrobial in nature. It is being produced at such great quantities and is readily available for use as an emerging environmentally friendly polymer.



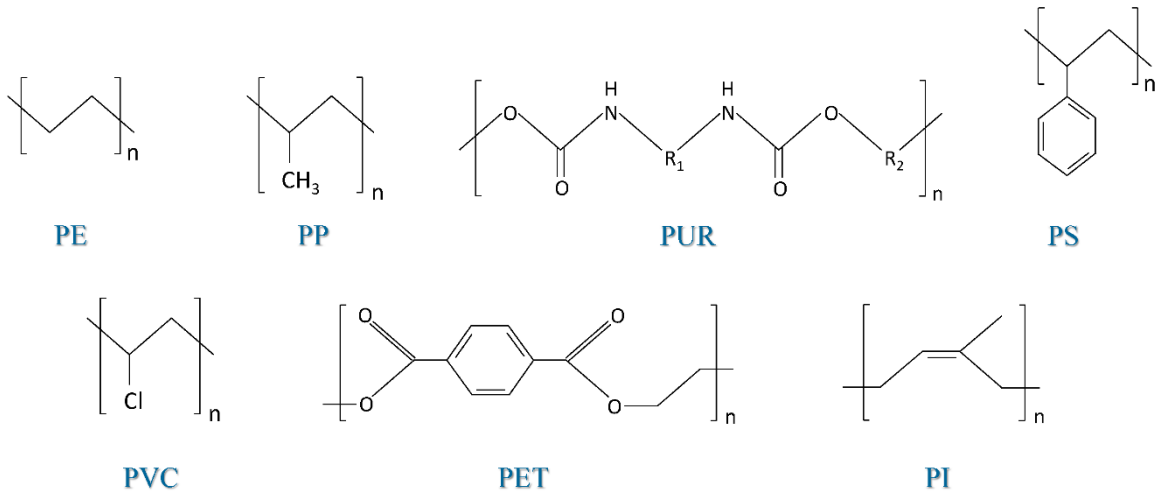
6) Cellulose-based plastics:

Cellulose bioplastics are mainly the cellulose esters, (including cellulose acetate and nitrocellulose) and their derivatives, including celluloid. Cellulose can become thermoplastic when extensively modified. An example of this is cellulose acetate, which is expensive and therefore rarely used for packaging.



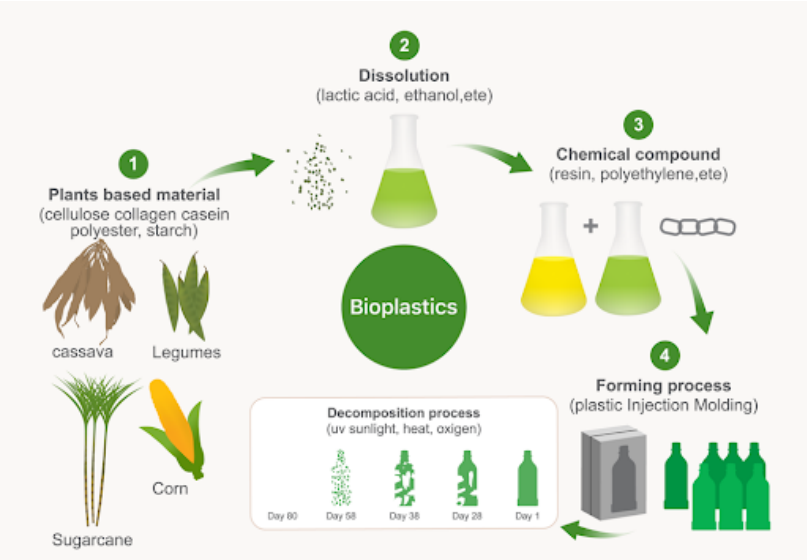
7) Petroleum-based plastics

Petroleum-based plastics are derived from petrochemicals, which are obtained from fossil crude oil, coal or natural gas. The most widely used petroleum-based plastics such as polyethylene terephthalate (PET), polyethylene (PE), polypropylene (PP), and polystyrene (PS) are not biodegradable. However, the following petroleum-based plastics listed are:



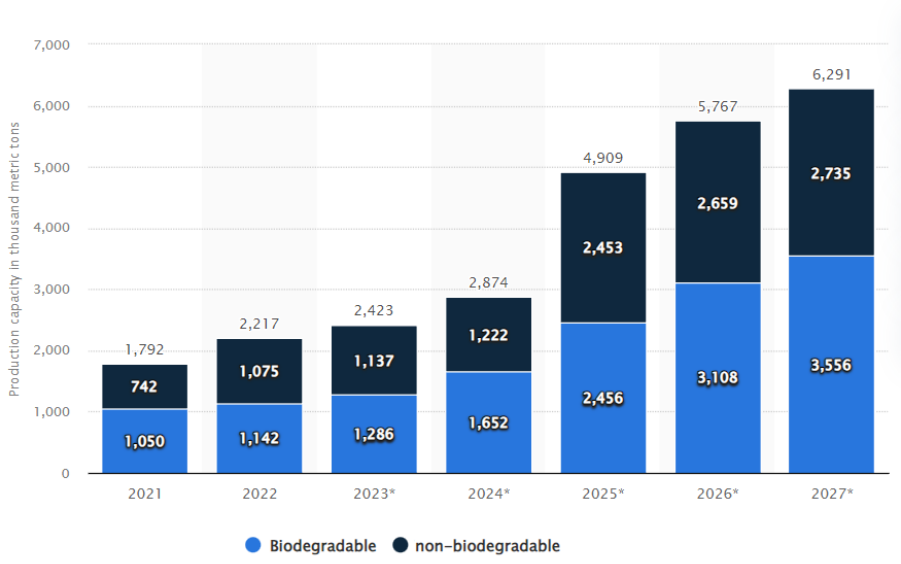
PRODUCTION OF BIO-DEGRADABLE PLASTICS:

The process of production of bio-degradable plastics is like that of general plastics, the difference being the raw materials.



The process of production starts with harvesting the necessary raw materials, which includes, sugarcanes, corn, legumes and other forms of bio-waste. These raw materials are subjected to pre-treatment where they undergo conditions of heat and anaerobic digestion to obtain cellulose and starch. These compounds are then subjected to dissolution where they are dissolved in a particular solvent until the solution is saturated. The solutions are then subjected to a series of processes under optimum pressures and temperatures to obtain a chemical compound which is the substance that is put into the desired mold. The obtained product is allowed to cool down, giving us the final product, which after usage can be disposed. After disposal, these products undergo the same process mentioned above but this time as biowaste. This way, bioplastics are recyclable.

PRODUCTION STATS



APPLICATIONS OF BIODEGRADABLE PLASTICS:

- Take-away containers
- Dust-bin covers
- Goods packaging
- Agriculture
- Drugs and Medicines

ADVANTAGES OF BIODEGRADABLE PLASTICS

1.Reduction in Carbon Emission:

The formation of traditional plastic involves the use of carbon in an excessive amount. This carbon is released into the atmosphere when the used plastic begins to decompose or melt. There are positives that methane and other pollutants could also be released when traditional plastic is recycled or burned.

In contrast, biodegradable plastics do not release carbon, as no carbon is used in its manufacturing process. Biodegradable plastics are broken down by naturally occurring bacteria and since these plastics are plant-based, a minimal amount of carbon is released during the composting process.

2. Lesser Energy Consumption:

The manufacturing of biodegradable plastics requires less energy than the production of traditional plastics, which requires much more energy. In comparison to the production of plastic from raw petroleum, biodegradable plastic of the same quantity and quality requires 65% less energy. We become less dependent on petroleum as we get it from products like switchgrass or corn, and at the same time, the use of petroleum can be restricted to other purposes like transport and heating.

3. Less Landfill Area Needed:

Plastics that are non-biodegradable are brought to landfills to discard them. Consequently, land area that could have been used for agriculture, residence or industrial applications is instead converted to landfills. If bioplastics are used, there is no need to add more landfills since these plastics can be absorbed by the soil and be converted to compost or humus.

4. Recyclable:

Because biodegradable plastics can undergo decomposition, they are returned to the environment and the **ecosystem** at a faster rate than other types of plastics.

This can be viewed as a natural form of recycling, since it involves the breakdown and conversion of the plastic into simpler compounds which may then be reabsorbed as nutrients by the soil, or as gases by the atmosphere. Natural recycling is an eco-friendly process because it is usually the result of activities of naturally occurring microorganisms like bacteria and fungi.

DISADVANTAGES OF BIODEGRADABLE PLASTICS:

1.Higher Capital Cost:

Generally, the cost of purchasing equipment for the manufacture and recycling of biodegradable plastics, is higher than that of traditional plastics.The reason for this lies in the fact that biodegradable plastics are still in their development stage, and have not proliferated in terms of the availability of products, methods and technologies. Estimates suggest up to 50% more cost of manufacturing biodegradable plastics.

2. Need for Composters:

The flipside of using biodegradable plastics is that there will be a need for industrial composters to turn them into composts and availability of the equipment in some countries can be a problem. Apart from the cost, not all countries have the proper equipment, especially if this is not the priority of the government. In the end, the bioplastics that need to be processed will not be discarded properly.

3. Risk of Contamination:

Biodegradable plastics should not be mixed with non-biodegradable plastics when thrown in garbage bins. The problem here is that not all people know how to segregate or distinguish bioplastics from other plastic types. Once these two types of plastics are mixed together, these bioplastics become contaminated and cannot be used anymore. Consequently, these contaminated bioplastics will end in landfills and add to the volume of thrash.

4.Biodegradable plastics may produce methane in landfills:

Our primary concern with greenhouse gas emissions is with carbon dioxide, but we must also consider the amount of methane that we release each year. The reflecting effect of this gas is significantly higher than what CO2 causes. Because some biodegradable plastics produce methane when decomposing in landfills, it is possible that some of these natural plastic items could be creating

a more harmful effect on the environment than if we stuck to the traditional manufacturing cycle.

CONCLUSION:

Biodegradable plastics provide a pathway towards a more sustainable future. They are a promising alternative to traditional plastics due to their potential to reduce environmental pollution and waste accumulation. They are designed to break down naturally through biological processes into harmless substances, such as water, carbon dioxide, and biomass, under specific conditions.

The use of biodegradable plastics can help mitigate the negative impact of plastic waste on ecosystems, particularly in marine environments. Traditional plastics can persist for hundreds of years, causing significant harm to marine life and ecosystems. Biodegradable plastics, on the other hand, have the ability to degrade within a relatively shorter time frame, reducing the risk of long-term environmental damage.

THANK YOU