Bio plastic production through food waste.

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Introduction

Bioplastics are polymers made from renewable biomass sources such vegetable fats and oils, maize starch, straw, woodchips, sawdust, and recovered food waste, among others. Some bioplastics are made from natural biopolymers such as polysaccharides (e.g. starch, cellulose, chitosan, and alginate) and proteins (e.g. soy protein, gluten, and gelatin), while others are made chemically from sugar derivatives (e.g. lactic acid) and lipids (oils and fats) from plants and animals, or biologically from sugar or lipid fermentation. On the other hand, common plastics like fossil-fuel plastics (also known as petro-based polymers) are manufactured from petroleum or natural gas [1].

Many bioplastics have the benefit of being biodegradable. Not all bioplastics are biodegradable, and some bioplastics decompose more slowly than petroleum-based polymers.

Types

Starch-based plastics

Thermoplastic starch is the most widely used bioplastic, accounting for over half of the bioplastics market. A simple starch bioplastic film may be made at home using gelatinizing starch and solution casting. Pure starch can absorb moisture, making it an appropriate material for producing medication capsules in the pharmaceutical business. Bioplastic made entirely of starch, on the other hand, is brittle. Plasticizers such as glycerol, glycol, and sorbitol can be added to starch to enable thermoplastic treatment. The properties of the resulting bioplastic (also known as "thermoplastic starch") may be tailored to specific purposes by changing the amounts of these elements. Traditional polymer processing methods include extrusion, injection moulding, compression moulding, and solution casting [2].

Starch-based bioplastics are typically blended with biodegradable polyesters to make starch/polylactic acid, starch/polycaprolactone] or starch/Ecoflex (polybutylene adipate-co-terephthalate manufactured by BASF) blends. These mixtures are biodegradable and utilised in industrial applications. Roquette, for example, has created its own starch/polyolefin combination. Although these mixes are not biodegradable, they have a smaller carbon footprint than petroleum-based polymers for similar uses.

Starch is a low-cost, plentiful, and renewable resource. Starch-based films (primarily used for packaging) are biodegradable and compostable goods manufactured from starch combined with thermoplastic polyesters. These films are commonly found in consumer products packaging, such as magazine wrappers and bubble wrap. These films are commonly used in food packaging as bakery or fruit and vegetable bags. These films are used in composting bags. In the collection of organic waste on a selected basis Starch-based films can also be used as paper. Starch-based nanocomposites have been extensively investigated, with increased mechanical, thermal, moisture resistance, and gas barrier characteristics [3].

Cellulose-based plastics

The cellulose esters (such as cellulose acetate and nitrocellulose) and their derivatives, such as celluloid, are the most common cellulose bioplastics. When cellulose is heavily changed, it can become thermoplastic. For example, cellulose acetate is a costly material that is seldom used for packaging. Due to their lower hydrophilicity than starch, cellulosic fibres added to starches can increase mechanical characteristics, gas permeability, and water resistance [4].

Using a technique known as hot pressing, a group from Shanghai University was able to create a new green plastic based on cellulose.

Other polysaccharide-based plastics

Other polysaccharides, such as chitosan and alginate, can be made into plastics as well. Chitosan is easily dissolved in moderate acidic conditions, making solution casting a simple operation. Chitosan has a great capacity to make films. Furthermore, chitosan can be thermo mechanically processed into a plasticized form using an internal batch mixer and compression moulder when mixed with a small amount of acid. Chitosan may be easily combined with plasticizers, nanoparticles, or other biopolymers due to its high viscosity after thermo mechanical processing [5].

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