Bioplastics and their Impact on Environment

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Opinion Article

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DESCRIPTION

Bioplastics include plastic materials made from renewable biomass sources such as vegetable fats and oils, corn starch, straw, woodchips, sawdust, recovered food waste, and so forth. Some bioplastics are manufactured directly from natural biopolymers such as polysaccharides (e.g. cellulose and chitosan) and proteins (e.g. soy protein, gelatine), while others are chemically synthesised from sugar derivatives (e.g. lactic acid) and lipids (oils and fats) derived from plants or animals, or biologically produced through sugar or lipid fermentation. Common plastics, on the other hand, are made from petroleum or natural gas, such as fossil-fuel plastics. One advantage of bioplastics is their lack of reliance on fossil fuel as a raw material, which is a limited and unevenly distributed resource tied to petroleum politics and environmental consequences. According to life cycle analysis studies, some bioplastics can be produced with a lower carbon footprint than their fossil counterparts, such as when biomass is used as a raw material as well as for energy production. Other bioplastics' processes, on the other hand, are less efficient and have a higher carbon footprint than fossil plastics.

The distinction between non-fossil-based plastic and fossil-based plastic is mostly irrelevant because resources such as petroleum are just fossilized biomass. As a result, whether a plastic is degradable or non-degradable (durable) is determined by its molecular structure, not by whether or not the raw material is fossilized. There are both durable bioplastics, such as Bio-PET or bio polyethylene (bio-based analogues of fossil-based polyethylene terephthalate and polyethylene), and degradable bioplastics, such as polylactic acid, polybutylene succinate, or polyhydroxyalkanoates.

To avoid plastic pollution, bioplastics must be recycled similarly to fossil-based plastics; "drop-in" bioplastics (such as bio polyethylene) fit into existing recycling systems. Although biodegradability may provide a destruction pathway in some applications, such as agricultural mulch, the idea of biodegradation is not as simple as many imagine. Because biodegradability is heavily dependent on the chemical Supporting structure of the polymer, and different bioplastics have diverse topologies, it cannot be expected that bioplastics in the environment will readily disintegrate. Biodegradable polymers, on the other hand, can be made from fossil fuels.

Environmental impact

Although bioplastics utilize less nonrenewable energy than conventional plastics and release less greenhouse gases, they can have severe environmental effects such as eutrophication and acidification. Bioplastics have a larger potential for eutrophication than ordinary plastics. Biomass production through industrial farming techniques causes nitrate and phosphate to filter into water bodies, resulting in eutrophication, the process by which a body of water becomes overly nutrient-rich. Eutrophication is a global danger to water resources because it creates destructive algal blooms, which create oxygen destruction zones and kill aquatic organisms. Bioplastics also contribute to acidification. The large increase in eutrophication and acidity generated by bioplastics is also caused by the use of chemical fertilizer in the cultivation of renewable raw materials to create bioplastics.

Bioplastics also have lower human and terrestrial ecotoxicity and carcinogenic potentials than traditional plastics. Bioplastics, on the other hand, are more harmful to aquatic ecosystems than conventional polymers. Bioplastics and other bio-based materials deplete stratospheric ozone more than conventional plastics because of nitrous oxide emissions during fertilizer application during industrial farming for biomass production. Artificial fertilizers increase nitrous oxide emissions, particularly when the crop does not require the whole amount of nitrogen. Toxicity from pesticides used on crops used to manufacture bioplastics is one of the minor environmental consequences of bioplastics. Bioplastics also contribute to CO_2 emissions from harvesting vehicles.

Other minor environmental implications include excessive water consumption for biomass production, soil erosion, soil carbon losses, and biodiversity loss, all of which are mostly caused by bioplastics-related land use. The use of land for bioplastics manufacturing results in lost carbon sequestration and raises carbon prices while diverting land from its current usage.

Although bioplastics are tremendously beneficial since they reduce non-renewable consumption and Green House Gases (GHG) emissions, they also negatively influence the environment through land and water consumption, pesticide and fertilizer use, eutrophication, and acidification; hence, one's preference for bioplastics versus conventional plastics depends on what one deems the most important environmental impact.

Another concern with bioplastics is that some of them are created from edible sections of plants. Because the crops that produce bioplastics can also be used to feed people, bioplastics compete with food production. These bioplastics are referred to as "first generation feedstock bioplastics." Non-food crops (cellulosic feedstock) or waste materials from first generation feedstock are used in 2nd generation feedstock bioplastics (e.g. waste vegetable oil). Algae is used as the feedstock in third generation feedstock bioplastics.