Ensuring bio-based plastics are truly sustainable

A new study has shed light on the sustainable credentials of bio-based plastics. It indicates that, as yet, no bio-based plastics are sustainable, owing to practices including pesticide use. However, this could change with further technological development.

Plastic is very useful, but there is increasing concern about its impact on the environment and human health. Two major sustainability concerns are: it relies on non-renewable resources, and it cannot degrade. Traditional plastics are manufactured using carbon from petroleum. Bio-based plastics are considered more sustainable because they use carbon from renewable resources, such as corn starch, soybean protein and cellulose. In some cases, they can be biodegradable.

The researchers assessed the existing evidence on the sustainability of bio-based plastics and conducted interviews with manufacturers of bio-based plastics that are commercially available or in development. Sustainability assessments were based on the materials' environmental, health and safety impacts throughout their life cycle.

The study considered possible sustainability impacts to be those that arise from using GMOs and hazardous pesticides to cultivate the feedstock (e.g. corn, soy), the use of hazardous chemicals during production and processing, the use of harmful additives or untested materials for which health effects are not well known, potential hazards in workplaces, as well as efficiency in the use of resources including water, energy and materials. The study was limited as much information about commercial materials is not publicly available.

Although in some aspects bio-based plastics are more sustainable than traditional plastics, the analysis identified several environmental and occupational health and safety hazards in their production. Some bio-based plastics are preferable from a health and safety perspective; these include polyhydroxyalkanoates (PHAs), poly-lactic acid (PLA) and starch. However, they also have some potential hazards, for example, production of PHA may expose workers to chemicals that are possibly carcinogenic, and PLA production uses a tin-based chemical that could have toxic effects on the hormonal system. Some bio-based plastics are preferable from an environmental perspective, such as starch, PHA and soy protein. However, all bio-based plastics require land for production, which may compete with land needed for food. In addition the feedstock for bio-based plastics may be genetically modified or grown using toxic pesticides, which can pollute the environment.

Research is currently underway to develop a second generation of bio-based plastics from sources that do not compete with food production, for example, agricultural by-products including corn straw and algae. In addition, processing bio-based feedstocks to produce plastics requires significant amounts of energy and water, but since the processes are in their infancy and on a small-scale, they may become more efficient as they develop.

The study lists a number of recommendations for improving the sustainability of bio-based plastics. In terms of feedstock production, it suggests using agricultural or industrial by-products and sustainable agriculture methods to grow crops for bio-based plastics. In terms of plastic production, it suggests using materials that generate useful by-products, avoiding using any engineered nanoparticles for which risks are not well understood or for which the human health and environmental effects are not well known at present, as well using renewable energy and recycling water. Alongside this, the study recommends better education of consumers to encourage the use of more sustainable plastics, as well as work with governments to put in place the infrastructure needed to successfully compost and/or recycle bio-based plastics.


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