

The multifaceted challenges of bioplastics



Bioplastics have yet to make an impact in addressing plastics pollution. Policy measures, innovation and public discourse are needed to address misconceptions, clarify labelling and ensure their effective end-of-life management.

As concerns over plastic waste and greenhouse gas emissions continue to mount, the development of bioplastics has emerged as a promising solution. Bioplastics can be either bio-based (that is, fully or partially made from biomass) or biodegradable or compostable (can be broken down into simpler elements or can be degraded only under specific composting conditions) or a combination thereof. The promises of bioplastics are manifold; by harnessing renewable feedstocks, they can reduce our reliance on finite fossil resources and lower the greenhouse gas emissions associated with plastics production. Moreover, biodegradation offers the tantalizing prospect of plastics that harmlessly decompose after use, mitigating the scourge of plastic pollution that afflicts our oceans and ecosystems. However, bioplastics currently account for only about 1% of the total global market share of plastics¹ – a sobering statistic for one of the most promising (technical) solutions to tackling plastics pollution.

Several issues need to be overcome to increase the global adoption of bioplastics; for example, the production of many bioplastics still relies heavily on food crops, such as corn, which raises concerns over potential competition with food supplies and effects on food security. Still, estimations suggest that only 1.5% of the total agricultural land would be needed for growing renewable feedstock even if bioplastics were to completely replace conventional plastics (as discussed by Koo and colleagues in this issue). Nonetheless, negative public perceptions require engagement in public discourse with awareness campaigns to educate consumers, dispel myths and foster a positive perception of bioplastics. Technological innovations in tapping into waste biomass, algae or bacterial sources could further help alleviate these concerns.

Realizing the full environmental benefits of bioplastics will further depend on effective management of their end of life². Facilities for industrial composting and anaerobic digestion must expand to handle the increasing volumes of biodegradable and compostable plastics. Notably,

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consumers need to know how to correctly dispose of bioplastics products. Excessive or misleading labels can be confusing or even deceptive for consumers and may encourage littering or cross-contamination of recycling streams. For example, if bioplastics are put into the same recycling bin as are traditional plastics made of polyethylene terephthalate (PET), the recycling of PET will be contaminated, as it relies on pure PET flakes, and this will ultimately defeat the purpose of working towards a circular plastics economy, despite good intentions.

The impact of policy measures on fostering the adoption of bioplastics is also undeniable; these include tax incentives, investment in research and development, bans on certain conventional plastics, and policies that increase costs of landfilling, incineration or export overseas. Last but not least, successful adoption hinges on continued innovation to improve the cost and performance of bioplastics³ to match the economics and properties of conventional plastics. Innovations in fermentation techniques, enzymatic processes, alternative chemical-recycling pathways and biotechnological approaches are contributing to the development of bioplastics with improved performance. Moreover, in this issue, Koo and colleagues discuss more-accessible and more-robust screening tools that could mitigate the long, laborious and expensive bioplastics certification and labelling process.

Therefore, for bioplastics to make a real impact on the transition to a more circular and sustainable plastics economy⁴, complex challenges spanning technology, policy, infrastructure and public awareness need to be addressed. Collaborative efforts from all stakeholders – industry, government and consumers – will be essential to truly unlock their potential as a game changer in addressing plastics pollution.

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