

# Bioplastics, biodegradable plastics, and other fake solutions



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**Abstract:** Plastics are at the center of the triple planetary crisis. Replacing this material with bioplastics or supposedly biodegradable alternatives has gained strength among the solutions presented. However, there is a widespread lack of knowledge about the meaning of these terms, which are printed on packaging, leading to mistaken purchasing decisions. Moreover, the malicious use of greenwashing, focused on exacerbating profits over sustainability, imposes obstacles to global initiatives. Therefore, in addition to actions aimed at reducing plastic consumption, the labeling of products that claim environmental benefits will need to be regulated. Such initiatives are essential to prevent the proliferation of fake solutions to the global plastics crisis.

The widespread leakage of plastic waste into natural environments is at the core of a contemporary planetary crisis that has its roots in the simultaneous global loss of biodiversity, climate change, and pollution. From this perspective, the international scientific community has warned of systemic environmental damage caused by the production, consumption, and disposal of synthetic polymers derived from petroleum – plastics – which are now ubiquitous, especially in marine and coastal systems (Viera et al., 2021). Although the environmental impacts caused by plastics are largely associated with the entanglement or accidental ingestion by marine macrofauna organisms, particles smaller than 5 mm, known as microplastics (MP), add an even more harmful component that also affects human health. MPs originate either from the fragmentation of larger polymeric utensils or from the disposal of small particles used in consumer products. They are easily transported and disseminated through the atmosphere, ocean currents, coastal flows, and river discharges. Consequently, MPs have been found in organs and tissues of animals, plants, and human beings in potential association with several harmful effects (Nunes et al., 2023).

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The extensive impacts resulting from the improper disposal of plastic waste have promoted a global debate. While international diplomacy is discussing a legally binding instrument focused on creating a

regulatory framework to reduce plastic pollution, some countries are trying to implement legislation to promote a circular economy, reduce production, and replace plastics with alternative materials. These initiatives are largely driven by an increase in the level of commitment among consumers – who, it is worth remembering, are also voters – to environmental sustainability. The industry is aware of these changes in behavior, and over the last decade it has been feeding the market with materials that claim to be of biological origin (bioplastics or green plastics), compostable, oxo-biodegradable, and/or biodegradable (Viera et al., 2020). However, the meaning of these terms is widely unknown and, as they are printed on packaging, they often mislead the purchasing decision of the consumer. In this regard, bioplastics are polymers made either entirely or partially from renewable materials of biological origin, without necessarily differing chemically from their equivalents made from petroleum derivatives (Nazareth et al., 2022). The obvious conclusion is that although these materials help minimize carbon dioxide (CO<sub>2</sub>) emissions, they generate exactly the same type of waste as conventional plastics, as they do not undergo complete environmental degradation. It is important to note that a few bioplastics can degrade quickly under composting conditions, which differ from real environments.

Despite label claims, supposedly biodegradable synthetic polymers should be able to decompose into carbon dioxide (CO<sub>2</sub>), water (H<sub>2</sub>O), and/or methane (CH<sub>4</sub>) when exposed to natural environments within reasonable time frames. However, in some natural environments, such as the deep sea, where a large portion of the plastics discarded globally end up, degradation simply does not occur due to low temperatures and lack of light and competent microbiota (Viera et al., 2021). In this context, it is important to distinguish biodegradable materials from compostable materials, which only undergo degradation under specific conditions that differ from those found in real nature. Therefore, although many commercial products made of plastic claim biodegradability, this property is not observed in most utensils available on the market (Moreno et al., 2023). Another category of alternative plastics has recently emerged, the oxo-degradable plastics, which contain pro-oxidant additives that supposedly accelerate the breakdown of polymer chains by light radiation. However, due to the lack of evidence regarding their complete degradation and potential acceleration in the formation of MPs, they have since been banned in several countries, including in the European Union. Nevertheless, a recent study carried out in 40 Brazilian supermarkets found that 94% of plastic products that claimed to be biodegradable were in fact of this category (Moreno et al., 2023).

While the democratic world debates multilateral solutions to the plastic crisis, which simultaneously threatens biodiversity and human existence, contemporary societies are gradually becoming more aware of the need to change consumption habits. In the meantime, the

development of products that offer environmental benefits, even if more expensive, represents a valuable tool for dealing with our reliance on synthetic polymers. However, the practice of greenwashing<sup>1</sup>, aimed at exacerbating profit above commitments to sustainability, poses a serious obstacle to global initiatives (Moreno et al., 2023; Nazareth et al., 2019). From this perspective, it is important that the communication between the private sector and consumers is honest, because while governments spend public resources on education for more environmentally aware citizens, greenwashing practices can cause further damage to the – already shaken – consumer confidence in sustainable products (Viera et al., 2020). Finally, in addition to local and global actions to challenge the powerful plastics industry, the labeling of products that claim environmental benefits must be regulated. Such initiatives are essential to prevent the proliferation of fake solutions to the global plastics crisis, which needs to be addressed from multiple perspectives.

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1. A deceptive marketing strategy that aims to make a company appear more sustainable than it actually is, usually by offering products that claim environmental benefits that are not truly delivered to the consumer.

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