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How Green are my Plastics

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Abstract: Today plastics and other polymers are being widely used for packaging. In India there is ban on single use plastics and hence there is a need to look at alternate materials that are green and eco friendly and also natural in origin Green polymers are thus one of the solutions
Some of the actions that Mission LIFE encourages include:
Saving energy
Reducing waste
Saving water
Reducing single-use plastic
Adopting healthy lifestyles
When we want to reduce single use plastics we need alternative materials. There is need for green polymers.

Keywords: plastics, polymers, energy, green.

Introduction:

A circular bioeconomy is an economic model that aims to maximize the value of biological resources and minimize waste. It uses renewable resources to produce food, materials, and energy, and it emphasizes investing in human, social, natural, and physical capital

Bio-based plastics are gaining traction for their perceived sustainability, yet they still contribute to plastic pollution. The rapidly growing market for these plastics necessitates efficient end-of-life recovery. Assessing material composition and product design impact on recovery pathways is crucial for enabling a circular economy for bio-based plastics. Establishing a wider range of recovery pathways and

The circular economy emphasizes preserving the value of products and their materials by either prolonging the life of products or reintroducing materials back into the system for reuse. Decisions made during product design directly impact the ability to recover a product at the end of its life cycle. Specifically, in material-level recovery, product design significantly influences the separation of plastic parts from a product, a critical factor for material-level recovery.

Bio-based polymers operate differently in the circular economy compared to petrochemical-based polymers when material-level recovery is considered. The circular economy typically distinguishes between a biocycle and a techno cycle,

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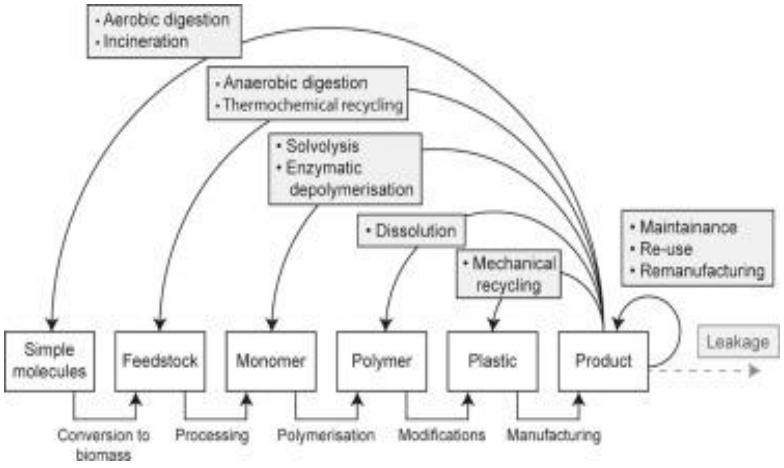
where recovery of petrochemical-based plastics occurs only in the techno cycle. For petrochemical-based plastics, recovery pathways like incineration and aerobic digestion cannot be considered circular loops, as they introduce fossil greenhouse gas emissions to the atmosphere. Bio-based plastics, on the other hand, can also flow through the biocycle because they are produced from biomass



Picture: courtesy: Resources, Conservation and Recycling Volume 199, December 2023, 107268

Bio-based plastics are gaining momentum as a sustainable alternative, driving a shift towards circularity in the market. Efficient end-of-life recovery is crucial to prevent plastic pollution. As bio-based plastics become a larger part of plastic waste, understanding and enabling their recovery is key. While they perform similarly to petrochemical-based plastics at higher waste hierarchy levels, their material-level recovery varies significantly.
Chemical companies are leading the development of advanced recycling technologies that transform mixed plastic waste into valuable secondary raw materials, unlocking the enormous potential of bioplastics and the circular economy.

To address the challenges, further development of novel recovery pathways and advancements in waste collection and sorting systems are crucial.

While biodegradation in nature is considered a potential solution to reduce plastic pollution, there is insufficient evidence to support the full degradation of most biodegradable bio-based plastics into CO2 and water, thus avoiding methane emissions. Despite these challenges, biodegradation in nature could be a viable option for certain plastic products that inevitably end up in the environment due to wear and tear, such as car tires or elastomer shoe soles.

Product design plays an essential but often overlooked role in improving the circularity of bio-based plastics. Decisions made during

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the product design process determine the range of recovery pathways for a product, along with the presence of associated services

Therefore, the recovery must be considered starting early in the design process. The implications discussed in this paper can be expanded by including different perspectives, such as those of legislation, business development and economy. The environmental impact of different recovery pathways has not yet been sufficiently quantified and presents an important area for future research.

Picture: Courtesy Bio Circular Economy
Source: Journal of Hazardous Materials
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Bio-based plastics offer an opportunity to accelerate the transition to a circular economy, but this requires a concerted effort to consider recovery at end-of-life carefully. The results presented in this article can be used by product designers, recyclers, and plastic producers. Product designers may use the outcomes when selecting a bio-based plastic and a targeted recovery pathway while ensuring that this recovery pathway is encouraged though the product design. The results should help recyclers and plastic manufacturers facilitate efficient recovery of bio-based plastics at end-of-life. Recyclers are encouraged to consider which recovery infrastructure may become relevant for the future end-of-life plastics composition. Finally, plastic producers are stimulated to consider the potential recovery of plastics under development.

The future of plastics can be free from choking waste. By embracing bioplastics and the circular economy, we can chart a course towards a more sustainable future for our planet. This collaborative effort, driven by innovation and a shared commitment to environmental responsibility, promises a future where plastic pollution is addressed. The path is now evolving, and effort need to be dome to come up with appropriate affordable, scalable, solutions.