Microalgae-Based

Bioplastic Production

GREEN PARTICAPATION, GREEN EUROPE

Project Number: 2023-2-TR01-KA154-YOU-000168735

A11- Potential of microalgae in the fight against climate change

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Erasmus+

TÜRKİYE ULUSAL AJANSI
TURKISH NATIONAL AGENCY

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Presentation Objectives

- Explain the environmental benefits of microalgae-based bioplastics
- Demonstrate the bioplastic production process through a hands-on workshop
- Engage participants with discussion questions for an interactive experience



Environmental Benefits of Microalgae-Based Bioplastics





Environmental Issues and the Potential of Bioplastics

- Traditional plastics can persist in the environment for hundreds of years, causing pollution.
- Bioplastics derived from microalgae are biodegradable and reduce environmental impact.
- Microalgae can utilize waste resources like CO_2 and wastewater, contributing to sustainability.

"Microalgae, such as Chlorella and Spirulina, are emerging as sustainable sources for bioplastic production due to their high biopolymer content."

— Lopez-Pacheco et al., 2022

Discussion

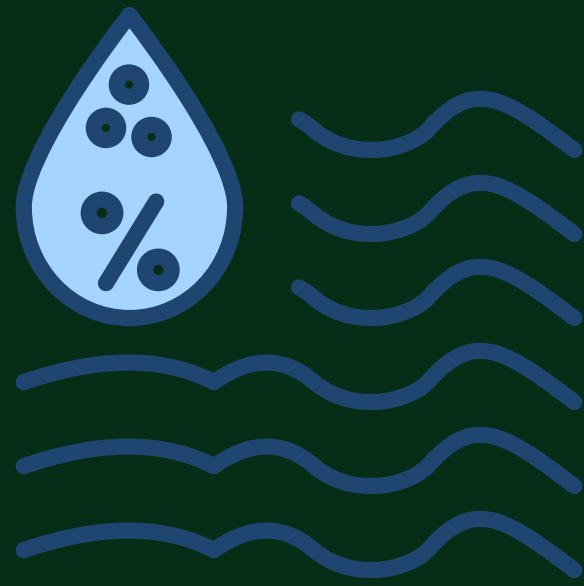
- Can microalgae-based bioplastics replace traditional plastics?
- In which industries might they be more effective?
- Which application areas are the most suitable for microalgae-based bioplastics? (Food packaging, medical products, single-use items...)



Microalgae-Based Bioplastic Production Process

1. Microalgae Cultivation: Growing microalgae in photobioreactors
2. Harvesting and Drying: Collecting and drying the microalgae biomass
3. Biopolymer Extraction: Extracting biopolymers from the biomass
4. Polymerization and Molding: Processing biopolymers into bioplastic products





“Bioplastics derived from microalgae exhibit high biodegradability and eco-friendly properties, making them suitable for applications in packaging and medical materials.”
— Dogruoglu et al., 2023

Global Market Trends and Economic Potential of Microalgae Bioplastics

Global market size, investment potential, and future projections for microalgae-based bioplastics.

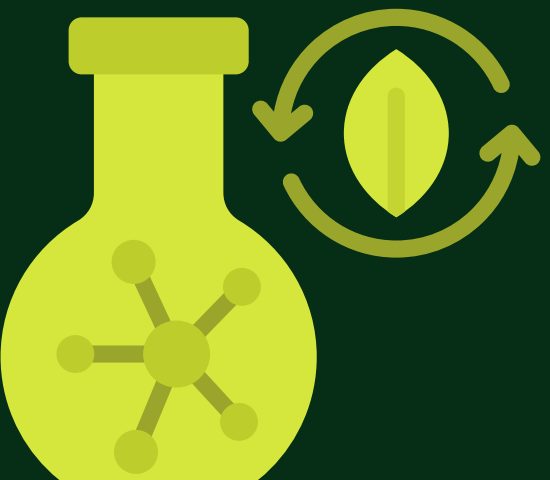
According to Allied Market Research (2023), the global bioplastics market is projected to reach $120 billion by 2032, with microalgae-based bioplastics emerging as one of the key sustainability-driven segments contributing to this growth.



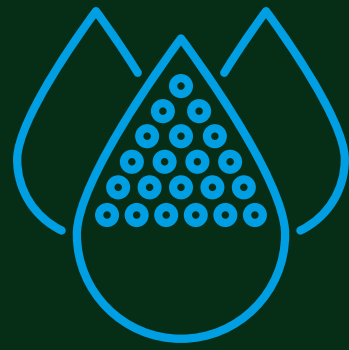
Life Cycle Assessment (LCA) of Microalgae Bioplastics

Environmental impact evaluation of microalgae bioplastics through Life Cycle Assessment (LCA), including carbon footprint, energy consumption, and water usage.

Life Cycle Assessment (LCA) is a systematic method used to evaluate the environmental impacts of a product throughout its entire life cycle — from raw material extraction to end-of-life disposal.

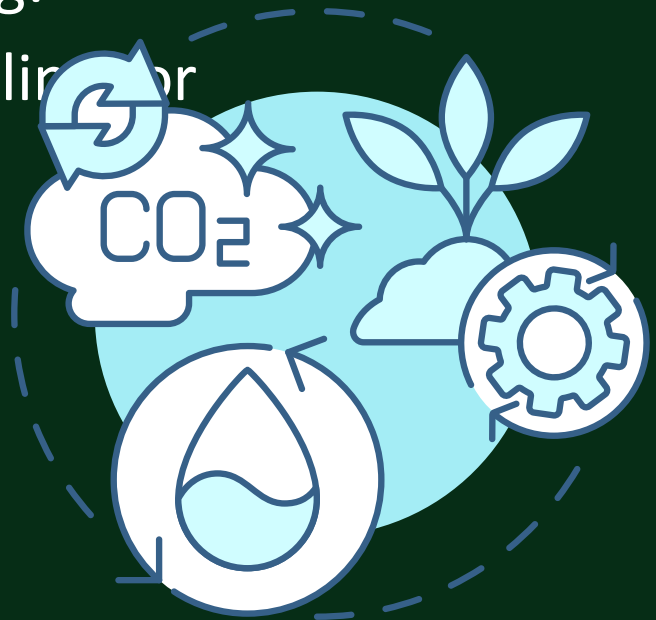






For microalgae-based bioplastics, LCA includes:

- Algae Cultivation: Growing microalgae in photobioreactors or open ponds (calculating water, energy, CO_2 usage).
- Biomass Harvesting & Processing: Drying and extracting biopolymers from the algal biomass.
- Bioplastic Production: Polymerization and product shaping.
- Usage & Disposal: Product lifespan, biodegradation, recycling or composting.



Environmental Advantages:

Lower carbon footprint compared to fossil-based plastics.

Utilization of wastewater and CO_2 as inputs.

Production of biodegradable and eco-friendly products.

📚 Literature Example:

“Microalgae-based bioplastics exhibit significant environmental advantages o
conventional plastics, including up to 50% lower greenhouse gas emissions over t
life cycle.”

(Bhattacharjee et al., Journal of Cleaner Production, 2022)

Current Challenges and Limitations

Technical, economic, and logistical challenges hindering the widespread adoption of microalgae-based bioplastics (high production cost, scaling issues, market competitiveness).

Circular Bioeconomy and Zero Waste Potential

Integration of microalgae in circular bioeconomy systems for producing biogas, fertilizers, energy, and bioplastics, supporting zero waste models.



Case Studies: Successful Industrial Applications

Algix & Bloom Foam

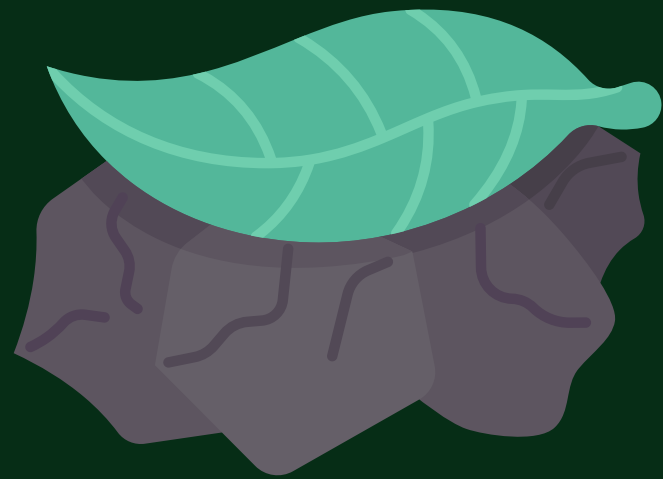
- Algix, in collaboration with Bloom Foam, produces sustainable shoe soles and midsoles made from algae-based bioplastic composites.
- These materials are used by brands like Adidas, Reebok, and Merrell for eco-friendly footwear collections.
- Algae-based foam reduces petroleum usage and helps clean up algae blooms from polluted waters.

Case Studies: Successful Industrial Applications

Algenesis Materials

- Algenesis Materials developed biodegradable phone cases made from microalgae-derived polyurethanes.
- Their products are fully compostable and break down in natural environments without leaving microplastics.
- Focus areas: consumer electronics, surfing equipment (bioplastic surfboards).

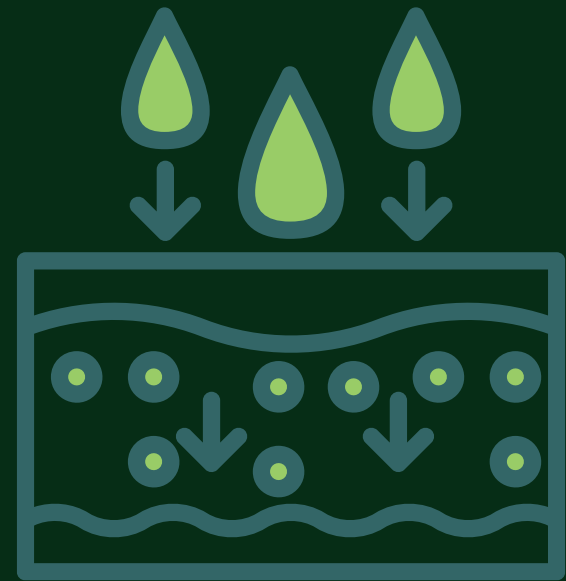




Case Studies: Successful Industrial Applications

Solaplast (BioBased Technologies)

- Solaplast produces bioplastic pellets from algae biomass, used in packaging, agricultural films, and injection-molded products.
- Their algae-based bioplastics offer UV resistance and biodegradability, making them ideal for outdoor applications.



Case Studies: Successful Industrial Applications

Checkerspot

- Checkerspot utilizes algae oil as a base ingredient to manufacture high-performance materials.
- Applications include ski equipment, outdoor gear, and coatings that traditionally rely on petroleum-derived plastics.
- They focus on functional optimization (lightweight, durable, and eco-friendly).



Case Studies: Successful Industrial Applications

Corbion (Algae Ingredients & Bioplastics)

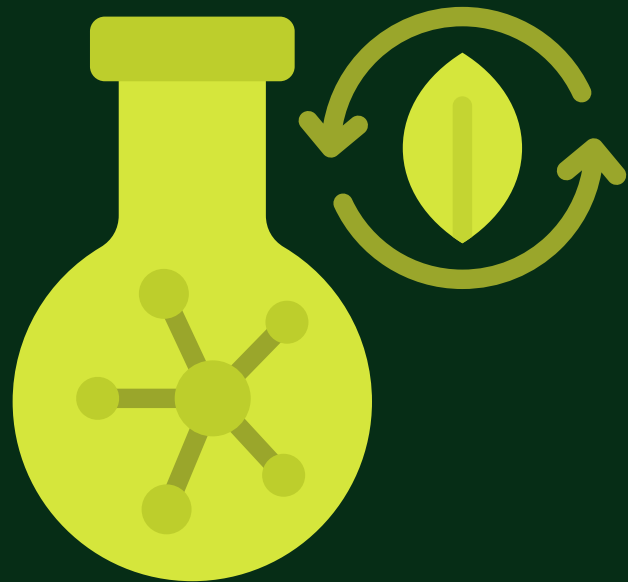
- Corbion produces algae-derived polylactic acid (PLA) used in biodegradable plastic packaging.
- Their algae-based solutions reduce greenhouse gas emissions and improve biopolymer flexibility and strength.



Case Studies: Successful Industrial Applications

Evoware (Indonesia) – Algae-Based Edible Packaging

- Evoware develops seaweed-based edible bioplastics for single-use packaging (burger wrappers, sachets).
- Though primarily seaweed, similar processes are adapted for microalgae composites in biofilms.

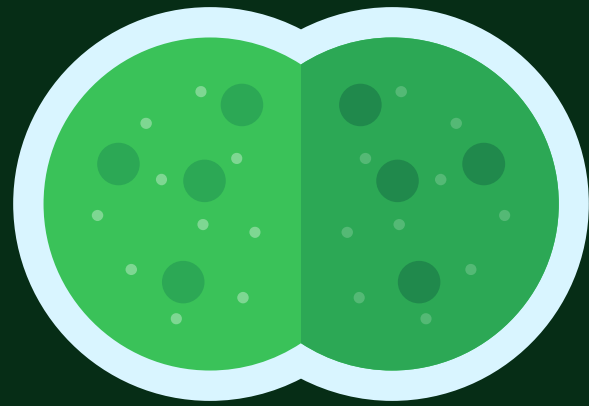


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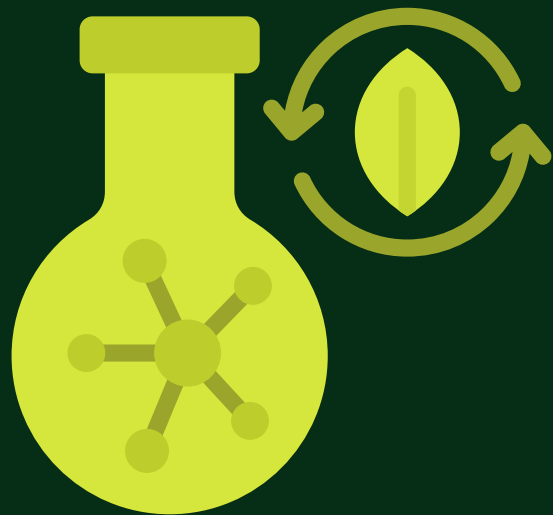


Policies Supporting Microalgae-Based Products

Global Support Frameworks

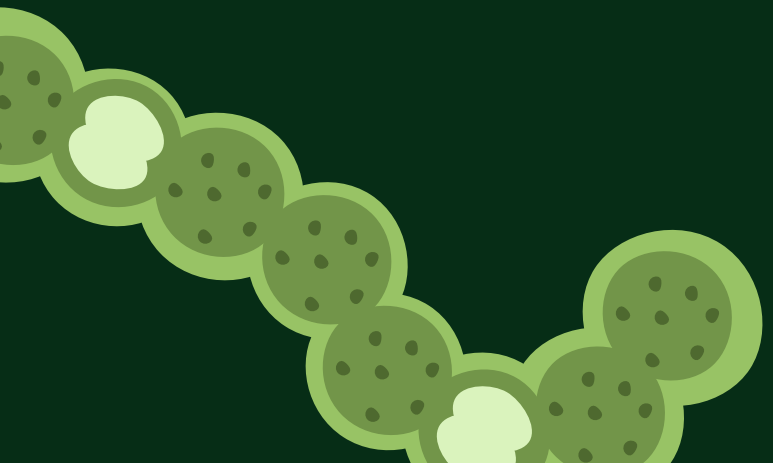
- European Green Deal: Promotion of circular economy and bio-based products
- Horizon Europe Projects: R&D funding for algae bioplastics
- US Renewable Energy Incentives: Tax benefits and investment support for algae biofuels

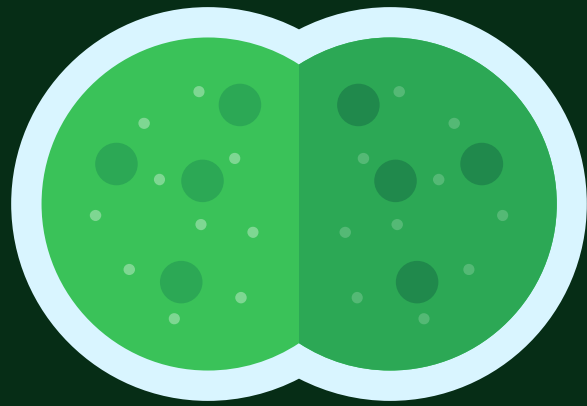




Policy Mechanisms in Türkiye

- TÜBİTAK 1501 & 1512 Programs: Support for algae biotechnology projects
- KOSGEB Innovation and Entrepreneurship Funds
- Biofuel and Bioplastic Incentives (Ministry of Agriculture & Energy)





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- https://www.evoware.id

THANK YOU FOR YOUR ATTENTION!

Any questions?

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