Exploring drivers and barriers of Biocomposites' circularity

Kirsi Immonen, Katri Valkokari / VTT
Kirsi.Immonen@vtt.fi

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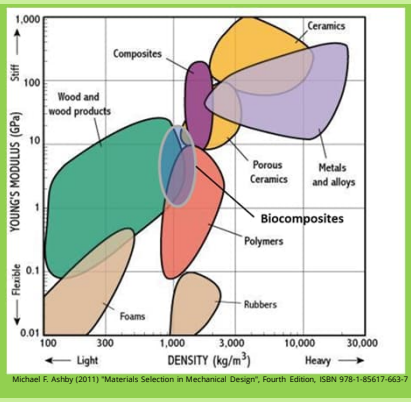
DRIVERS

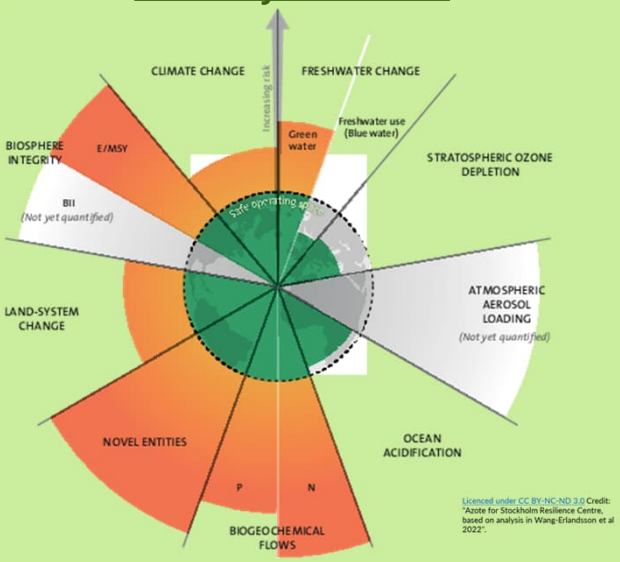


Biocomposites

Plastic or Bioplastic + Wood fiber or Natural fiber

Enable bio-based plastic use in demanding high-performance applications such as:
- Transportation
- Construction
- Furniture
- Sport equipment etc.

Planetary boundaries



SYSTEMIQ (2022) ReShaping Plastics – Pathways to Circular, Climate Neutral Plastic System in Europe (https://plasticseurope.org/changingplasticsforgood/

Scenario	Circularity %	CHG Emission, $MtCO_2e$	Virgin fossil plastic use, Mt	Actions related to circular economy of plastic materials (selected from a bigger group of actions)
Base Case (current system, no change)	14	112	44	
Current Actions Scenario	33	92	37	The existing regulations (2021) are in force and executed
Reduction & Substitution Scenario	52	68	29	Cost reductions and performance improvements for compostable and other bioplastics
Recycling Scenario	69	41	24	All plastic packages are designed to be recyclable Demands for recycled material content in plastic products
Circularity Scenario	78	33	20	All previous scenarios are in use Focus in consumer education and engagement
Retrofit System Change Scenario	78	25	20	Cost effective H, CCS and CH4 to olefins technologies in use Chemical recycling of plastics in wider use.
Net-Zero System Change Scenario	78	0	11	Cost effective C utilization technology in use. GHG reduction applied with plastic chemical recycling. ¼ of plastic raw materials in line with sustainable development (bio-based)

Plastics with fossil-based raw materials have impact on:
- **Chemical pollution - Novel entities**
- **Climate change**
- **Freshwater change**

Bioplastics and biocomposites help to reduce those changes, but can increase issues related to land use

-> CIRCULAR ECONOMY IS NEEDED FOR ALL MATERIALS

Biocomposites Market size was valued at USD 27.33 Billion in 2022 and is projected to reach USD 79.15 Billion by 2030, growing at a CAGR of 18.63% from 2023 to 2030.

Report ID: 33305, Verified Market Research | Apr 2023

One of the major global challenges we face in the materials science is the transformation from fossil, petrochemistry based polymeric materials to the sustainable, renewable and carbon-binding materials.

Facts about fossil-based plastics:
- Produced 8,3 billion tons since 1950's[1,2]
- Yearly production 400 million tons and doubled by 2040[1,2]
- Corresponds 4% of climate change now and 15% in 2050[3]
- Recycled globally only 9%[1]

Facts about bioplastics:
- Yearly production 2.4 million tons (<1% of fossil based)[4]
- **Not really recycled yet!**
- **Now mainly used as energy!**

BARRIERS

Issues need to be tackled before biocomposite/ bioplastic recycling is realized

- **Logistics** to recycling?
- How to secure **volumes** sufficient for cost-effective recycling?
- Should there be own EU level **recycling labels** for biocomposites/bioplastics?
- Is **reuse** of biocomposite products possible?
- **New product innovations** for recycled materials?
- Best **recycling method** for biocomposite/bioplastic – mechanical, chemical, enzymatic?
- How to arrange **collection of long life time biocomposite** products (construction, furniture, sport equipment etc.)?
- How to arrange **collection of shorter life time products** (cutlery, cosmetic packaging, electronic packaging etc.)?
- How to deal with **wide material base** in biocomposite's in recycling?
- **Who will recycle** biocomposites and bioplastics – existing or novel companies?
- Best way for biocomposite's **identification** from other recycled material streams?
- How to **separate** different biocomposites with various raw material base from each other or is separation even needed?

1)Geyer, Jambeck, Law Sci. Adv. 2017;3: e1700782, 2) Rosenboom, Nature Reviews 2022, 7, 3) www.iso.org , 4) www.bioplastics.org

Aalto University
Luke Natural Resources Institute Finland
Lapin yliopisto University of Lapland
VTT
Academy of Finland
strategic research