Exploring the Carbon Footprint of Biocomposites through Life Cycle Assessment

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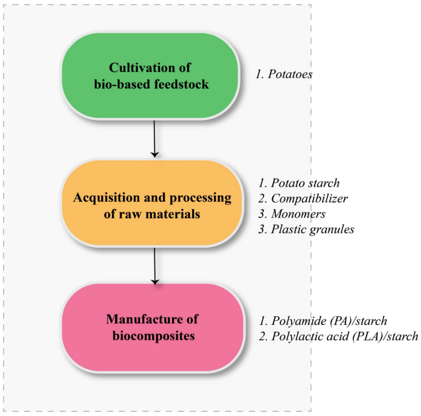
Introduction

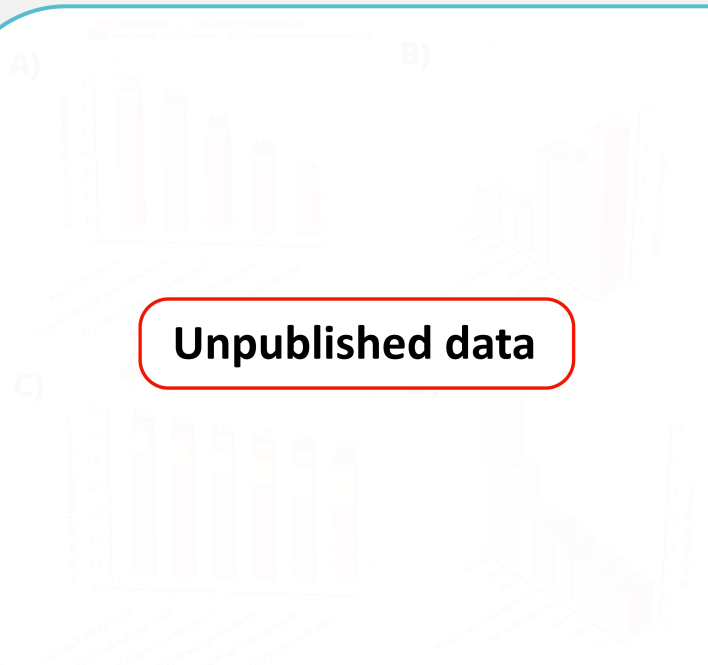
- Accelerating climate change demands the development of more climate-friendly plastics and biocomposites
- The carbon footprint of polyamide-based biocomposites has currently been scarcely studied
- It is beneficial to quantify the impacts of plastics and biocomposites already at the early stages of development

Materials and Methodology

- **Goal and scope:** to quantify the carbon footprint and define the hotspots
- **System boundaries:** cradle to gate
- **Functional unit:** 1 kg of biocomposite or biocomposite granules
- **Regionalization:** Finland (biocomposites) and Germany, Netherlands, or Thailand (raw materials)
- **Software:** Sphera's LCA FE with MLC 2023.1 or 2023.2 Databases
- **LCIA method:** EF 3.1
- **Impact category:** carbon footprint (kg CO_2 eq./kg of biocomposite)
- **Sensitivity analysis:** Internal circulation of cooling water and/or different types of electricity



Results and Discussion



Polyamide (PA)/starch biocomposite (A,B):

- Carbon footprint reductions of up to [redacted] were achieved
- Carbon footprint reductions of [redacted] and [redacted] were acquired when compared to fossil-based PA6, PA12, and PA6.6, respectively

Polylactic acid (PLA)/starch biocomposite (C,D):

- Carbon footprint reductions of up to [redacted] were achieved
- Carbon footprint reductions of [redacted] and [redacted] were acquired when compared to fossil-based High Impact Polystyrene (HIPS), Acrylonitrile Butadiene Styrene (ABS), and PA6.6, respectively

➡ In both cases, monomers/PLA contributed the most to the carbon footprint [redacted]