Polyester Upcycling and Fiber Composite Furniture

Polyester is a market leader in the textile industry. While fast fashion trends, large amounts of **polyester waste** is generated. As a **non-biodegradable** material, whether incinerated into carcinogenic compounds or piled up at landfills, polyester **threatens the health of our entire ecosystem**. Efforts promoting sustainable fashion have not demonstrated measurable success.

Waste generation is not the only problem. Polyester production is unsustainable as it is predominately created from polyethylene terephthalate: a material produced from **fossil fuels**. Additionally, polyester manufacturing involves combining dyes and other chemicals. Improper management and containment of these additives can lead to **water and soil pollution affecting nearby communities** [1]. In the entire production process, up to **27.2 kg CO2 equivalent** can be produced per one kg of polyester fabric [1].

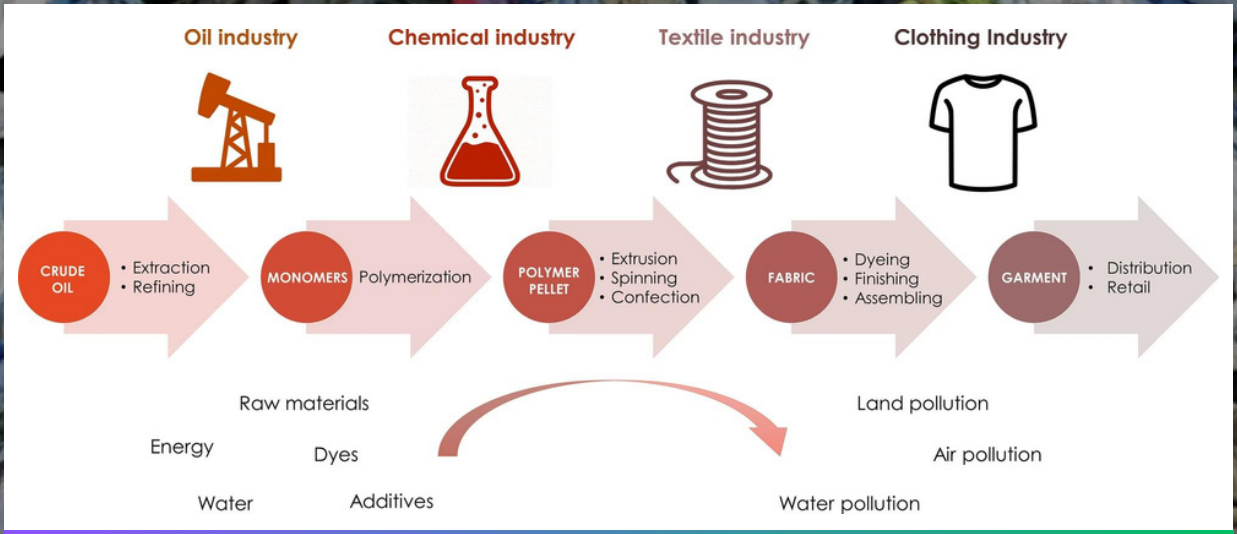


Fig. 1: Polyester step-by-step manufacturing process [1].

While there are existing technologies to recycle polyester, there are significant challenges that prevent recycling from being a viable solution:

- As of 2021, recycled polyester **only holds 15%** of market share [2].
- Textiles in fast fashion have a short lifecycle that leads to a **high frequency of recycling**.
- Recycling is **energy-intensive** and **not cost-effective**.
- Contamination and impurity make recycling **even more challenging**.

Instead, what if we approach the way we think about polyester waste differently?

Advay Sudarshan | Patrick Harsono | Jesse Wei | Hugo Ji
University of Illinois at Urbana-Champaign

The Solution

1. While industry and market trends change, waste management and recycling processes cannot keep up with changes in wasted material.

- Fast fashion brings more polyester waste than the world has ever seen before.
- Improvements in manufacturing process and recycling technologies may alleviate the waste load, but such progress is not guaranteed.
- Approaching this issue with traditional recycling methods would simply lead to more energy consumption

2. Moving existing waste from short-lifecycle markets into markets with longer lifecycle can reduce new material demands.

- Long-lifecycle markets tend to be overlooked from a sustainability perspective.
- For example, the furniture market sees longer product lifecycles and thus a lower waste and recycling frequency.
- Utilizing waste from short-lifecycle markets in production of long-lifecycle markets reduces total new material demand.

3. Consequently, we can reduce the usage of virgin non-biodegradable materials in furniture by replacing them with robust composites made up of the polyester waste.

Our solution addresses unsustainable production. It will:

- Reduce the production of new non-biodegradable materials in furniture.
- Obtain more use out of existing polyester by shifting the use across markets within the textile sector.

Our solution's impact on industry infrastructure is twofold:

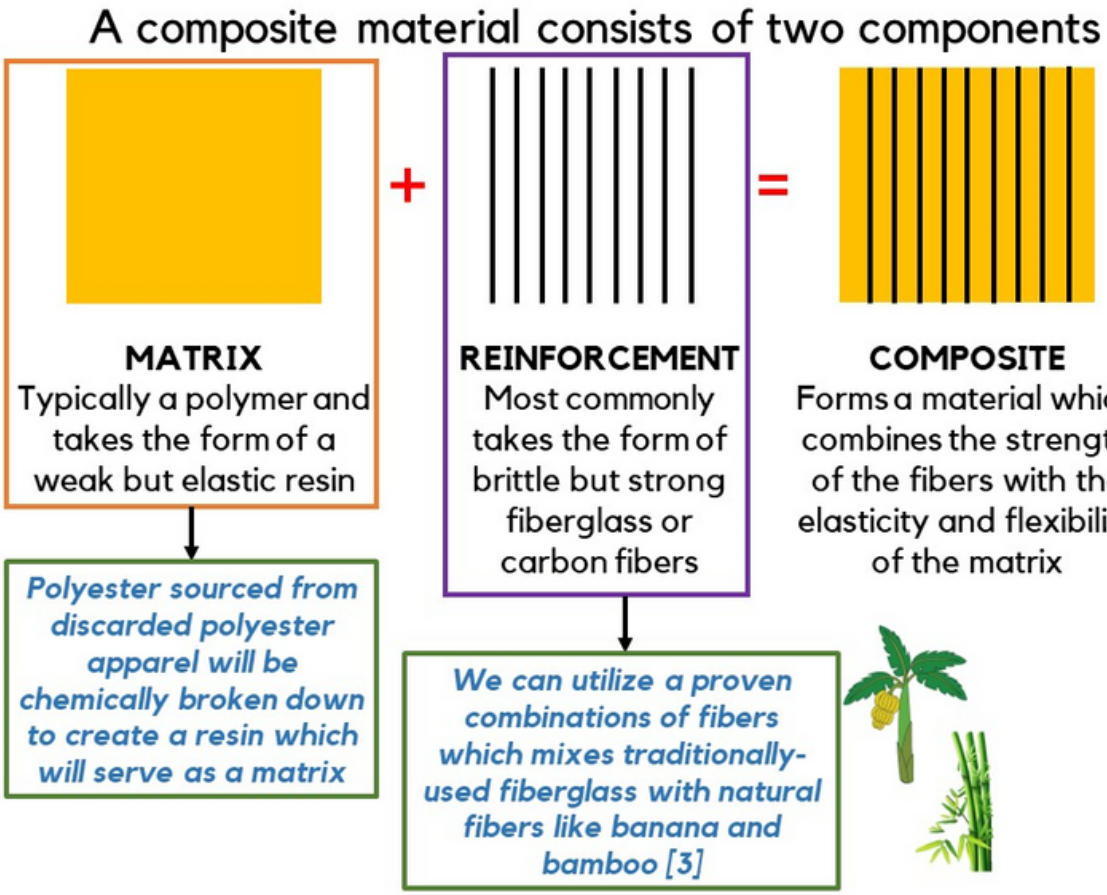
- Replace non-biodegradable materials in furniture by repurposing otherwise unusable polyester waste.
- Divert away from frequent polyester recycling - an energy intensive process.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Advay Sudarshan | Patrick Harsono | Jesse Wei | Hugo Ji
University of Illinois at Urbana-Champaign

The Implementation



We need the textile industry to play their part to use more sustainable natural fibers for their products to make this solution more effective.

A heightened demand is created for polyester recycling in the medium term as a result of this approach.

The end goal is that the furniture industry has access to more sustainable raw materials while enabling a sustainable and gradual removal of polyester from an industry with a short product life cycle

References and Acknowledgements

We would like to acknowledge Prof. Jeff Baur for his guidance and expertise for this competition.

[1] Palacios-Mateo et. al. "Analysis of the polyester clothing value chain to identify key intervention points for sustainability". *Springer Open*, January 2021. https://enveurope.springeropen.com/articles/10.1186/s12302-020-00447-x

[2] "Recycled and conventional polyester fiber as share of total production worldwide from 2008 to 2021". October 2022. https://www.statista.com/statistics/1250998/global-share-recycled-polyester-fiber/#:~:text=Recycled%20and%20conventional%20polyester%20production%20share%20worldwide%202008%2D2021&text=In%202008%2C%20around%20eight%20percent,had%20increased%20to%2015%20percent.

[3] Gowda et. al. "Polymer matrix-natural fiber composites: An overview". March 2018. https://www.tandfonline.com/doi/full/10.1080/23311916.2018.1446667#:~:text=3.-,Thermoset%20based%20natural%20fiber%20composites,into%20fibers%20at%20low%20pressures

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