

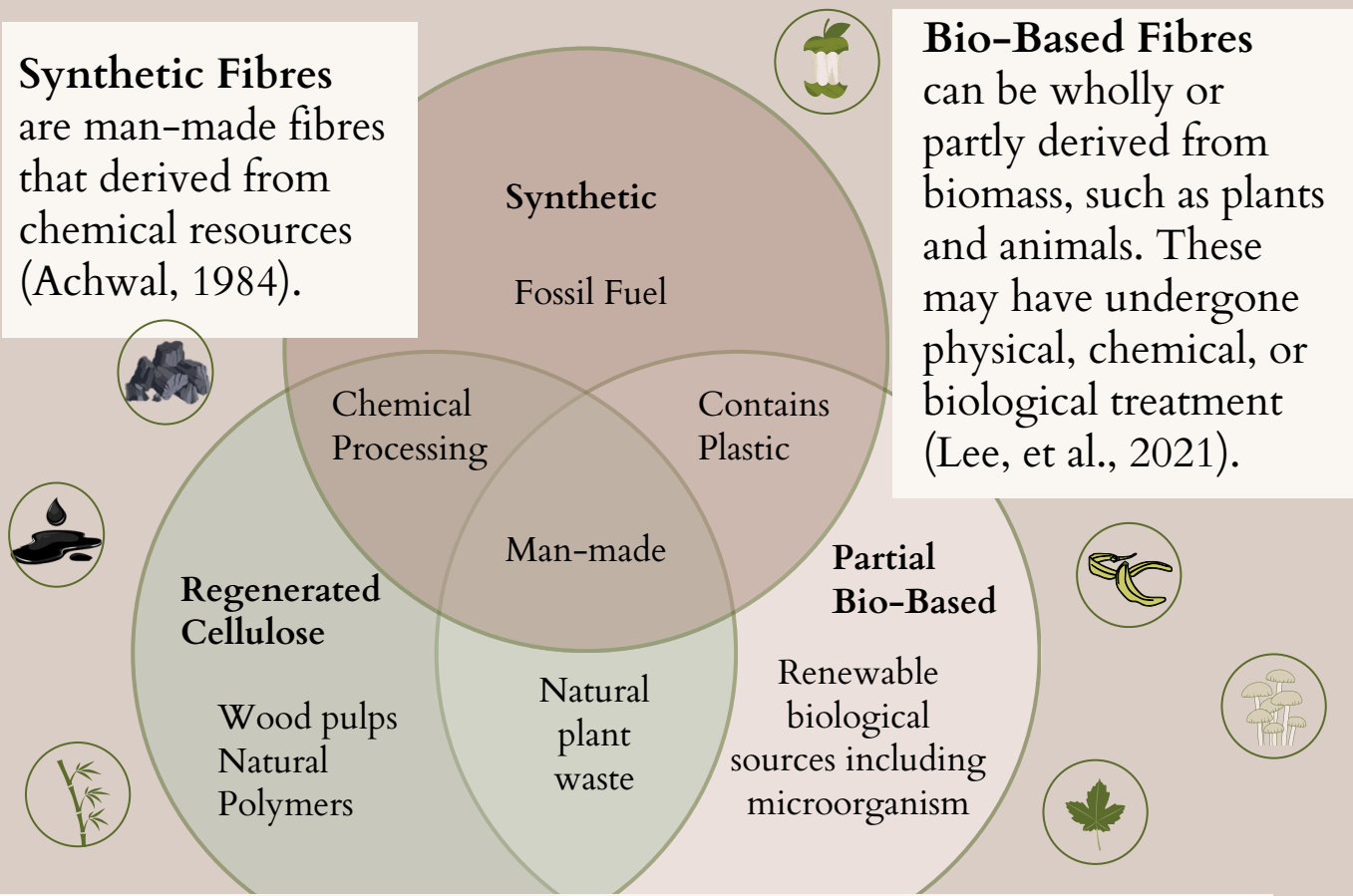


EXPLORING THE APPLICATIONS AND DANGERS OF SYNTHETIC FIBRES IN FASHION

SYNTHETIC FIBRES IN FASHION

Overview of Application

Synthetic Fibres are man-made fibres that derived from chemical resources (Achwal, 1984).



Bio-Based Fibres can be wholly or partly derived from biomass, such as plants and animals. These may have undergone physical, chemical, or biological treatment (Lee, et al., 2021).

Regenerated Cellulose Fibres, otherwise known as Semi-synthetic fibres, are regenerated plant based fibres. These are usually made from woods pulps dissolved in chemicals. (Textile Exchange, 2024).

Consumer Insights

Figure 1: Survey Result (Authors' own, 2024)

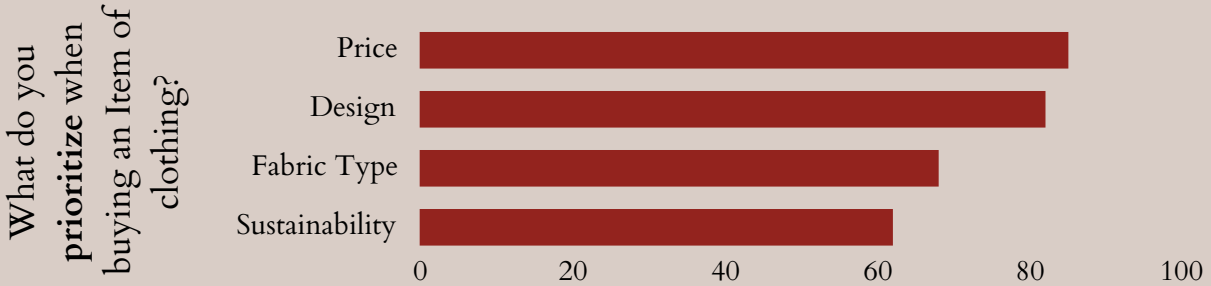
In the survey conducted 29 Gen Z consumers were asked their preference's and awareness of fabric types in order to gain understanding of Gen Z's attitudes towards synthetic fabrics

58.6% of the Gen Z consumers who took part in the survey could not differentiate between natural and synthetic fabric.

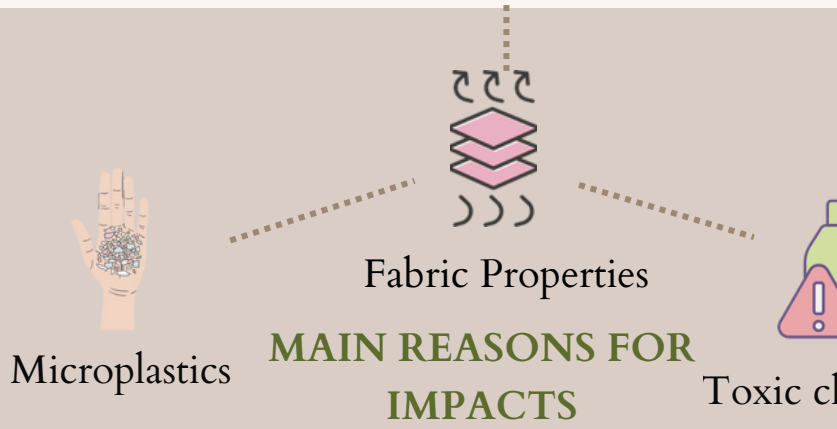
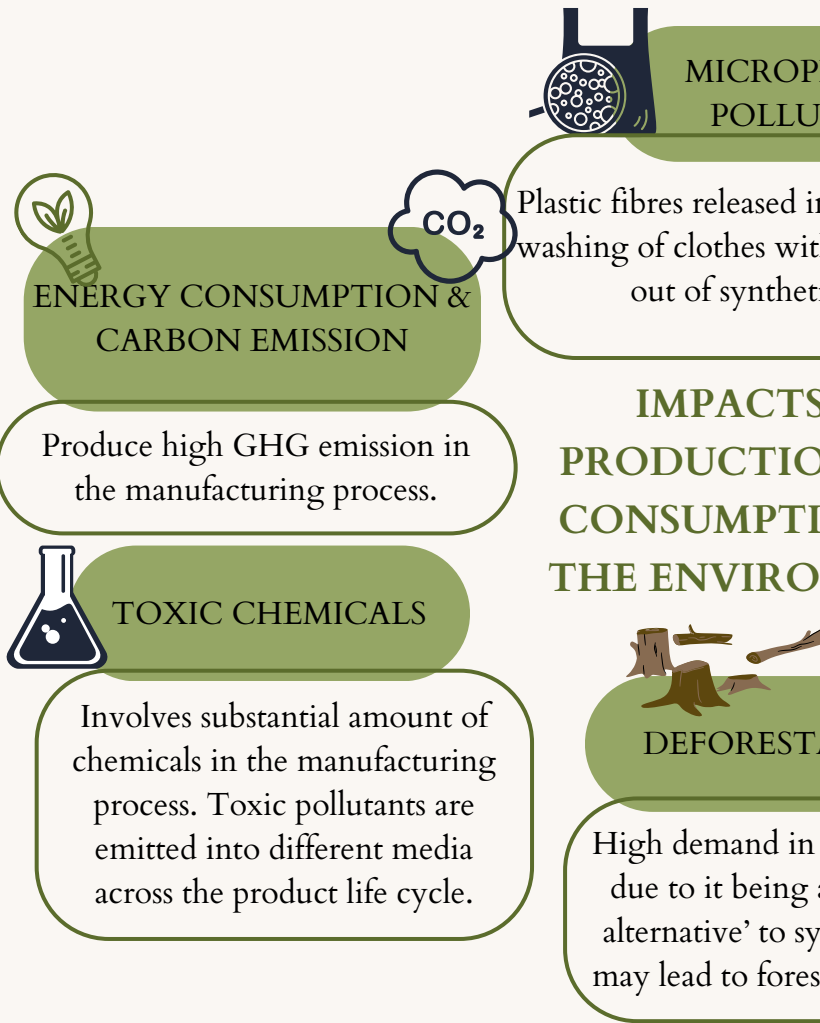
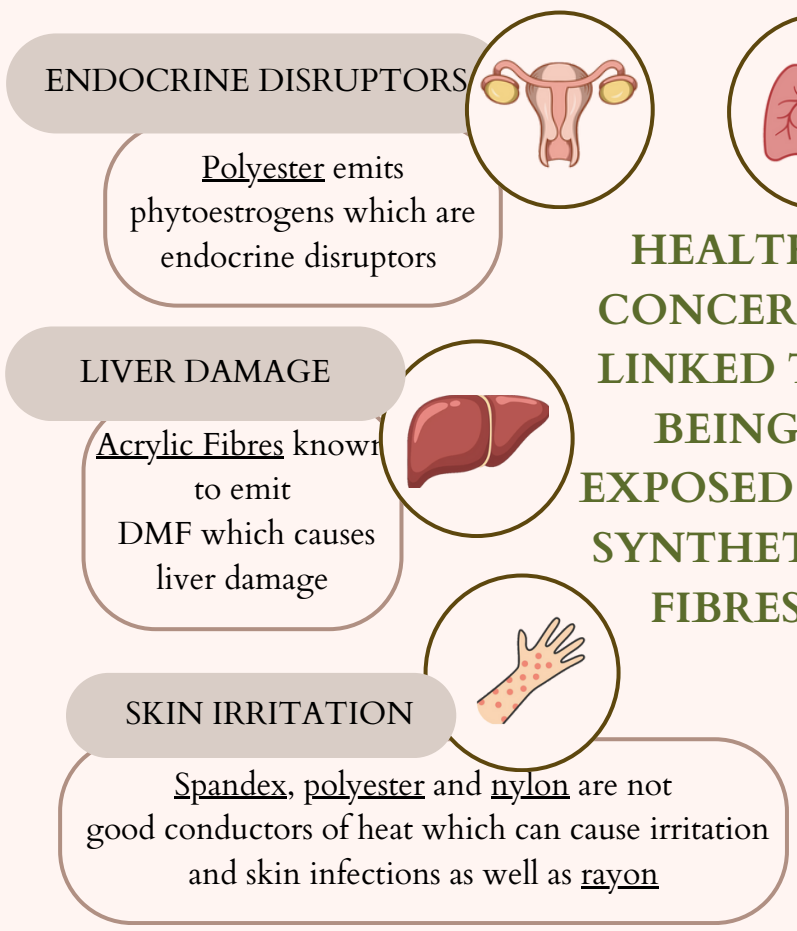
55.2% would prefer to buy naturally derived fabrics

72.4% were unaware of the potential health risks that the use of synthetic fibres

55.2% were aware of the environmental impacts of synthetic fibres.



Dangers/Negative Impacts



CON: DANGERS & SOLUTIONS

Relative Impact



RESPIRATORY INFECTIONS

Studies have confirmed that exposure to synthetic fibres can cause respiratory infections like pneumonia

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CARCINOGENS

Polyester and nylon found to contain multiple carcinogens



REDUCED SPERM COUNT

Polyester proven responsible for reproductive system disorders like reduced sperm counts.

PLASTIC UTION

d into water during
with materials made
etic fibres.

NON- BIODEGRADABLE

Petroleum based fibres stays on the planet, and release heavy metals into soil and groundwater.

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WATER USAGE

High usage of water for cooling and processing in production, creating additional strains to freshwater supply.

TATION

in cellulose fibre
g a 'sustainable
synthetic fibres
rest exploitation.



chemicals

Designers like Natsai Audrey Chieza are experimenting with using actinobacteria to naturally dye fabric.

Identified Potential Solutions

Biomaterial Innovation



What can this replace?
The use of animal fur and synthetically made faux fur using acrylic fibres. It claims to reduce microplastic in water and air stream as part of production

BioFluff using plant based fibre to replace animal and faux fur

The recent innovations above provide a more sustainable and less toxic option for certain synthetic materials like PVC/ PU. They are derived naturally and go through limited chemical processing. The examples shown recycle food waste (e.g pineapple, hemp, algae) that is already biodegradable which also helps reduce waste, they also release less carbon emissions in their production.

Although biomaterials seems a more sustainable alternative with limited health risks, the cultivation process may be too costly to multi produce and meet industry demands. However for higher end products and retailers it is a definite viable alternative and its production could be potentially altered to reduce costs

What can this replace?

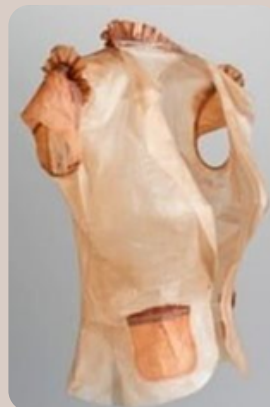
offer's an alternative to petroleum based fibres. The form of bio-plastic used in the dress could work as a substitute for plastic embellishments like sequins.



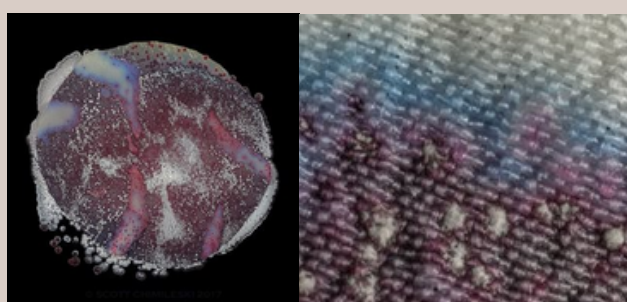
Piñatex using pineapple based fibre to replace animal leather and PVC

Bacterial Cellulose

Bacterial Cellulose (BC) is generated from a network of carbohydrate molecules which can be found in organic waste. The bacteria is grown in vats consisting of growth media, which is a form of gel or liquid used in growing microorganisms.



Unprocessed Bacterial Cellulose & Pieces of clothing made from BC (Choi et al., 2022)



Piece of fabric dyes by *S.coelicolor* (Chimileski, 2017)

Enhancing Natural Fibre Production

The standards & procedure of Organic Cotton:

Identified Opportunity 2

Utilize rainwater, better grown in tropical climate.

Use beneficial predator insect or biological pesticides such as neem oil.

Growth

Identified Opportunity 1.1

Intercropping or crop rotation each year with other nitrogen-fixing crops/plants like peas, wheat, rice, and false indigo, to help minimize disease problems and enrich soil quality (Baravkar, 2023).

Harvest

Hand-picked

Treat

Bleach with hydrogen peroxide

Potato starch for sizing

Spin

Natural spinning oils used to facilitate spinning

Finish

Identified Opportunity 1.2

Low-impact dyes and earth clays are for colouration.

Natural vegetable and mineral inks and binders are used for printing on organic cotton fabric

Towards Affordable Sustainability: Optimizing Natural Fibre Production and Eliminating Synthetics

By: Chealy Oeng (10831310)

Macro Issue

Synthetic fibres have dominated the textile industry by accounting for 65% of the global fibre production (Textile Exchange, 2023). Due to their non-biodegradability, fashion companies have chosen to source recycled or regenerated versions as part of their initiative towards circularity. Although these innovative fibres contribute in reducing landfill, they still have the same impact as virgin synthetics. Synthetic garments can release up to 700,000 microplastic particles into the air and water stream from a single wash (Somers, 2020), which poses harm to both the environment and human's health.

Micro Solution

Despite being aware of the negative impact of synthetic clothes, the majority of consumers still prioritize price and design over sustainability. With the ever-evolving trends and constant demand for newness, the ultimate solution to the use of synthetic fibres in clothing is to integrate sustainable natural fibres into mass-produced fashion. Hence, making sustainable fashion more accessible and affordable.



Finding the golden mean between fast and slow fashion.

Main reasons synthetic fibres are dominating the market:

- Cost
- Accessibility
- Durability
- Versatility

Scalable production of sustainable natural fibres needs to be achieved in order to reduce their cost and replace synthetic fibres. Moreover, the sustainability standards of the fibres needs to be ensured from the farming process up until the final product.

References

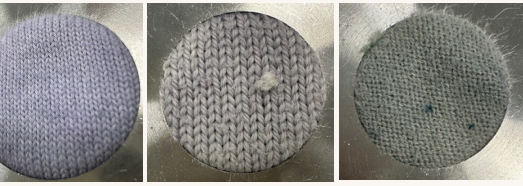
Barron, M. (2023) Are bacteria the next big thing in fashion?, ASM.org. Available at: <https://asm.org/articles/2023/december/fashion#:~:text=Bacteria%2C%20or%20rather%2C%20bacterial%20cellulose,solution%20to%20an%20unattractive%20p>

Somers, S. (2020) Our clothes shed microfibres – here's what we can do: Fashion Revolution. Available at: <https://www.f>

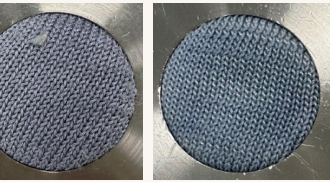
Textiles Exchange (2023). Materials Market Report 2023 Available at: <https://textileexchange.org/knowledge-center/rep>

Stability & Versatility Assessment

Wear Test on Single Jersey Knitted Samples



Cotton vs Wool vs Acrylic (100 cycles)



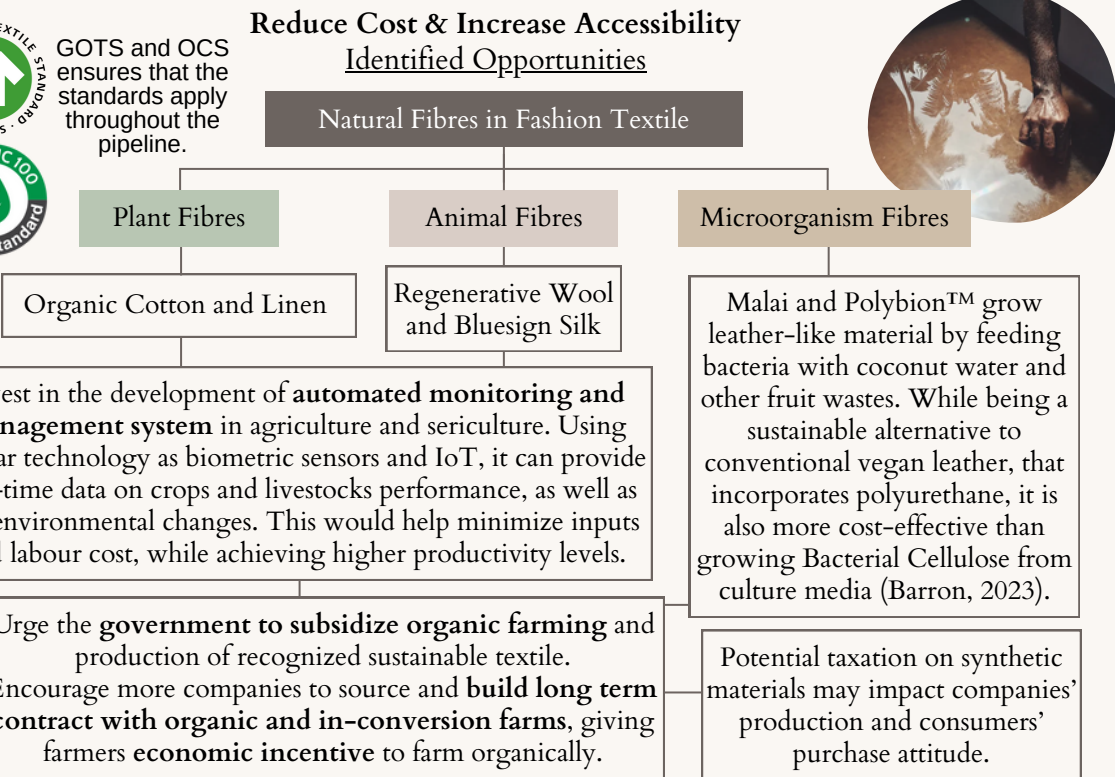
Nettle (100 cycles) vs Nylon (2000 cycles)

Key findings:

- Cotton, wool and acrylic are commonly used in knitwear. All 3 sample types began to show sign of pilling after 100 cycles.
- Nettle fabric has similar stiffness as linen and nylon. Nylon has higher durability.

Experiment with Red Cabbage Dye

Key findings: Nylon and acrylic did not show strong colours compared to the natural fibres (cotton, silk, wool, nettle, seaweed, and pineapple). Chemical inputs would be required to bind dyes to these synthetic fibres in the industrial production. This includes polyester, as it is a more hydrophobic material.





A Study on
Potato Starch
Bioplastic as
a Replacement
for
Polyethylene
and other
Petroleum-
Based
Plastics

ARE POTATOES THE NEW PLASTIC?

PLASTIC: THE PROBLEM

As discussed as part of the macro topic investigation, plastic-based fibres **wreak havoc** on our **ecosystems and health** causing issues such as **microplastic waste** and even medical complications like **reproductive disorders**. An alternative is crucial for the **fashion industry** to continue to thrive! Since researching alternatives to 4 main synthetic fabrics used in the industry, I wanted to also take a further look at other **plastic-based polymer materials** used such as **PE, PU and PVC**. These materials are harder to **replace** than cloth-like synthetic materials like **acrylic** and **polyester**. This is because **acrylic** and **polyester** naturally **mimic** non-synthetic materials like **wool** and **cotton**, however polymers such as **polyethylene** resemble a **rubber-like plastic texture** which is much **harder** to **imitate** using natural materials.

Polyethylene, PVC, PU are materials used in the fashion industry that cause **irreversible damage** to the environment and our health.



THE SOLUTION?

So, how can we **mimic** this **rubber-like material** without any **detriment** to the **environment** or **human health**? **Bioplastic**! Potato-based bioplastic is not only **non-toxic** and **biodegradable**, it can also be cultivated from potato **waste** which contributes to a "**circular economy**". However, it must be tested further to ensure its potential.

Polyethylene (PE) dominated the product segmentation in 2023 with a market revenue share of above **24.0%** (GVR, 2023)

Potato-Starch
Bioplastic

may present a promising **potential alternative** to conventional plastics such as **polyethylene**. with benefits such as...

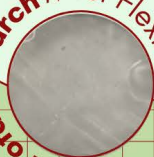
Non-toxic Biodegradable Utilises Waste



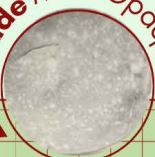
WHAT I'M DOING

I have developed 5 bioplastic sample solutions comprising of potato starch bioplastic plus a range of different fillers. I am testing these sampled to underpin their differing properties and determine the most ideal alternative to polyethylene. Then, based on these results, i will determine how the material could be implemented in the market!

Potato Starch Most Flexible



Zinc Oxide Most Opaque



Cellulose Most Durable



Eggshell Most Biodegradable



Beeswax Most Water-Absorbant

