3.2 Man-made fibres with low environmental impact

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3.2.2 Synthetic polymer-based fibres

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TEXTILE FIBRES

NATURAL FIBRES

ANIMAL

VEGETAL

- SEED
- BAST
- LEAF
- FRUIT

MINERAL

MAN-MADE FIBRES

ORGANIC

- **NATURAL POLYMER**
  - Chitosan
  - PLA
  - Alginate
  - Fibres with a cellulosic base
  - Fibres with a cellulosic base + additives
  - Milk fibres
  - Soy fibres
  - Elastomer
- **SYNTHETIC POLYMER**
  - Recycled polyester
  - Recycled polyamide

INORGANIC

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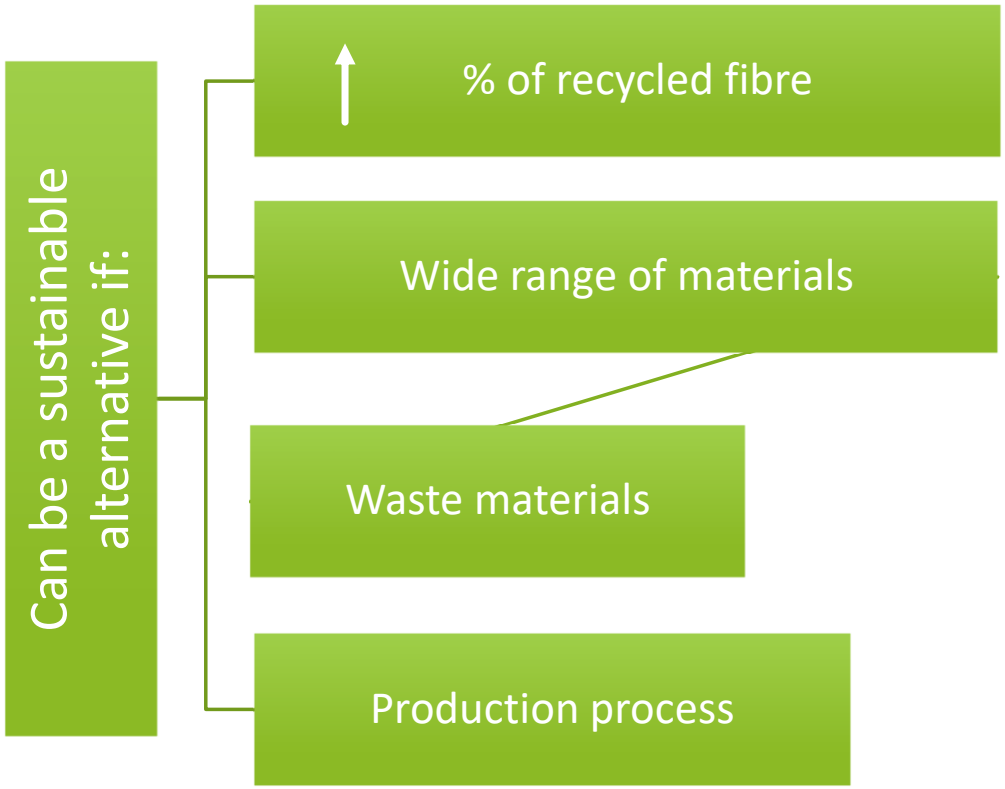
3.2.1 Natural polymer-based fibres



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Natural polymer-based fibres: CHITOSAN

Chitosan fibres are made from chitin, which is extracted from shrimp or crab shells. Its low-performance manufacturing process makes the fibre expensive, and in addition its mechanical properties are low.

Some of the characteristics/properties of chitosan are:

- Promote healing by acting on the immune system and accelerating the regeneration of epidermal tissue.
- Improves body immunization against possible diseases.

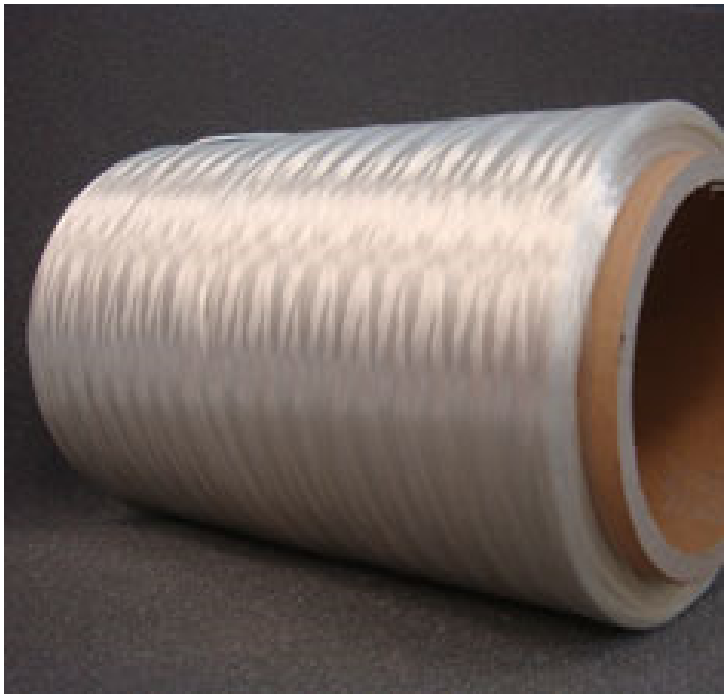

Figure 1. Appearance of chitosan fibre[1].

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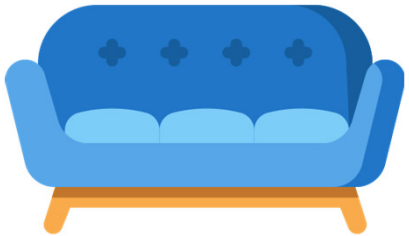
Natural polymer-based fibres: CHITOSAN

Applications:

Toiletries



Decoration

Underwear
Clothing in general

Bandages
Pads

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Natural polymer-based fibres: PLA

Polylactic acid fibre (PLA) is made from lactic acid obtained by fermenting corn starch (dextrose).

It offers a comfort and an insulation comparable to the natural fibres and an easy care just like synthetic fibres. It can be mixed with wool, cotton, or viscose, both in knit and in openwork.

Some of the advantages provided by these fibres are:

- Low humidity absorption
- Low resistance to abrasion
- Resistance against ultraviolet radiation
- Toughness

Figure 2. Appearance of PLA fibre[2].

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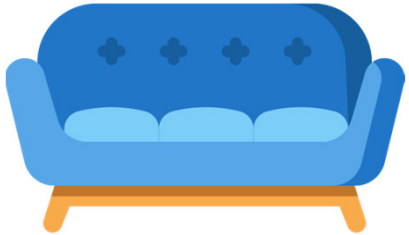
Natural polymer-based fibres: PLA

Applications:

General clothing

Diapers
Wound dressing



Bedding
Rugs
Upholstery
Outdoor furniture

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Natural polymer-based fibres: ALGINATE

Alginate (ALG) is a natural polymer organic chemical fibre obtained from alginic acids metal salts. It is obtained from some algae and is extracted from them by treatment in an alkaline medium.

Characteristics:

- Absorption of up to 20 times its weight
- Good resistance to solvents
- Low mechanical resistance

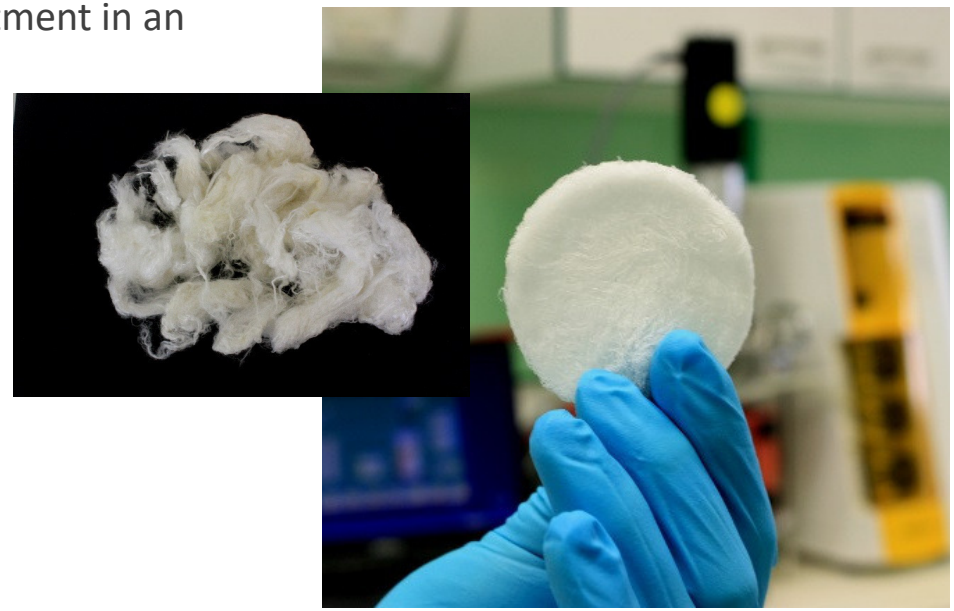

Figure 3. Appearance of alginate fibre[3].

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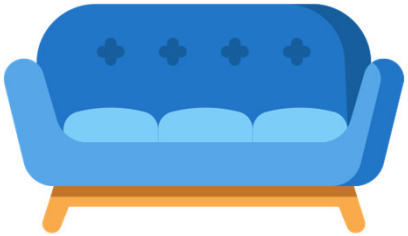
Natural polymer-based fibres: ALGINATE

Hygiene products

Underwear
Socks



Decorative fabrics

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Natural polymer-based fibres: CELLULOSIC-BASED FIBRES

Cellulose fibres are fibres made, through a chemical process, with cellulose ethers or esters , which can be obtained from the bark, wood or leaves of plants, or from other plant material. There are different types of fibres from cellulose depending on its regeneration process and the process of obtention.

- Viscose (CV).

Figure 4. Appearance of viscose fibre[4].

- Modal (CMD).

Figure 5. Appearance of modal fibre[5].

- Lyocell (CLY).

Figure 6. Appearance of Lyocell fibre[6].

- Cupro (CUP).

Figure 7. Appearance of cupro fibre[7].

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Natural polymer-based fibres: REGENERATED CELLULOSE FIBRES

Regenerated cellulose fibres have a lower environmental impact since the products made with them can be made using recycled fibres, and they are biodegradable because their cellulosic nature. Although the obtention processes are different, some are more respectful towards the environment than others. In general, items made from regenerated cellulose are comfortable thanks to their ability to absorb moisture, which is superior to that of cotton or silk. Some of the fibres obtained from regenerated celluolse are:

- Viscose
- Modal
- Lyocell
- Rayon
- Cupro

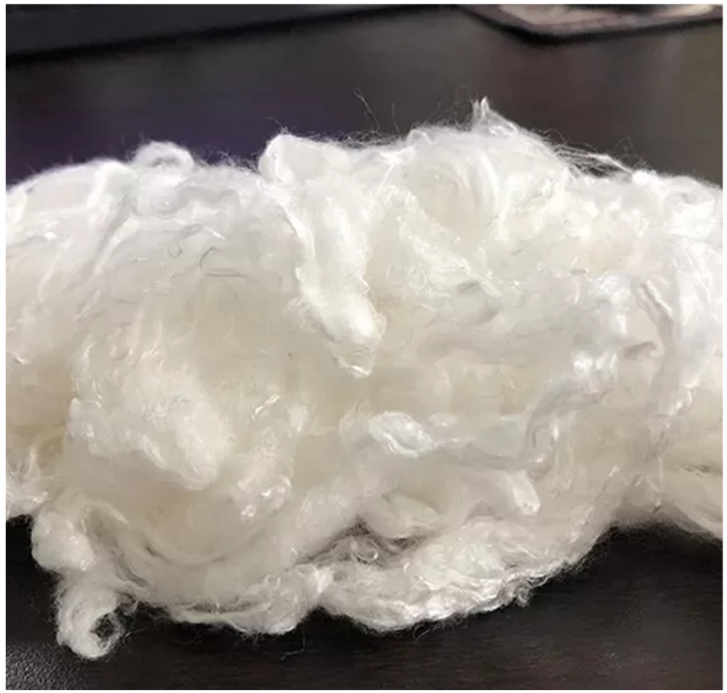

Figure 8. Appearance of rayon fibre[8].

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Natural polymer-based fibres: REGENERATED CELLULOSE FIBRES

RAYON
Regenerated cellulose fibre, usually derived from wood pulp.Viscose, modal, lyocell and bamboo are different types of rayon.

VISCOSE
Uses regenerated cellulose polymer obtained by the viscous process from wood and vegetable fibres.

MODAL
Its production process uses beech trees with a process similar to that of viscose. Lenzing Modal® process only uses trees from sustainably exploited forests (PEFC-certified).

LYOCELL
Lyocell is manufactured in a close circuit loop system that recycles almost all the chemicals used. Tencel® is the brand of lyocell marketed by Lenzing AG.

CUPRO
Cupro is an artificial cellulose fibre made from cotton waste. The whole process is performed in a closed loop circuit.

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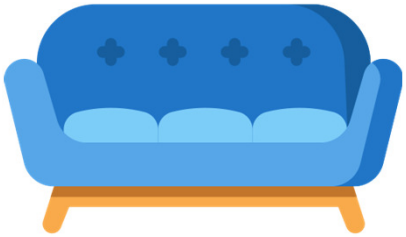
Natural polymer-based fibres: REGENERATED CELLULOSE FIBRES

Applications:

Fashion
Underwear
Socks



Garden furniture
Textiles for decoration

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Natural polymer-based fibres: MILK FIBRES

Milk protein fibre is manufactured from waste milk (2 million tons are disposed of around the world in a year) through a bioengineering technique that offers environmental benefits.

Milk fibre is made from 100% renewable resources and thanks to an eco-efficient production technology, it presents significant advantages for consumers and the environment:

- Fast production
- High level of profitability and minimal CO_2 emissions.
- Free of waste production process.

Figure 9. Appearance of milk fibre[9].

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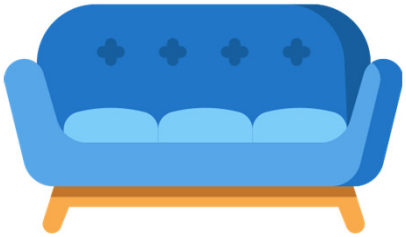
Natural polymer-based fibres: MILK FIBRES

Applications:

Clothing
Underwear
Socks



Household textiles
Towels
Bed sheets

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Natural polymer-based fibres: SOY FIBRES

It is made by distilling soy protein and refining it. Then, an auxiliary agent and biological enzymes are added making the spatial structure of the protein change. Polymers are then added to the liquid mixture and temperature is applied. The threads are extracted by wet spinning technology. Main properties of soy fibres are:

- Can be dyed using acid and reactive dyes
- Good values for fastness to light and perspiration
- Others

Figure 10. Appearance of soy fibre[10].

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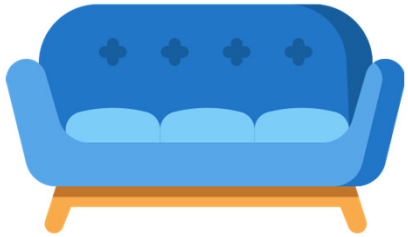
Natural polymer-based fibres: SOY FIBRES

Applications:

Children's clothing
Underwear and outerwear
Sportswear



Home textiles

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Natural polymer-based fibres: ELASTOMER

Elastomeric fibres are those ones that are able to elongate themselves up until 400% and recover its original aspect rapidly and repeatedly.

Rubber can be transformed into an elastomeric fibre.

Rubber natural fibres are produced from the salvia extracted from a tree called *Hevea brasiliensis* and the rubber is produced after its coagulation.

Figure 11. Appearance of elastomer fibre[11].

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Natural polymer-based fibres: ELASTOMER

Applications:

Sportswear
Lingerie

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3.2.2. Synthetic polymer-based fibres

TEXTILE FIBRES

- **NATURAL FIBRES**
  - **ANIMAL**
  - **VEGETAL**
    - **SEED**
    - **BAST**
    - **LEAF**
    - **FRUIT**
  - **MINERAL**
- **MAN-MADE FIBRES**
  - **ORGANIC**
    - **NATURAL POLYMER**
      - Chitosan
      - PLA
      - Alginate
      - Fibres with a cellulosic base
      - Fibres with a cellulosic base + additives
      - Milk fibres
      - Soy fibres
      - Elastomer
    - **SYNTHETIC POLYMER** ←
      - Recycled polyester
      - Recycled polyamide
  - **INORGANIC**

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Natural polymer-based fibres: RECYCLED POLYESTER

Recycled polyester, also known as rPET, is made by melting down existing plastic (PET) and spinning it back into new polyester fibre. While much attention is paid to rPET made from consumer-discarded plastic bottles and packaging, it can also be made from post-industrial materials.

- Not biodegradable
- Reusing material (2nd life)
- As good as non-recycled PET
- Less production energy and resources than PET
- Recycling limitations
- Non-sustainable recycling process
- Microplastics

Figure 12. Appearance of recycled polyester fibre.

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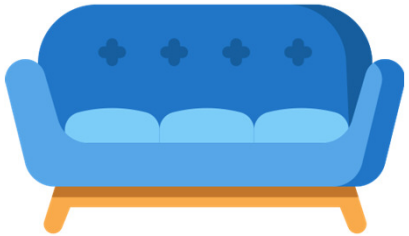
Natural polymer-based fibres: RECYCLED POLYESTER

Applications:

Clothes
Sportswear



Pillows cover
Curtains
Bed sheets
Carpets

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Natural polymer-based fibres: RECYCLED POLYAMIDE

The raw material source for recycled polyamide (PA) uses to be old fishing nets and carpets, as well as waste from the manufacturing industry.

Some companies have patented a recycling process that transforms post-industrial technical textiles, like airbags, into premium plastics. This technology offers new products that are more ecological and with similar performance to those made of PA.

Figure 13. Recycled polyamide fibre[13].

- Reduced carbon footprint
- Reduction to al half non-renewable resources

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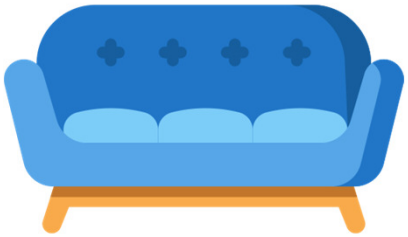
Natural polymer-based fibres: RECYCLED POLYAMIDE

Clothes

Airbags
Wheel covers



Carpets

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Thank you for your attention!

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