

# Chemistry

**The complexity of synthetic and natural fibres**

RecyCOOL Lessons

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# The complexity of synthetic and natural fibres

## **Description of the lesson**

In this lesson you will feel your clothes, what's the difference between different materials?

You will learn about their chemical structure and what the difference between natural and synthetic fibres is. You will also explore a way to test whether your fabric is made with synthetic materials.

## **Objective**

The objective of this lesson is to understand the differences between natural and synthetic fibres and recognize them by touch.

## **After this lesson you will be able to**

- recognize the difference between natural and synthetic fibres through touch, how they feel like and where they come from
- talk about the different structures of natural and synthetic fibres
- know the different impact on the Earth

## **Tools and materials**

your own wardrobe or the clothes you and others are wearing, pen and paper

## MATERIAL QUALITY:

This means how good a material is.

## LAYER:

For example an onion has many layers.

## HUMID

Something that is slightly wet or damp.



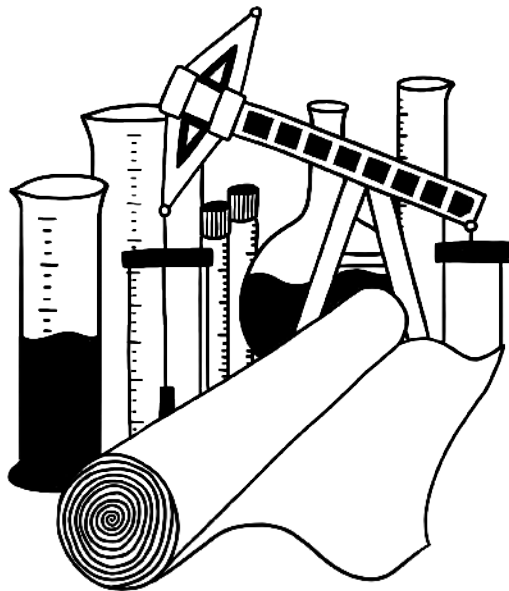
Have you ever noticed that different garments feel differently, by touch, some are softer, some can crinkle?

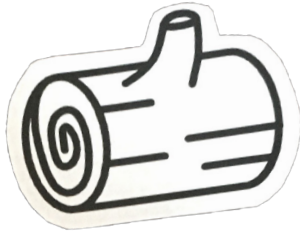
Note down your thoughts.

Do you have any idea why this is?

Today we are going to look at what our clothes are made of. Write down a list with materials you know or can find on the labels from your Shirt.

**Do you know which raw material these fabrics are made from?** Add to your list and write down all the raw materials that make up the fabrics.





## FIBRE

polyester

nylon

elastane

cotton

wool

modal

viscose

Tencel

linen



## ORIGIN

fossil fuels

fossil fuels

fossil fuels

cotton plant

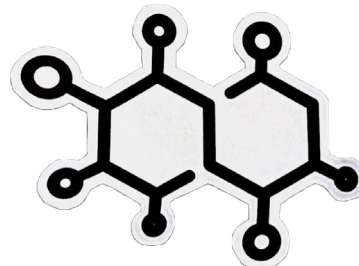
sheep

wood

wood

wood

flax plant



For example, polyester is made from polyester granules, which are made of fossil fuels. **This is the same basic material as PET bottles.** To make fibres for your clothing, the granules are heated to about 280 degrees and then pressed through very thin spinnerets. This creates very fine threads that are spun together. **For clothing, they are often ripped apart again, spun together, twisted and otherwise differently finished.**

Polyester is basically complex polymers strung together. **These are so complex and tightly bound together that they are very difficult to break down.**

In contrast to that, natural fibres naturally have a very complex structure. These, of course, are not pressed by nature through spinnerets. The fibre is built up in many layers. **In the middle there is a cavity, then the second wall with some layers with strands running in opposite directions.**

Then comes a layer that is responsible for the fibre winding up to 60 times per centimetre. The first wall is divided into two layers, The first wall divides into two layers with different protective functions and then on the outside comes the cuticle, another protective layer.

**The cotton fibre consists largely of cellulose.** Cellulose is also a polymer, but it is composed of simple sugars via a different compound.

**That is why it is more degradable.** Due to its layered structure, cotton fibre has great functions. **Cotton fabric is a good insulator when dry, absorbs water well, is breathable, and if grown organically, is better for the skin, in comparison to polyester.**

It is also very common to mix fibres. There is only one huge problem with it, that makes recycling nearly impossible.

Okay, different fibres are made from different materials. But how does the difference manifest itself? **Compare how different the clothes feel, how different is the touch of the fabric?** Feel in your closet with closed eyes. You will probably experience different textures by touching different fabrics.

**Take out any garments that you think are made of natural fibres, put them in a pile and the ones that are made of synthetic fibres, place in a separate pile.**

Were you right? If there is no label in your shirt, you can't know for sure. But you can ask your classmates, friends or family what they think.

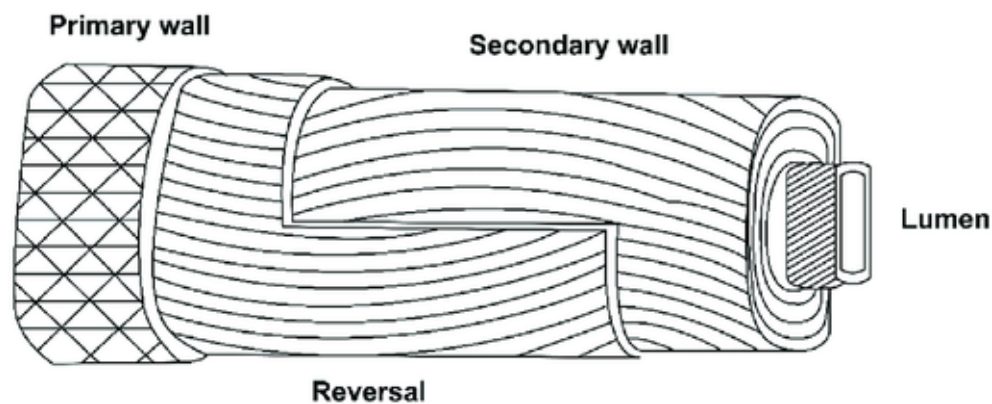


Photo credit: M. Dochia and Z. Roskwitalski

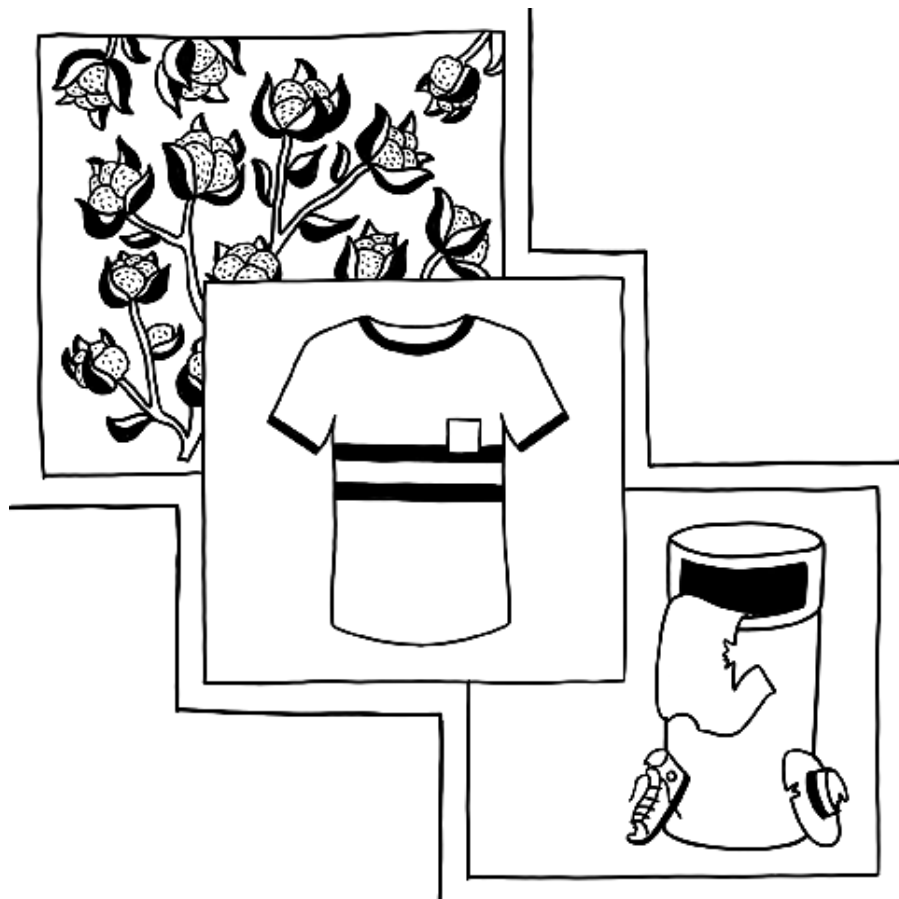


This video explains how to recognize materials by touch. If you want to learn more, you can have a look at [this video](#).

The video shows you different opportunities of recognizing fibres: Wrinkle the fabric in your hands. **If the wrinkles stay, there is a high chance it is natural.**

If you are unsure, keep the fabric in your hands for some time, if it gets humid and warm, there are probably synthetic fibres involved. (think of the plastic bottles, that are the same material. Plastic bottles also would not absorb any humidity)

**Keep in mind: there are many fabrics that are mixed of natural and synthetic fibres, so it is often not easy tell.**



# Reflection

Did you know that a high percentage of our clothes are made of plastic?

How does it feel to know you are wearing plastic on your skin?

Was it easy for you to recognize the different materials?

Have you ever felt a difference before or did you choose specific garments due to their material?

What material is your favourite garment made of?



# Resources

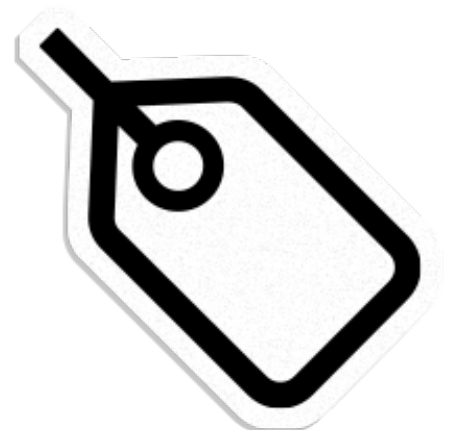
Thomas Seilnacht. 2022. Available at: [https://www.seilnacht.com/Lexikon/k\\_polyes.html](https://www.seilnacht.com/Lexikon/k_polyes.html)

M. Dochia, Z. Roskwitalski, in Handbook of Natural Fibres: Types, Properties and Factors Affecting Breeding and Cultivation, 2012. Available at: <https://www.sciencedirect.com/topics/materials-science/cotton-fiber>

## Attachments:

How It's Made Polyester (National Geographic)  
<https://www.youtube.com/watch?v=zYkglUysDKk>

Burn test  
<https://www.youtube.com/watch?v=stTUA5ckhc8>



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