

Identification of Textile Fibres by means of Pyrognostic Analysis



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Picture 1. Alcohol burner

1 Objectives

1.1 Didactic

- Knowing and applying the experimental methods needed for the identification of textile fibres by means of pyrognostic analysis.
- Identifying the textile materials by their behaviour during the pyrognostic tests.
- Classifying the cellulosic, protein and synthetic fibres.
- Getting fibres from fabrics.

2 Theoretical introduction

Textile materials are the basis of fashion, so choosing the right one is the key to get a successful project. Knowing about the properties of the fabric is very useful to foresee its behaviour when handled and to guarantee its suitability for the chosen design and for its final use.

The procedure used to identify the fibres of a fabric will depend on the nature of the sample, on the experience of the analyst and on the available equipment.

One of the simplest tests is the identification by means of pyrognostic analysis (from Greek pyr, fire, and gnosis, knowledge). It is a very simple method that will give us information about the nature of the fibres that make up the fabric which we are working with, just studying its behaviour when brought up to a flame.

This test, also known as burning test, consists of bringing fibres or yarns up to the flame of the fabric we want to identify, analyzing its way of burning, the odour it produces and the waste remaining after the burning.

If the sample is made up of just one fibre, the test will show if the fibre is cellulosic, protein or synthetic. Mixtures of fibres can't be identified by the burning test.

The following table shows the behaviour of some textile fibres when brought up to the flame.:

	FIBRES	Behaviour up to flame	Behaviour in flame	Behaviour removed from the flame	Type of Smoke	Odour	Waste
NATURAL	CELULOSIC Cotton Linen	It doesn't melt, it doesn't shrink and it goes away from the flame	It burns quickly and without melting	It goes on burning without melting	Grey	Burnt paper	Grey and very light ash with smooth edges.
	PROTEIN Wool Silk	It melts down, it curls up and it goes away from the flame	It burns slowly and melting a bit, yellow flame	It goes on burning very slowly and it self-extinguishes	Grey	Burnt hair	Crashable black ash
ARTIFICIAL	Acetate Triacetate	It melts going away from the flame	It burns slowly while melting, yellow flame	It goes on burning and melting	Grey	Acetic acid, Vinegar	Brittle and black ashes of spheroidal shape
	Rayón viscose Lyocell	It doesn't melt nor shrink	It burns quickly without melting yellow flame	It goes on burning without melting	Grey	Burnt paper	Grey, very light and with smooth edges ash
SYNTHETIC	Polyamide	It melts down and it shrinks going away from the flame	It burns slowly melting down, yellow flame	It self-extinguishes almost always	Grey	Boiled celery	Hard and resistant ashes of black colour and of spheroidal shape
	Polyester	It melts down and it shrinks going away from the flame	It burns slowly and it melts, yellow flame	It self-extinguishes almost always	Black	Aromatic sweet	Hard resistant black ashes spheroidal shape
	Acrylic	It melts down and it goes away from the flame	It burns melting, bright flame	It goes on burning and melting	Black	Acrid, pungent, unpleasant	Gummy, black ashes of spheroidal shape
	Modacrylic	It melts down and it goes away from the flame	It burns very slowly, melting without a flame	It self-extinguishes	White	Sweet, like a gum	Hard and brittle ashes, of black colour and of spheroidal shape
	Polyethylene Polypropylene	It melts and it shrinks going away from the flame	It burns and melts, bright flame	It continues burning and melting	Cerulean Steam	Melted wax	Hard resistant brownish ashes, with spheroidal shape

Table 1. Behaviour of some textile fibres when brought up to the flame.

3 Materials, equipments and working tools

3.1 Materials

- 1 sample of 10x10 cm of pure fabric of vegetable fibre.
- 1 sample of 10x10 cm of pure fabric of animal fibre.
- 1 sample of 10x10 cm of pure fabric of artificial fibre.
- 1 sample of 10x10 cm of pure fabric of synthetic fibre.
- 1 sample of 10x10 cm of fabric made up of a mixture of fibres.

3.2 Equipments and working tools

- 1 scissors.
- 1 tweezers or tongs.
- 1 pin or bradawl.
- 1 magnifying glass or thread counter.
- 1 alcohol burner.
- 1 porcelain capsule or similar bowl with some water.
- 1 EPI.



Picture 2. Working tools.



Picture 3. Extraction of threads.

4 Experimental procedure

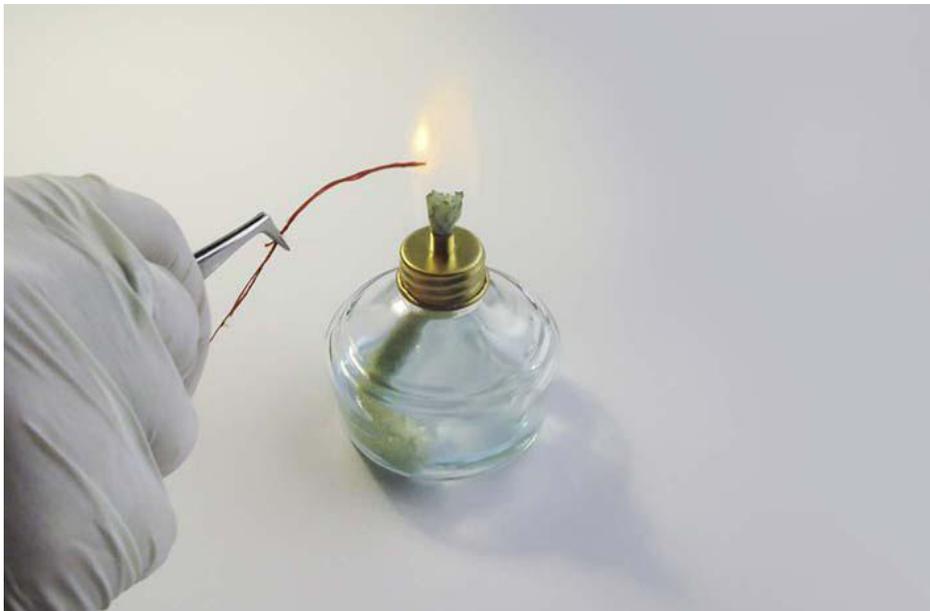
Students number: 1

Time: 2 hours

It will be done an experiment per each one of the samples, proceeding like this:

- I. Unravelling and taking out several yarns from the fabric.
- II. Verifying if seemingly there are differences among them as regarding the brightness, the twisting or the colour.

- III. Getting the yarns apart if there are clear differences among them, this shows that there may be two or more different fibres in the sample.
- IV. Holding the yarns horizontally with the help of tongs.
- V. Approaching the yarns slowly to the edge of the flame and observing their behaviour.
- VI. Checking if they curl up, shrink or if they go away from the flame.
- VII. Bringing the sample up to the flame and observing its behaviour.
- VIII. Checking if it melts or if it burns and if it does it slowly or with difficulty.



Picture 4. A yarn in the flame.



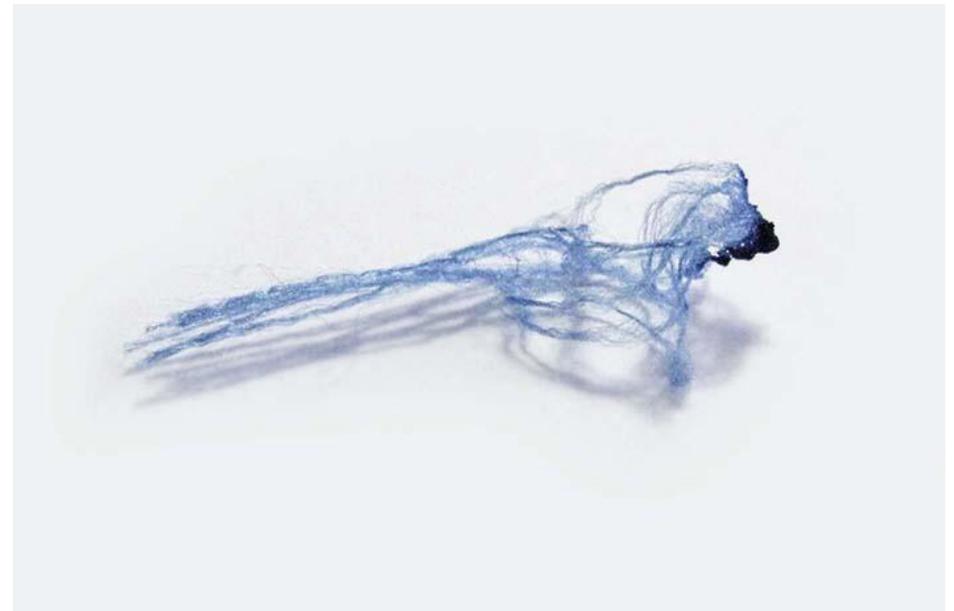
Picture 5. Yarn going away from the flame.

- IX. Analyzing the flame that is produced during the burning determining its colour and brightness.
- X. Analyzing the kind of smoke that it gives during the burning establishing its colour.
- XI. Analyzing the odour that it gives during the burning.
- XII. Checking if the odour is like burnt paper, burnt hair, vinegar, boiled celery, melted wax, sweet, aromatic or unpleasant.
- XIII. Removing the sample from the flame and observing its behaviour.
- XIV. Checking if it keeps burning with or without melting and if it self-extinguishes.

- XV. Letting the rest of the fibre drop inside the capsule with water just in case it doesn't go out on its own
- XVI. Examining the characteristics of the waste.
- XVII. Checking the amount of ash and determining its colour and its shape. Establishing also if it is soft, hard or fragile.
- XVIII. Repeating the process in order to verify the obtained results.



Picture 6. A yarn when is removed from the flame.



Picture 7. Waste.

5 Safety and work specific rules

5.1 Safety and handling of the equipments

a) Using the alcohol burner

Before lighting the burner we have to check that there isn't any flammable material nearby. To extinguish the burner we must put the cap on it, never blow it out. To refill the burner we have to make sure that it is completely extinguished and we mustn't fill it to the brim. In case some drops of alcohol were spilled over we'll clean it all before lighting the burner again.

b) Burns

Special attention must be paid when working with samples of fabrics that are made up of fibres which burn off melting. If there are small burns, we must wash the affected area with cold water.

5.2 Waste materials management

A rest of threads will be kept for later practices. The ashes and waste of burn will be managed as is indicated in Table 2.

	Blue container Paper and cardboard	Yellow container Plastics	Green container Glass	General container Mixed waste
urban waste	Not applicable	Not applicable	Not applicable	ashes and waste of burn
Chemical waste	group I Halogenated solvents	Not applicable		
	group II Non halogenated solvents	Not applicable		
	group III Watery Solutions	Not applicable		
	group IV Acids	Not applicable		
	group V Oils	Not applicable		
	group VI Solids	Not applicable		
	group VII Special	Not applicable		
Dyes	Not applicable			

Table 2. Waste management

6 Instructions to elaborate the memory

The memory will contain the following:

- a) Front page
- b) Index
- c) Registration of results

We'll make a table as the right one (Table 3) where the observed results will be registered.

- d) Interpretation of results

In accordance with the obtained results we'll be able to identify the textile fibres that are making up the samples of pure fabrics, classifying them in cellulosic, protein and synthetic. If we get enough data from one of the samples of the experiment we'll be able to say the name of the fibre.

- e) Bibliography and resources

Samples	1	2	3	4	5
Behaviour when approaching to the flame					
Behaviour in the flame					
Behaviour when removing from the flame					
Odour					
Waste					

Table 3. Registration table

7 Complementary documentation

7.1 Bibliography

HOLLEN, Norma. *Introducción a los textiles*. Editorial Limusa. México D.F. 1999. ISBN: 968-18-1898-9.

7.2 Related practices

- Identification of fibres for microscopy.

7.3 Multimedia resources

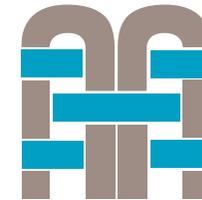
Video of the practice:

Behaviour of the cellulosic, protein and synthetic fibres in a flame.

Available in:

- 1 [http:// www.laboriodemoda.com](http://www.laboriodemoda.com)
- 2 [http:// fashionlaboratory.org](http://fashionlaboratory.org)

**This study guide is part of a living process.
It is important for us to be open to the changes produced by its implementation.
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