

# ZIENTZIA AZOKA

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### How can we clean stains from clothes without soap?

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**HYPOTHESIS:**

Is it true that the water in an increasing temperature cleans better?  
And if we add substances like vinegar, lemon juice and bicarbonate?

**INTRODUCTION:**

In this project we want to verify whether water at different temperatures affects the removal of certain stains from clothes (mainly oil and wine stains).

To do this, we introduced the stained clothes into water at different temperatures and observed which water was more murky (as an indication that the clothes were cleaner) or contained more lipids.

In addition, we used lemon juice, baking soda and vinegar together with the water to see if we could achieve better cleaning.

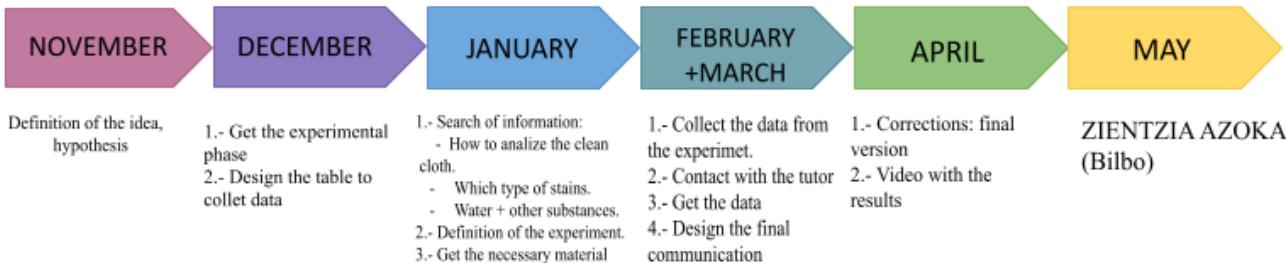
A colour-based method (Sudan III) was used to detect lipids and a visual method was used to test the cleanliness of the wine stains.



**Image 1:** materials used in the experiments

## MATERIALS AND METHODS:

In the following image you can see how we organised the work to develop our project



### OIL EXPERIMENT:

#### Materials:

Cloth,  
oil,  
water at different  
temperatures,  
termometre,  
bicarbonate,  
lemon juice,  
vinegar,  
test tubes,  
pipette, casseroles,  
heater,  
cylinder,  
a spoon  
camera

#### Procedure:

- Put of 1ml of oil on a cloth
- Insert this stained cloth into 100ml of water at room temperature, 25º C and 50ºC.
- Wait 10 minutes and take 10ml of the dirty water in each test tube.
- Heat and mix the Sudan III with alcohol and put a different amount of it in the three test tubes (0'1ml, 0'5ml, 1ml).
- Repeat the procedure adding
  - 10ml of lemon juice to the second casserole,
  - in the third recipient we added a spoonful of bicarbonate, and
  - in the last one we poured 10 mL of vinegar.

EXPERIMENTS	Oil stain	Oil stain	Oil stain
WATER	H <sub>2</sub> O room temp	H <sub>2</sub> O at 25°C	H <sub>2</sub> O at 50°C
WATER + LEMON JUICE	H <sub>2</sub> O room temp + 10 mL lemon juice	H <sub>2</sub> O at 25°C + 10 mL lemon juice	H <sub>2</sub> O at 50°C + 10 mL lemon juice
WATER + VINEGAR	H <sub>2</sub> O room temp + 10 mL vinegar	H <sub>2</sub> O 25°C + 10 mL vinegar	H <sub>2</sub> O 50°C + 10 mL vinegar
WATER + BICARBONATE SODA	H <sub>2</sub> O room temp + Spoonful baking soda	H <sub>2</sub> O 25°C + Spoonful baking soda	H <sub>2</sub> O 50°C + Spoonful baking soda

- Take a picture of the test tubes .
- Compare the color obtained with pattern made of the Sudan III
- the darker the colour, the more waste cleaned.

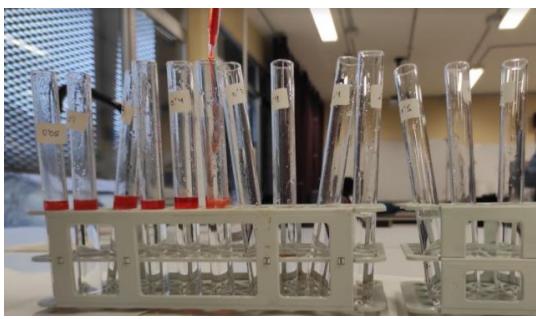


Image 2: Pattern of Sudan III



Images 3-4: preparing the experiment with oil stains



**Image 5:** experiment with oil stains

### How to prepare Sudan III

Sudan III is a fat-soluble dye that is used to color nonpolar substances such as oils, fats, waxes, greases,...

We take 1g of sudan III and we mix it with 100 ml of ethyl alcohol and water. We put the mixture in the heater at 70° C for 10 minutes until it dissolves. Then we filter it and then we reserve it in a beaker and with a spatula mix it again to finally cover it to use it the following days. As it is insoluble in water and soluble in fats, like this we can distinguish the oil from the water in the test tubes.



**Image 6:** preparing the Sudan III

### WINE EXPERIMENTS:

#### -Materials:

Cloth,  
wine,  
oil,  
water at different  
temperatures,  
termometre,  
bicarbonate,  
lemon juice,  
vinegar,  
test tubes,  
pipette,  
spoon,  
casserole,  
beaker and  
a cylinder.

#### -Procedure:

1. We are going to cut a cloth in small pieces and insert it for five seconds in a beaker wine.
2. Take the cloth with wine and add it to water in different temperatures and substances.

EXPERIMENTS	Wine stains	Wine stains	Wine stains
WATER	H <sub>2</sub> O room temp	H <sub>2</sub> O at 25°C	H <sub>2</sub> O at 50°C
WATER + LEMON JUICE	H <sub>2</sub> O room temp + 10 mL lemon juice	H <sub>2</sub> O at 25°C + 10 mL lemon juice	H <sub>2</sub> O at 50°C + 10 mL lemon juice
WATER + VINEGAR	H <sub>2</sub> O room temp + 10 mL vinegar	H <sub>2</sub> O 25°C + 10 mL vinegar	H <sub>2</sub> O 50°C + 10 mL vinegar
WATER + BICARBONATE SODA	H <sub>2</sub> O room temp + Spoonful baking soda	H <sub>2</sub> O 25°C + Spoonful baking soda	H <sub>2</sub> O 50°C + Spoonful baking soda

3. Then hang up the cloth pieces and let them dry up.
4. See which one cleans better the cloth and take photos.



**Image 7:** experiments with wine stains

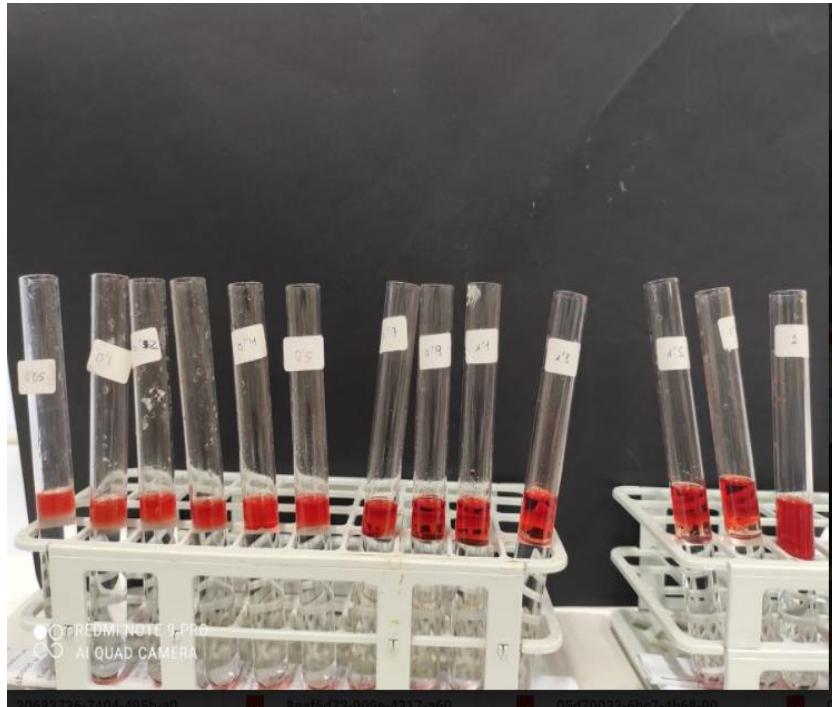
## RESULTS:

In the case of the experiments carried out with oil stains, once the oiled clothes were placed in water (at different temperatures and with different composition), we assumed that if the clothes are washed, it is because the oil has passed into the water.

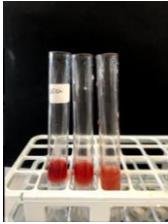
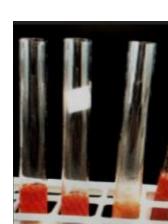
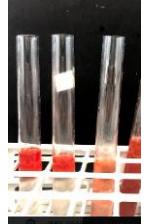
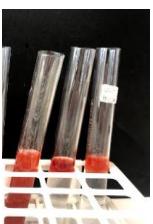
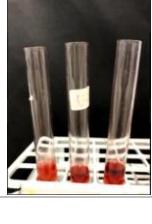
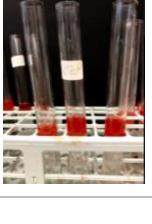
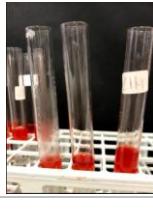
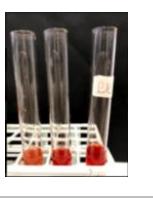
We have compared the results of the oil-stained water with a Sudan III scale at different concentrations that has been used as a standard.

In the following pictures, you can see the colouring obtained by the dirty water.

## OIL STAINS

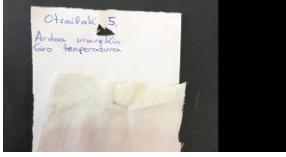


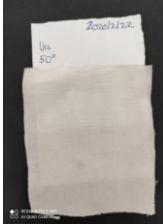
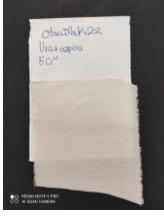
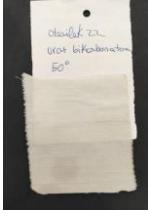
**Image 8:** Sudan III standard

	100ml WATER	100ml WATER + 10ml VINEGAR	100ml WATER + 10ml LEMON	100ml WATER + 10ml BICARBONATE
ROOM TEMPERATURE	<b>Image 9:</b> 3 test tubes of each type are shown			
25°C				
50°C				

- At room temperature, the water types that have taken more oil are the just water and the water with bicarbonate, because that are the darkest ones.
- In 25 degrees the just water and the water with vinegar are the darkest, so they are which they have taken most oil.
- At 50 degrees the one with just water is the darkest, so is the one that took more oil.

### WINE STAINS:

	100ml WATER	100ml WATER + 10ml VINEGAR	100ml WATER + 10ml LEMON	100ml WATER + 10ml BICARBONATE
ROOM TEMPERATURE				
25°C				

	100ml WATER	100ml WATER + 10ml VINEGAR	100ml WATER + 10ml LEMON	100ml WATER + 10ml BICARBONATE
50°C				

- At room temperature, the cleanest is water with bicarbonate, because it has no red color.
- At 25° C too the water with bicarbonate is the cleanest cloth, but the one with just water is very clean too.
- In the last one, at 50° C the one with lemon juice is dirty, but the other three have been cleaned.

## CONCLUSION:

In the experiment of the oil stains, the experiment that involved just water at 50°C has cleaned the stains better. So the temperature matters.

In the experiments with wine stains, the bicarbonated water has been the best cleaning stains, but at 50° C vinegar and just water have cleaned the stains too.

Our hypothesis was correct, the hottest water cleaned the stains the best.

Although we have concluded what is shown above, it must be said that the method used can lead to mistakes, as the light of each day can change the shade of the fabric of the garment. For best results, it would be advisable to use techniques that always use the same light.

This experiment can be done by comparing more types of stains and their effect on different clothing fabrics. It would be very interesting if clothes could be washed in a more environmentally friendly way, without the need to use synthetic soaps.

## BIBLIOGRAPHY:

### HOW TO MEASURE THE TURBIDITY OF THE WATER

- <https://www.youtube.com/watch?v=VkbEFHA2KQ>
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- <http://academic.uprm.edu/gonzalezc/HTMLobj-859/maguaturbidez.pdf>

## ACKNOWLEDGEMENTS

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## Zientzia Azoka abian!



Gaur **Uxue Sánchez kimikaria** izan da DBH3ko ikasleekin bere ikerketa proiektuari buruz hitz egiten. Kimikako teknikak arkeologiako ikerketan aplikatzen ari da. Horrez gain, ikertzaile baten ibilbidea zertan datzan ere argitu die ikasleei eta hauek hainbat galdera egiteko aukera izan dute.

Orain, guk ere gure proiektua lantzen jarraitu behar dugu.

Picture from the school's website