Adding Soap Decreases Surface Tension of Water

Shelly

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INTRODUCTION

"Surface tension is the tendency of liquid surfaces to shrink into the minimum surface area due to the cohesive nature of their molecules." (Wikipedia, 2022) Here comes a question, how does soap change the water's ability to stay on a penny? When we wash dirty dishes or clothes, for water to flow more easily into the small spaces to clean thoroughly, you need to decrease its surface tension. So, we can develop the hypothesis that adding soap can decrease the surface tension of the water.

MATERIALS AND METHODS

Table 1. Materials required in the experiment

50mL beakers*2	Pennies*2
Droppers*2	Paper towels
Tap water	Soapy water

Experimental design:

The experiment is divided into two groups: the controlled group (tap water) and the experimental group (soapy water).

The independent variable of the experiment is the presence of soap in the water which can be changed by adding soap to one of the groups while the other does not.

The dependent variable of the experiment is the maximum number of water droplets that can stay on a penny, which can be measured by counting the maximum number of water droplets until the water begins to spill over the sides of the penny.

The controlled variable of the experiment is the height/speed of dropping and the amount of water in one drop. We should always drop at the same vertical height (from the dropper to the penny) during the experiment, and control the time interval between the two drops the same. We should also make sure the amount of water in one drop is equal in each trial.

RESULTS

Table 2. The maximum number of water droplets that can stay on a penny

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average
Tap water	42	33	31	29	44	35.8
Soapy water	32	25	30	18	21	25.2

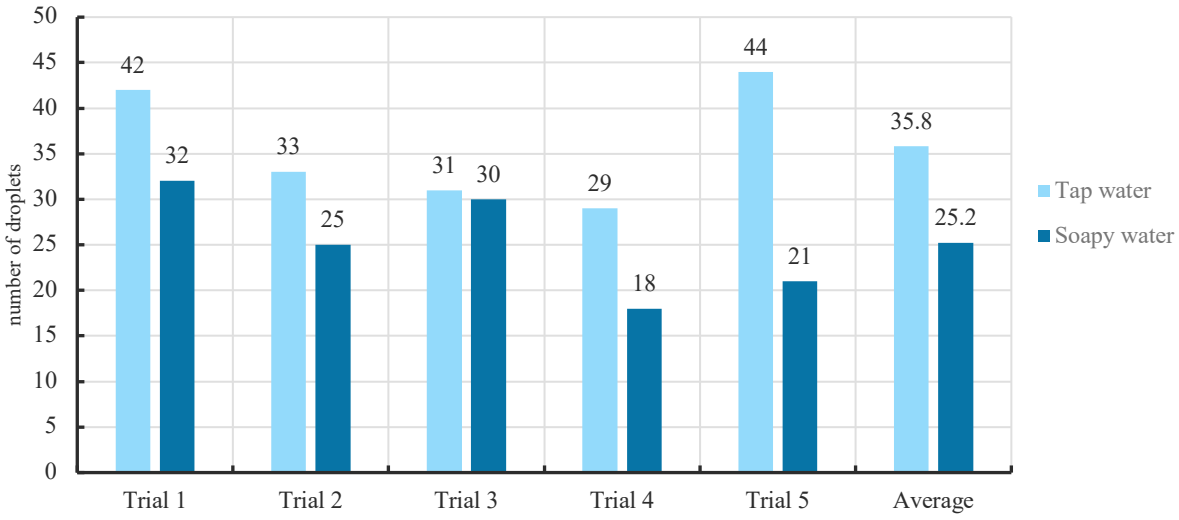

Figure 1. The maximum number of water droplets that can stay on a penny

Table 2. and Figure 1. shows that a penny can hold more tap water droplets than soapy water droplets.

DISCUSSION

Conclusion:

The hypothesis is supported by the experiment. Adding soap decreases the cohesive force of water molecules and decreases the surface tension of the water.

This is because soap molecules are composed of long chains of carbon and hydrogen atoms. One end of the chain is hydrophilic while the other end is hydrophobic. “In soapy water, the hydrophobic ends of the soap molecule repel water and push their hydrophobic ends out of the

surface water molecules, this separates the water molecules from each other and therefore weakens the hydrogen bonds holding the water molecules together at the surface, causing the decrease in surface tension." (Ron Hipschman, 1995)

Evaluation:

The experiment's data is quantitative, leading to the problem of accuracy. The material used cannot make sure that the amount of water in one drop is the same in each trial because we cannot measure the volume of water on the penny, which could easily affect the results of the experiment. Therefore, it is inaccurate to use the number of water droplets to convert the surface tension of water.

We can use a syringe instead of a dropper to make the data more reliable. We just need to look at how much water is left in the syringe and calculate how much water has been pushed out of the syringe by subtracting this value from the initial value. This method is more accurate because the syringe directly measures the volume of water on the coin.

Since the height is also difficult to control without using tools, the results can also be easily influenced. So, we can find something like an iron stand to fix the position of the syringe to keep the vertical distance between the syringe and the penny the same in each trial.

REFERENCES

https://en.wikipedia.org/wiki/Surface_tension (2022)

https://www.exploratorium.edu/ronh/bubbles/soap.html (Ron Hipschman, 1995)