



To investigate the effectiveness of removal of stain on cloth using a plethora of natural cleaning agents

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Abstract

The aim of the experiment was to find out which natural cleaning agent works best to clean a stained cloth. We used a range of cleaning agents from a mixture of vinegar and baking soda to citric acid and saltwater to remove stains from stained cloth. The amount of red ink removed was determined by the amount of light that could pass through the liquid with the dissolved stain using a colorimeter. Our results showed that the mixture of vinegar and baking soda was the best stain remover. We boiled it down to two reasons, abrasiveness and the pH value, mainly the acid-base reactions that determine the effectiveness of the cleaning agent.

Introduction

Laundry detergent most likely contains carcinogens (substances capable of causing cancer in living tissue). Most people may be using toxic laundry detergents to clean their family's clothes. This is because there are harmful toxins in the detergents like fragrance and bleach which can cause problems to humans. In our opinion, using natural detergent will be less harmful towards the human body especially for children and elderly whose skin is more sensitive. Also, families who are not financially stable will try their best to save money and this may be one of the ways people do so as the ingredients used in these natural detergents are not costly. Through investigating the effectiveness of removal of stain on cloth using different cleaning agents, we are able to conclude which natural cleaning agent is the best in removing stains from clothes. This also provide research which may help in future investigations on the different effectiveness of natural cleaning agents.

Theoretical background

Most household cleaning products on market shelves today contain many harmful and hazardous toxins and chemicals. These hazardous toxic substances can enter the body through ingestion, inhalation or absorption through the skin, which can affect the heart, lungs, kidneys, liver and the brain and have the potential to cause many serious health problems.

Natural cleaning agents are non-toxic unlike most cleaning agents that are commonly made of chemicals that can damage the environment as well as the human body.

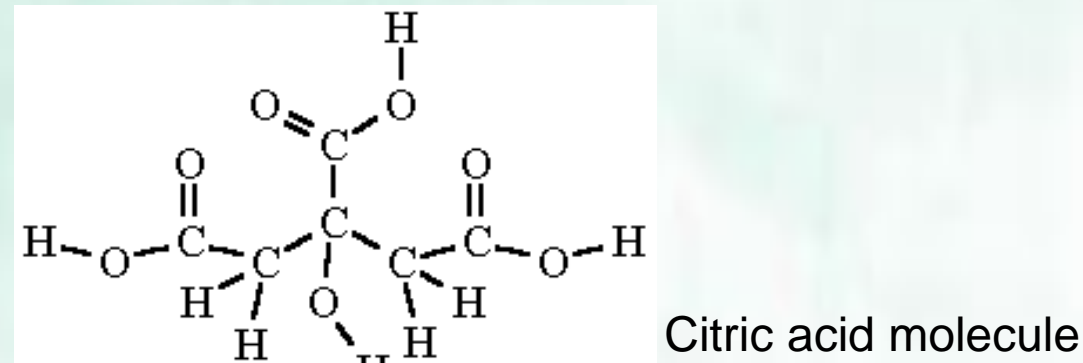
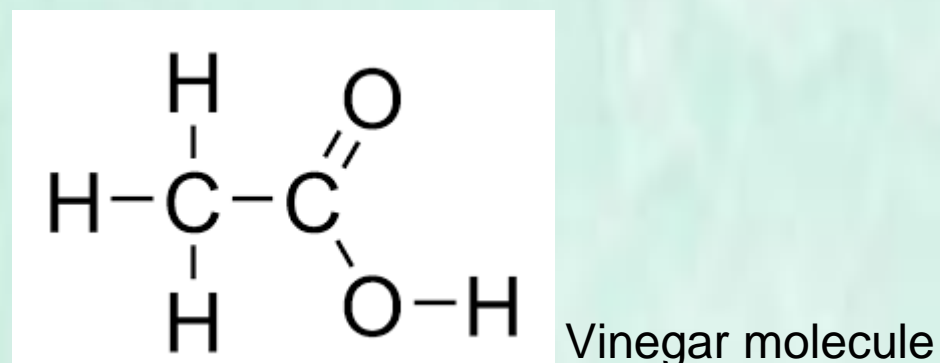
The natural cleaning agents we are using are salt, citric acid, white vinegar and baking soda.

Citric acid is often found in lemons and oranges thus leading many to use lemons as a cleaning agent and companies also add lemons into the cleaning agents to preserve the cleaning agent. Its pH value is 3.4. Its chemical formula is $C_6H_8O_7$. Citric acid is used in metal cleaners, oven cleaners, dishwasher cleaners, soap-scum removers, bathroom cleaners, tub and tile cleaners, carpet cleaners, dish soaps, laundry detergents, air fresheners, window cleaners, stain removers and dishwasher rinse aids.

Vinegar is a sour-tasting liquid containing acetic acid with a pH value of 2.4. Vinegar contains 5–20% acetic acid (CH_3COOH), water, and other trace chemicals, which may include flavorings. The acetic acid is produced by the fermentation of ethanol by acetic acid bacteria. White vinegar, is usually made of laboratory-produced acetic acid combined with water. White vinegar is the most acidic, which can make it a potent cleaner. Vinegar's acidity is what makes it such a good cleaner. Because vinegar is so acidic, it can dissolve away soap scum, brines left by hard water, and glue left behind by stickers. It can also remove stains because it dissolves the stains in the acid.

Sodium bicarbonate, commonly known as baking soda, is a chemical compound with the formula $NaHCO_3$. It is a salt composed of sodium ions and bicarbonate ions. Baking soda is an alkaline compound formed from a positively charged ion, or cation, and negatively charged ion, or anion. But while ionically speaking baking soda is neutral, its pH is higher than neutral. This means that it is slightly basic. The acid-base reaction is also the reason baking soda and vinegar are cleaning partners in crime. The duo can clean tables and get rid of odours thanks to baking soda. Adding it in equal parts with water makes it a great cleaner because it can get rid of stains.

Table salt has a chemical formula of $NaCl$ with a pH value of 7, making it a neutral salt. Salt is made of one sodium ion and one chloride ion, which gives it a charge when the salt dissociates in water. This allows salt to have a water-absorbing quality. Salt is also abrasive. This allows salt to scrape away stains. Salt's absorbency allows it to absorb aqueous stains. It is effective yet a gentle scrub as it does not ruin surfaces.



Method and Procedure

- 1) Prepare the different cleaning agents (shown in the table) and ensure they are of the same volume (55 ml)
- 2) Put five drops of red food colouring into 20 ml of water
- 3) Stir the solution for 1 minute
- 4) Take 5 drops of the solution and drop it onto the cloth
- 5) Wait for 5 minutes for it to dry then put the cloth into a cleaning agent and make sure that it is fully soaked by using a stirrer to push it to the bottom
- 5) Soak each cloth into each cleaning agent for 15 mins each and take it out
- 6) After that, pour out 2 ml of S, which is the solution after the stained cloth is removed, into the cuvette
- 7) Set up the datalogger and put the cuvette into the colorimeter
- 8) Set the colorimeter to blue light and measure and record the percentage of transmittance
- 9) Repeat Steps 1-9 for each cleaning agent
- 10) Calculate the average of the results
- 11) Compare the percentage difference of transmittance, which is based on the red colouring that has been dissolved in the different cleaning agents, with the control set-up

Data Collected

Citric acid solution: 0.5 g of citric acid + 30 cm^3 of water

Salt solution: 5 g of salt + 25 cm^3 of water

	First Try (T%)	Second Try (T%)	Average (T%)	% difference in transmittance
55 cm^3 of water	85.0	88.2	87.0	NA
25 cm^3 of citric acid solution + 30 cm^3 of salt water	75.8	75.9	75.9	-12.8
5 g of baking soda + 50 cm^3 of citric acid	79.5	84.7	82.1	-5.6
5 g of baking soda + 50 cm^3 of artificial vinegar	84.7	87.1	85.9	-1.3
25 cm^3 of salt solution + 30 cm^3 of artificial vinegar	88.5	83.5	86.0	-1.1
25 cm^3 of artificial vinegar + 30 cm^3 of citric acid solution	86.4	89.9	88.0	1.1
27.5 cm^3 of vinegar + 27.5 cm^3 of water	91.6	87.9	89.8	3.2

Discussion and Conclusion

Based on our results, we conclude that the mixture of citric acid and salt water is the best cleaning solution compared to the rest of the cleaning agents. Based on our findings, the percentage difference in transmittance of light for citric acid and salt water is more than the percentage difference in transmittance of light for the other solutions. This means that the solution of citric acid and salt water, that has been soaked into by the stained cloth, has the least amount of light that can be transmitted so it means more of the stain has been removed. When more of the stain is being removed, the originally clear solution will turn yellowish orange, which causes the amount of light transmittance to decrease. Citric acid is acidic and salt water is neutral. Due to the fact that acid can remove stains by dissolving the stains and the salt water combined with the acid can create an abrasive solution that is able to clean quite well.

As these solutions are made out of natural ingredients, they will not work as effectively as laundry detergents or chemicals used in typical cleaning solutions. However, vinegar and baking soda creates an abrasive and acidic solution, and was able to remove some stains. The combination of salt and vinegar gave almost similar results to the baking soda and vinegar since baking soda is a salt. Therefore the marginal difference would be due to the type of salt used. In this case table salt vs baking soda. Vinegar and citric acid produced results that were slightly unexpected since acid would remove stains, two acids should do twice as well but the results prove otherwise. The baking soda and citric solution mixture stunned us since acids and alkalis were supposed to be good cleaning agents. The cause might be due to the fact that the reaction created more water and carbon dioxide than actual cleaning solution. The last solution proved to be interesting. Vinegar is an acid and since water dilutes solutions, the vinegar could not work as well to remove the stain.

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