UN environment programme

SUSTAINABLE DEVELOPMENT GOALS

GOETHE INSTITUT

Science Film Festival Knowledge Through Entertainment

MAKING A NATURAL CLEANING SOLUTION

KEY OBJECTIVES

Explore the science behind cleaning – test the pH of cleaning solutions
Make an environment friendly all purpose cleaner using fruit waste.
Research the environmental and health hazards of commercial cleaners.

INTRODUCTION

As the human population grows and our lifestyles become increasingly driven by convenience, the pollution to our environment has crossed all acceptable levels. Almost 80 percent of the world's waste water is dumped - largely untreated - back into the environment, thereby contaminating our lakes, rivers, oceans, aquifers and groundwater. Waste water also includes that which flows from the sinks, drains, showers and toilets of our homes. Commercial cleaning solutions commonly used in households today contain a variety of harsh chemicals that contaminate water bodies, cause allergic reactions and result in wide spread accumulation of toxic substances. Is there an effective natural alternative?

In this project, children will explore the science behind cleaning. Using easily accessible natural pH indicators, they will test their household cleaners for acidity/alkalinity and understand why that affects cleaning. Older children can understand the hydrophobic/hydrophilic property of surfactants in a detergent and how that plays a part in its cleaning action. Following this, children will make an all-purpose natural cleaning solution that will be effective for most household purposes.

The solution will be made with easily available and very affordable ingredients – brown sugar, left over fruit peels and water in the ratio 1:3:10. Children can also be encouraged to explore local, cultural and traditional cleaning practices in their communities. They can analyse its effectiveness, environmental impact and affordability, as compared to the harsh chemical cleaners.

GUIDING QUESTIONS

1. **What is a pH scale? How do we measure the pH of a solution? (Natural pH indicators are introduced)**
2. **What is the pH value of some of your household cleaners? Find out.**
3. **Do you know of some kitchen ingredients commonly used as cleaning agents? (Lemon, Tamarind, Wood ash etc.)**
4. **Find the pH of these natural cleaning products. Are they acidic/alkaline?**
5. **What is the science behind cleaning? What is an acidic cleaner used for? What is an alkaline cleaner used for?**
6. **Optional - What are surfactants? What is their role in a detergent? How does their hydrophobic/hydrophilic nature help cleaning?**
7. **What do you know about the ingredients in your household cleaners?**
8. **Is it possible that some/many of the chemicals seen in household cleaners and detergents are harmful to the humans/animals/water bodies?**
9. **Can a natural cleaner made from fruit peel, brown sugar and water suffice for our regular cleaning needs?**
10. **What do you think is the benefit of using citrus peels?**
11. **What do you think will be taking place in the bottle during the next 3 months?**
12. **Why do we use only plastic bottles and not glass bottles for making this solution?**
13. **What is the purpose of brown sugar in the making process of this liquid?**

CONNECTION TO SDGS

TOPICS

CHEMISTRY | BIOLOGY

CROSS LINKS

Water Pollution, Health Hazard, Sanitation

KEYWORDS

NATURAL CLEANER | FERMENTATION | WATER POLLUTION | PH VALUE | SURFACTANT

LEVEL

Primary/Secondary

RESOURCE TYPE

PROJECT

INTENDED AUDIENCE SIZE

50

MODE OF DELIVERY

Small group, Live online

TIME FOR ACTIVITY

Demonstration – 45-60 minutes
Fermentation time – 3 weeks or 3 months (depending on ingredients used)

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MATERIALS/ PREPARATION

For Turmeric pH indicator strips

- Turmeric Powder – 1 tbsp
- Rubbing Alcohol (Hand Sanitizer can also be used) – 25 ml
- Paper – 1 page, cut into strips (absorbent paper is preferable)
- A regular paint brush

Understanding Surfactants (Optional Activity)

- Mason Jar with lid
- Coloured Water – ½ the jar
- Oil – ½ the jar
- Detergent – 2 drops

For Natural Cleaner

- 300 g brown sugar/jaggery/molasses (Always use brown sugar, it contains a higher level of minerals)
- 900 g citrus peels (oranges, lemons, pineapple, sweet lime/ mosambi can be used)
- 3 litres of fresh water
- 1 tsp yeast (optional, using it will reduce the fermentation time)
- For this quantity, use a 5 litre plastic bottle/container (Note: Do not use glass since the gases released can cause it to break)
- If you want to reduce or increase the quantity of cleaner, just remember to follow this ratio of ingredients:
  1 part sugar+ 3 parts fruit waste+ 10 parts water.

TASKS/PROCEDURE

Making Turmeric pH indicator paper

Add the turmeric powder to the rubbing alcohol solution and stir well till it dissolves. Using a brush, paint the yellow solution onto the absorbent paper. Let it dry. Cut into rectangular strips.

Testing for Acidity/Alkalinity

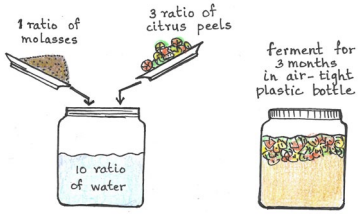
Put a drop of the household cleaning solution on a turmeric strip. Observe the colour of the paper. If it becomes red, the cleaning solution is alkaline (basic) in nature. If it stays yellow, it could be neutral or acidic. In this case, make a turmeric strip red by dipping it in an alkaline solution (eg baking soda). Put a drop of the cleaning solution to be tested on this red strip. If it turns yellow, the cleaning solution is acidic in nature. Use these indicator papers to test the acidity/alkalinity of your household cleaners. Also test the acidity/alkalinity of traditionally used natural cleaners like lemon, tamarind, wood ash etc. Discuss the science of cleaning and the ingredients in common household cleaners.
Note: In case turmeric is unavailable in your locality, there are other natural ingredients that can be used as pH indicators. Eg: Red (Purple) Cabbage

Understanding Surfactants (Optional)

Fill half the mason jar with coloured water. Fill the remaining half with oil. Observe the separation of oil and water. Now add 2 drops of detergent to the jar and shake vigorously. The oil and water have now mixed, showing the role of surfactants in helping oil break up into very small droplets that can be carried away.

Making the Natural Cleaner

Let's now make a powerful cleaning solution using brown sugar, fruit peels and water. Pour the water and sugar into the plastic bottle, mix well. Add the citrus fruit peels to this solution. Firmly seal the container and keep it in a cool, dark place. A fermentation process will take place during which gases will be produced (you can see the sides of the container bulging when this is happening). Therefore it is required to periodically open the lid of the plastic container and release the gases. Record the date of preparation of your natural cleaning solution. Your solution should be ready to use 3 months after preparation. If worms appear, add another 100 g of sugar to the ingredients and tightly close the cap, after some time the worms will disappear. Your finished liquid will be bright to dark brown in colour. Strain and pour the liquid into a bottle and store in a cool, dry and dark place. Dilute with water before using the solution for your cleaning activities.



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FOSTERING DISCUSSION

What can we do with the fruit/vegetable residue after straining the natural cleaning solution?
What does the waste water from our households contain? Where do they end up?
Do you know whether the waste water from your house /apartment goes to a Sewage Treatment Plant (STP)?
What do you think happens when water with toxic chemicals reach our water bodies?
What causes conditions like eutrophication and toxic foam in water bodies?
How can switching to natural cleaners make a difference to the pollution levels in our water bodies?

SAFETY INSTRUCTIONS

- Use only a plastic bottle. If you use a glass bottle, the gases released can result in it breaking.
- During the fermentation period, the lid of the bottle should be periodically opened to release the gases formed.
- Dilute as required with water before using the cleaning solution

POSSIBLE EXTENSIONS

- Try using different vegetables, fruits and their combinations to make natural cleaning agents.
- Talk to your family and explore traditionally used cleaning products in your culture/ community.
- Check the different areas where natural cleaners can be substituted for harsh chemical cleaners.
- Relate SDG 1-No Poverty, SDG 6-Clean Water and Sanitation with the affordability aspect of simple natural cleaning solutions (for older students)

Note: Vegetable residue can also be used for making the natural cleaner, however the liquid will have a sour smell, which is normal and not a cause for concern. If you want your solution to have a pleasant aroma, use citrus fruit peels. In case yeast is used (a teaspoon can be added to the sugar, citrus peel, water solution at the beginning), the fermentation time will decrease substantially. The natural cleaner will be ready within a month's time.

RESOURCE LINKS FOR FACILITATOR

How Cleaning Works:
https://explorationclean.org/
Environmental impacts of detergents:
https://sciencing.com/environmental-impacts-of-detergent-5135590.html

AUTHOR

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