For Students

Brushing up on chemistry

Task description

Students working in groups will fist work at home studying the ingredients of various commercial toothpastes. Then work in class will systematise the study of the ingredients. Next students will prepare in the lab an elementary toothpaste and will compare its action with commercial toothpastes.

Phase 1

Students are distributed by the class teacher in groups of 3-5, and are assigned to work at home studying the composition of some commercial toothpaste of their choice (The teacher however gives directions so that different target products are used, e.g. gum protecting, tooth whitening toothpastes, pastes containing baking soda etc.)

Phase 2

Students work in groups in class to identify chemically the various ingredients, to characterise the function/use of each ingredient, and to group together various ingredients according to their action and function. Students undertake to study further the various categories of ingredients/compounds (one different category by each group). Other uses of these compounds should be given attention too.

Phase 3

Students present their previous work in class to their schoolmates. Each group presents its own category of ingredients.

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Phase 4

Students undertake to prepare in lab a naïve toothpaste, using available at home materials, and testing the action of their toothpaste by comparing it to that of a commercial brand.

SAFETY NOTE! *Students should not use the homemade tooth- paste or eat hard-boiled eggs that have been in the laboratory or in contact with laboratory equipment.*

Part 1: Making coloured eggs[1]

_ 1. Pour about 0.5 cup (120 mL) of boiling water into a glass. Stir in 1 teaspoon (5 mL) of vinegar and 20 drops of food colouring (red or blue recommended).

_ 2. Immerse a hard-boiled egg in the food colouring solution until it is stained with colour (at least 5 minutes).

_ 3. Remove the egg from the food colouring solution and place it on a paper towel to dry. Store the stained egg in a refrigerator overnight if you will not be continuing the Activity until tomorrow. Otherwise, go on to step 4.

Part 2. Make and test toothpaste

_ 4. Measure two teaspoons (10 mL) of baking soda and a quarter teaspoon (1.25 mL) of salt into a plastic cup. Stir until well mixed.

_ 5. Add three-quarters of a teaspoon (3.75 mL) of glycerine to the baking soda/salt mixture. Stir it as thoroughly as possible. The mixture will be thick. Add water with a dropper while stirring until the mixture has about the same consistency as commercial toothpaste.

_ 6. Rinse the coloured egg with water and scrub it with a toothbrush. What happens to the color? Record the results.

_ 7. With a black permanent marker, draw a line on the eggshell, dividing its surface in half. Label one side **C,** for commercial toothpaste, and the other side **H,** for home-made toothpaste.

_ 8. Place a pea-sized amount of commercial toothpaste on the toothbrush, then brush side **C** of the stained egg for five strokes (one stroke equals one complete back-and-forth motion). (Picture 1). Rinse the egg and toothbrush thoroughly with water. Then, place a

pea-sized amount of homemade toothpaste on the toothbrush and brush side **H** for five strokes. Rinse the egg and toothbrush with water again. Record the results.

[1] The coloured eggs could be provived ready by the instructor.

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Picture 1 – Students testing their toothpaste in a Greek ninth-grade class.

_ 9. Measure the pH of water, the commercial toothpaste, and the homemade toothpaste using paper. Record your observations.

_ 10. Compare the abrasiveness (scratchiness) of the homemade and commercial toothpastes by rubbing a pea-sized amount of each between your fingers, being sure to rinse thoroughly with water between samples. Record your observations.

Phase 5

The project is completed with an evaluation and recapitulation in class of the performed work. The following questions aim to test student's reporting ability and comprehension of issues related to the activity.

Questions

_ 1. Research the nine categories of ingredients in toothpastes listed in the introduction. Give an example of each and explain its function. What is the purpose of each ingredient in your homemade toothpaste? What categories of ingredients are missing from the homemade toothpaste?

__2. Which toothpaste felt more abrasive to you in the touch test in step 10? Why is an abrasive useful in cleaning? Can an abrasive cause any problems in cleaning teeth?

__3. Compare the pH values of tap water, homemade toothpaste, and commercial toothpaste. How could pH affect the cleaning ability of toothpaste?

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__4. How do plain water, homemade toothpaste, and commercial toothpaste compare in

cleaning ability in steps 6 and 8?

__5. How does fluoride help to prevent cavities? Does it pose any risks to users? Would your homemade toothpaste

help to prevent cavities? Does it pose any risks to users?

__6. If you wanted to make a “whitening” toothpaste, what ingredient could you add to your mixture? Design an

experiment to test your new toothpaste. Be sure to get your instructor’s approval before doing any experiments.

The importance of dental care

Finally, you will discuss in class the importance of regular dental care and other related issues:

- Foods that are damaging to teeth, especially sugars.
- The practice of water fluorination for teeth protection. The importance of REGULAR and PROPER brushing of teeth.
- The types and role of toothbrushes, and need to replace them frequently.
- Various other dental-care products (dental rinses and gels, dental floss).
- The necessity to visit the dentist at least once a year for a check of the condition of teeth, and for a professional cleaning of teeth (which removes built-up dental caries that brushing has failed to remove. (The dentist also will teach the optimum method of brushing the teeth.
- Teeth-colorants used for checking presence of caries in teeth.

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