WORKSHEET #2

Super Shampoo Scrubbing Bubbles Analysis

It is difficult to obtain exact information from the side panel of a bottle of commercial shampoo about its exact formulation and chemical makeup. These facts are generally withheld from the general consumer by the manufacturer due to proprietary laws. However, it is possible to obtain some empirical data about the characteristics and relative effectiveness of a given shampoo. A number of basic factors will be studied in this activity, and from the data collected, students will be able to draw a limited number of conclusions.

Materials Per Lab Group:

- 1 dropper vial Universal Indicator
- 1 vial of india ink
- 1 heat lamp
- 1 marble (be sure to test it before the lab)
- 1 balance
- 1 clock with a minute hand
- 1 sheet of graph paper
- 1 six-inch test tube
- 1 250ml cylinder with a stopper
- 5 vials of different commercial brands of shampoos

SHAMPOO	***Step 1*** **PH 1% Solution**	***Step 2*** **% Solid**	***Step 3*** **Flash Foam Volume Minutes**	***Step 4*** **Foam Retention after 10 Minutes**	***Step 5*** **Relative Viscosity**	***Step 6*** **Dispersion Test**	***Step 7*** **Cost per mL**	***REMARKS RATING***

Procedures

Step 1: Determination of pH

Prepare a 1% solution diluting 5.0ml of shampoo with 500ml of distilled water. Prepare enough to be used here and again in segment C. Utilize Universal Indicator to determine the pH. Enter in the Data Collection Table.

Step 2: Determination of Solids:

Weigh a container and pour 3 to 5 grams of shampoo into it. Weigh the shampoo in the container.

Weight of shampoo + container = _____ grams

Weight of container = _____ grams

Weight of shampoo sample = _____ grams

Expose the sample to a heat lamp until the sample is dry of all volatile matter.

Weight of sample after heating = _____ grams

$$\% \text{ of solids} = \frac{\text{Sample weight after heating} \times 100}{\text{Starting sample weight}}$$

Step 3: Determination of Flash Formation

Pour 50ml of 1% solution into a 250ml-graduated cylinder. Insert the stopper and shake 10 times. Measure volume of foam generated and record the time. Total volume of foam subtract 50 = flash foam volume. Enter data into the table.

Step 4: Determination of Foam Retention Time

Uncap the graduated cylinder and record the foam volume at the end of each minute for 10 minutes.

Construct a graphic representation of the foam showing volume versus time. Use time as the independent variable. Using a graphical spreadsheet or graph paper, create a graph of all of the shampoos tested using different colors for each of the commercial shampoos tested.

Step 5: Determination of Relative Viscosity

Use a six-inch test tube to serve as a falling tube. Fill the tube with water and measure the time in seconds of the fall of the marble. Fill the same tube with shampoo and measure the time of fall (in seconds) using the same marble. The room temperature and sample material temperatures should be constant.

$$\text{Relative Viscosity} = \frac{\text{Time of fall (Shampoo)}}{\text{Time of fall (Water)}}$$

Step 6: India Ink Dispersion Test

Add one drop of black india ink to 50ml of 1% shampoo solution in a bottle or cylinder and shake 5 times. Examine the results to determine if the india ink is present in the solution only, in the foam fraction, or in both. Have your students estimate the degree of contamination present in the foam fraction as *None*, *Light*, *Moderate*, or *Heavy*.

Step 7: Determination of Cost per 5ml of Shampoo

Knowing the total volume of the shampoo and the price, calculate the cost per 5ml sample by direct proportion.

$$\frac{\text{Total Volume (ml)}}{\text{Cost (in cents)}} = \frac{5\text{ml}}{x}$$

Guidelines for Evaluating Collected Data

- Most shampoo formulas have a pH (1% water solution) of about 7.0. Acidic values are commonly found in the shampoo samples tested. The more alkaline, or the higher the pH value, shampoo causes your hair to break more easily. The more you use a shampoo of this type, the more the individual strands of hair will become coarse and roughened, giving your hair a dull and lifeless sheen, look, and feel.
- Quality shampoos fall in the 20 – 30 percent range of solids.
- Shampoos that present a foam volume of 100 ml or greater, with a small bubble diameter, and with a foam retention rate of five minutes stabilization are considered to be of an excellent quality.
- Viscosity is directly related to the percentage of solids found during the determination of solids lab activity in Step #2.
- If your results during the foam fraction lab activity picked up a large amount of the carbon from the ink (as indicated by a darkened foam observed over the solution), this will indicate a low or poor quality of shampoo. The dirt and grease should remain in a suspended state in the water so that they may be "swept away during a rinse of excess water. This can be difficult if the foam fraction contains a high level of contaminants, dirt, or grease in it.
- The cost factor of each shampoo can be compared to its general performance. The shampoo must be able to remove dirt and grease particles while still leaving a thin coating of your hair's natural oils, called sebum. If too much sebum is removed from your hair, your hair will dry out. Shampoos formulated for oily hair are designed to remove more of your hair's sebum. Shampoos for dry hair are designed to remove less sebum and often contain fatty materials to assist in supplementing your hair's natural sebum oils.

Group Data Analysis Conclusions

Compare all of the data that has been collected by your fellow classmates and determine which shampoo will be awarded the "Best of Class" honor.

Conclusion: _____