Lab – Water Softening

Purpose: To investigate the properties of hard and soft water and determine which materials are good at softening water.

Procedure:

1) Set up two test tubes in a test tube rack. Into each test tube, you will filter a solution.
2) Fold two pieces of filter paper. Insert one into each funnel.
3) Discuss with the other group at your lab table which two of the following 4 filters each group will set up.
   - Funnel 1 should only contain a filter paper
   - Funnel 2 should contain a filter paper filled with 1/3 full of sand.
   - Funnel 3 should contain a filter paper filled with 1/3 full of Calgon.
   - Funnel 4 should contain a filter paper filled with 1/3 full of ion exchange resin.
4) Pour about 10 mL of hard water into each funnel. Make sure no water goes over the filter paper or out of the funnel.
5) Collect the filtrates (liquid that goes through the funnel) in the test tubes.
6) Add 10 drops of sodium carbonate to each filtrate. Record whether a precipitate forms. A cloudy precipitate indicates that the Ca^{+2} ion (a hard water ion) was not removed.
7) Discard the test tube solutions. Clean the test tubes thoroughly with tap water and rinse with distilled water.
8) Pour another 10 mL sample of hard water through each funnel. Catch the filtrate in the test tubes.
9) Add 1 drop of Ivory liquid hand soap to each test tube.
10) Stir each test tube gently. Wipe the stirring rod before inserting it into the other test tube.
11) Compare the cloudiness, or turbidity, of the two soap solutions. Record your observations. The greater the turbidity, the greater the quantity of soap dispersed,
12) Stopper each test tube and then shake vigorously. The more suds that form, the softer the water. Measure the height of suds in each test tube.
13) When you and the other group are both finished testing your two filters, exchange filters and repeat steps 4 – 12 with the new funnels.

Data Table:

Test	Filter Paper	Filter Paper w/ Sand	Filter Paper w/ Calgon	Filter Paper w/ Ion Exchange Resin
Reaction with Na_2CO_3				
Degree of cloudiness (turbidity) with Ivory soap				
Height of suds				

Questions:

1) Which was the most effective water softening method? Explain why you think this.

2) What relationship can you describe between the amount of hard water ion remaining in the filtrate and the cloudiness of the Ivory soap?

3) What effect does the relationship in (2) have on the cleansing action of the soap?

Conclusion: