Buffering Capacity Lab

Introduction

Buffers are chemical substances that can reduce variations of pH in a solution by either adding or removing small amounts of hydrogen. In food, they can be used specifically to: reduce changes in flavor intensity of flavor chemicals, reduce changes in sourness, sweet/sour balance, reduce variation in color shade of natural colors, and reduce variation in texture from lot to lot.

Buffering capacity is the ability of a buffer to resist changes in pH, and is expressed as the molarity of sodium hydroxide – NaOH (or hydrochloric acid – HCl) required to increase/decrease pH by 1.0. Saliva contains buffers that can resist a change in pH when an acid is added to it. This property is due to the bicarbonate content of the saliva, which helps to regulate salivary pH. Normally, when an acid enters the mouth, the salivary flow rate will increase. Within minutes, the acid is neutralized and cleared from the mouth and the pH returns to normal.

Beverages also contain varying degrees of buffering capacities. Research has shown that the ability of a beverage to resist pH changes brought about by salivary buffering may play an important part in tooth erosion. Beverages with high buffering capacities may induce a prolonged drop in oral pH when a person drinks the beverage, which increases the chances of tooth erosion.

Introduction Paragraph with Title

1. What is a buffer? What is buffering capacity?
2. How can a high buffering capacity in beverages affect tooth erosion?
3. What is pH? What is the difference between an acid and a base?
4. How does pH relate to the body (in the mouth and throughout the body)?
5. How does change in pH affect the body?

Question: How does the buffering capacity of different beverages compare? Which beverage is the worst for your teeth?

Hypothesis/Prediction: State a prediction about what will occur in the lab. From best to worst, rank the beverages in a list.

Materials: Compile a list of all the materials used in the lab

Safety: List all safety precautions for the lab

Variables: List the independent, dependent, control variables, and 3 constants

Procedure:

1. Measure 25 mL of the beverage using the graduated cylinder provided.
2. Take the **initial pH** of the beverage using the pH probes. Record in data chart.
3. Using the funnel, carefully pour 10 mL of NaOH into the burette that is secured to the ring stand with a clamp. Record **the initial NaOH** amount in the data chart.
   NOTE: Be sure that the burette valve is in the OFF position
4. Carefully add one drop of NaOH into the beaker. Gently swirl the beverage a few times to mix the base keeping the probe in the beaker.
5. Read the pH on the probe screen.
6. Continue adding one drop of NaOH until the pH has been raised by 1.
7. Record the **final NaOH** amount in your data chart. Record the **final pH.**
8. Calculate the how much NaOH was used and record in the data chart.

Results:

- **Data Chart**: Create an organized data chart to record pH data for all beverage types
- **Graph**: Graph results for all beverage types

Conclusion:

1. Rank the beverages from the highest buffering capacity to the lowest buffering capacity?

2. Explain how buffers resist changes in pH.

3. What inferences can be made about the effects of the beverages on tooth erosion?

4. How might a person reduce the degree of erosion on the teeth when drinking different beverages?

5. Write a paragraph to Mr. Robison explaining the pros and cons of having the different types of beverages used in the lab available in the school.