

**STUDENT
PRACTICAL SHEET**

NAME

FORM

DATE

Investigating pH and soft drinks

Introduction

Fruit drinks can contain more than juice. Food scientists can add natural chemicals to change the pH of the drink so that microbes are less likely to grow. Microbes can make the drink unpleasant or unsafe to drink.

Citric acid is a natural chemical found in lemons which can be used to lower the pH. Baking powder is safe to eat and can be used to increase the pH.

Aim

To investigate the effect of changing pH on the growth of a microbe in a chilled drink.

Equipment

- 1x boiling tube rack
- Warm water bath (set at 40 °C)
- Limewater (calcium hydroxide)
- Activated yeast solution
- 4x bungs and delivery tubes
- Stop watch
- pH meter
- Grape juice
- 2x Spatula
- Citric acid powder
- Baking powder
- Splash proof eye protection

Safety: Splash proof eye protection must be worn as limewater is an irritant.
See CLEAPSS Student Safety Sheet 32.



Image: Krones

Method

1. Using the 10cm³ measuring cylinder, put 5cm³ of limewater into each test tube and place in a test tube rack.
2. Using the 50cm³ measuring cylinder add 20cm³ of grape juice into each boiling tube and place in the boiling tube rack.
3. Label each boiling tube A to C. Then add 5cm³ of activated yeast to each tube. To test tube A add 1 spatula of citric acid and to test tube C add 1 spatula of baking powder.
4. Measure and record the pH of the liquid in each boiling tube.
5. Put the bung onto the boiling tubes and make sure that the delivery tube end is going into the limewater. Ensure that the boiling tubes are in the warm water bath.
6. Record how long it takes for the limewater to turn cloudy.

Questions

1. What is the independent variable in this experiment?

2. What is the dependent variable in this experiment?

3. What are the control variables in this experiment?

4. What microbe are we using in this experiment?

5. What do you predict will happen in this experiment?

6. Are your results reliable? **Yes / No / Don't know**
(delete as appropriate).

Explain your answer.

Results

| Tube | pH | Time (minutes) |
|------|----|----------------|
| A | | |
| B | | |
| C | | |

Conclusion

Fill in the missing words:

Yeast is a fungus which is a type of It can be used to find out the effect of on the growth of microbes in chilled drinks.

Yeast grew best in pH values closest to pH 7.

Grape juice is quite acidic with a pH value of By adding citric acid, the taste is not changed and the pH is reducing the growth of microbes and increasing the shelf life. When baking powder is added the pH is

The baking powder will react with some of the natural acids in the grape juice and will affect the and appearance of the product.

TEACHERS NOTES

Investigating pH and soft drinks

Teaching ideas

Allow students to set up the experiment and then encourage them to complete the questions while the yeast is fermenting. To increase the production of carbon dioxide the yeast mixtures could be put in a water bath set at 40 °C. This could be made with a 250cm³ beaker half filled with warm tap water.

Grape juice has a pH of about 3, with citric acid this is lowered to about 1 and with baking powder raised to about 7. At low pH values, the yeast will not respire and the limewater will not change. With just grape juice there is some fermentation occurring, and the limewater is likely to change. Neutral solutions, the colour of red grape juice will change (as this contains anthocyanin a natural acid base indicator). Initially effervescence will be observed as the citric acid reacts with the baking powder. Then the yeast will respire readily causing the limewater to change in about 20 minutes.

Answers

1. pH
2. time
3. control variables include: volume of yeast, volume of liquid, temperature, concentration of yeast.
4. yeast
5. prediction should be what they think will happen and why.

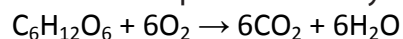
Conclusion

Yeast is a fungus which is a type of microbe. It can be used to find out the effect of pH on the growth of microbes in chilled drinks. Yeast grew best in pH values closest to pH 7. Grape juice is quite acidic with a pH value of (students own response). By adding citric acid, the taste is not changed and the pH is lowered reducing the growth of microbes and increasing the shelf life. When baking powder is added the pH is increased. But baking powder will react with some of the natural acids in the grape juice and will affect the taste and appearance of the product.

Extension Information

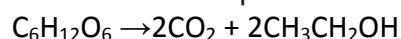
Yeast is a fast growing unicellular microorganism. They have a spherical shape and are classified within the fungi kingdom. Inside the cytoplasm of each yeast cell there are the organelles known as mitochondria. It is inside these structures that respiration takes place.

Yeast can respire aerobically and this can be represented by the following chemical equation:



This reaction is used in the baking industry to make bubbles of carbon dioxide in bread which then makes it rise. When the bread is baked, the yeast is killed and the respiration stops.

Yeast can also respire anaerobically and this can be represented by the following chemical equation:



This reaction is used in the brewing industry to make alcoholic drinks. The ethanol produced can then further oxidised to make ethanoic acid and this is the process used to make vinegar.

Yeast can spoil food by releasing the enzyme mixture that it produces known as zymase. This is a biological catalyst which consumes the sugars in the food. This chemically changes the composition of the food and with it the taste and mouth feel.

Yeasts are usually found on the surface of foods and are resistant to common additives introduced to foods to improve shelf life. Live yeast can be indicated using methylene blue.



Lesson plans, practical sheets and homework sheets in this series
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www.schoolscience.co.uk/partners/chilled-food-association

Author

Sam Holyman, Bablake School, Coventry, UK

