Natural and common ph indicators experiment essay sample

Science, Chemistry

An indicator is a halochromic chemical compound that is added to a solution to determine its pH. It is a chemical detector for hydronium ions. The indicator changes colour to show the pH of the solution. Some indicates are not very precise and only tell us whether the solution is acidic or basic. When the indicator is added to the solution, they bind to hydrogen or hydroxide ions. The different electron configurations of the bound indicator cause the indicator’s colour to change.

Some common indicators are: universal indicator, phenolphthalein, methyl orange, litmus, bromothymol blue.

However, there are some indicators that are found in nature in the form of plant pigments known as anthocyanins, which change colour over different pH ranges, depending on source. For example red cabbage juice will change colour to indicate pH if the solution is within the range of pH 1 – pH 12. Red beet juice will change from red to yellow between pH of 11 and 12. Therefore they are not as reliable as common laboratory indicators. Some other natural indicators include: Carrots, cherries, grapes, hydrangea, onions, poppy petals, rhubarbs, thyme and tulip petals.

Aim

To investigate the uses of various common and natural indicators in acidic, neutral and basic solutions.

Part A: COMMON INDICATORS

Equipment

0. 1 M solutions of sodium hydroxide and hydrochloric acid, distilled water, 3 test tubes, test-tube rack, 3 x 100mL beakers, liquid litmus, universal indicator, methyl orange,

Method

1. Using beakers, pour 2cm of acid into one test tube, 2cm of sodium hydroxide into another test tube, and 2cm of distilled water into the third test tube.

2. Add 3 drops of red litmus to each tube. Record results.

3. Repeat steps 2 and 3 for other indicators.

Results

Colour in strong acid (hydrochloric acid)Colour in strong base (sodium hydroxide)Colour in neutral solution (water)

LitmusPeach redBluePurple

Universal IndicatorDeep redDeep violetYellow

Methyl orangeOrange-redYellowOrange yellow

PhenolphthaleinColourlessPurple pinkColourless

Bromothymol blueYellowBlueDark Blue green

Distilled water was used instead of tap water because tap water is not completely pure. It may have traces of minerals and chlorine, potassium and sodium in it. This may affect the end result of the experiment.

Discussion

I found that some indicators distinguish between the acidity and basicity of the solution more obviously then others. For example, the litmus clearly indicates that a acid was peach, a base was blue and a neutral solution was purple, whereas a methyl orange indicator shows that an acid is orange-red and a neutral solution is orange. These two colours are very similar,
Also some of the colours that I observed were not the correct, for example the litmus indicator should actually show that an acidic solution is red not peach. I have learnt to wash my test tubes more carefully and not put sodium hydroxide into a test tube that had HCL in it, even after washing it.

Conclusion

Common indicators are useful in finding the pH of a solution. They change colour to show whether a solution is acidic or basic. Different indicators show different colours at the same pH. In a strong acid, bromothymol blue is yellow, litmus is red and methyl orange is orange-red. Overall I think that the universal indicator is the best to use because the colours are completely different at acidic, basic and neutral levels.

Part B: NATURAL INDICATORS

Equipment

0. 1 M hydrochloric acid and sodium hydroxide, distilled water, pink or erd flower petal, beetroot juice, tea bag, 3 x 100mL beakers, Bunsen burner, heat matm tripod, gauze, matches, 3 test tubes, test-tube rack, Pasteur pipettes, lab coat, safety glasses

Method

1. Gently boil 50mL of water in a beaker combined with the flower petals until the water becomes strongly coloured, then remove from heat. See picture

2. Place 20mL of beetroot juice in another beaker.

3. Boil 50mL of water in another beaker and add a teabag.

4. Place 2cm of hydrochloric acid in a test tube, 2cm of sodium hydroxide into a second test tube, and 2cm of distilled water in a third test tube.

5. Add about 10 drops of flower-petal water to each and record the colour of each solution.

6. Clean the test tubes an repeat steps 4 and 5. First using beetroot juice, then tea.

7. Carefully dry the freshly made indicator paper over a Bunsen burner flame, being careful not to burn it.

Results

Hydrochloric AcidSodium HydroxideDistilled Water

Beetroot Dark redDeep redRed

Flower petalPale pinkYellowPale purple

TeaLight yellowLight brownPale brown

I think that the flower petal indicator worked the best because the colours are completely different in each solution; HCL, NaOH, and H2O. This is unlike the beetroot juice and tea bag indicator, which both have similar colours in all solutions.

Other substances that might be natural indicators are carrots, cherries and rhubarbs, because they have pigments which can be used.

Discussion

The flower-petal indicator showed the widest range of colours. It was hard to make this indicator as we used different flowers and found that some flower petals had more colour in it then others.

Conclusion

Indicators' molecules change their structure and colour depending on whether they are in an acidic or basic solution. The plant indicator changed colour, because plants are sensitive to changes in pH as they have a certain acid/base balance to survive. The colour of plants often depend on the pH of their environment, therefore it is possible for plant solutions to be used as a pH indicator.

Bibliography

Books:

Science Focus 3- common indicators and natural indicators experiment

Core Science 1- structure of experiment report

Science Study Guide Year 9-10- definition of indicator

Websites:

En. wikkipedia. com- different natural indicators, definition of pH indicator

1001coolsciencefacts. com- why a plant can be used as an indicator