

PLANT EXTRACTS AS ACID-BASE INDICATORS

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An acid–base indicator is a substance that changes color as the pH of a solution changes. There are hundreds of different acid–base indicators, many of which can be extracted from common plants. Every indicator exhibits a different range of colors at different pH values. For example, the indicator phenolphthalein, which you have used in previous labs, is colorless in solutions with a pH less than 8 and pink in solutions with a pH greater than 8.

Indicators work because they are weak acids which, when in solution, exist in equilibrium with their conjugate base. The acid and its conjugate base each have different colors, and as the equilibrium shifts from one direction to the other, the color of the indicator solution changes. Some indicators exhibit only two colors and some exhibit a wide range. Each indicator must be individually studied to determine its behavior as a function of pH.

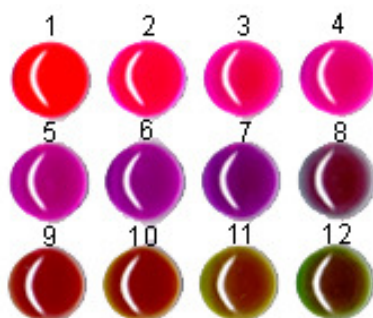


Fig. 1. Color obtained from red-cabbage extract in different pH values.

pH paper consists of strips of filter paper which have been soaked in an indicator. A drop of an unknown solution can be placed on the pH paper, and the resulting color compared to a chart. By matching the color of the paper to a color on the chart, the pH of the solution can be determined.

Procedure

A. Extraction of the acid-base indicator

Use at least two different leaves/flowers as samples. Suggested samples are: red cabbage, red rose petals, lanaya leaves, purple grape fruits, etc.

In a 50 mL round bottom flask, transfer about 2-6 grams of finely cut plant sample. Add just enough amount of ethanol as the extracting solvent. Make sure the volume of ethanol is enough to cover the entire sample. Record the mass of sample and solvent volumes used. Attach a condenser for a reflux set-up.

Gently heat the solution and re-flux for 30 minutes.

Filter the solution by gravity filtration. Collect the filtrate and transfer in the same round bottom flask.

Set-up distillation apparatus using the same round bottom flask and condenser. Distill the extract to concentrate until the volume of the extract is reduced to half or as possible.

Record the volume of the extract. Determine the density and check the pH using a pH paper. Store extracts in a vial or small reagent bottle.

B. Acid-Base Indicator test

Using a spot plate, transfer enough volume of the standard solutions (different concentrations of HCl, NaOH and NaCl solutions to provide a pH range of 1-13). Record the number of drops used for the standards. Using a medicine dropper, add 1 or more drops of the extract. The number of drops should be noted and the same for all the test standards.

Compare the different extracts in terms of their ability to differentiate pH ranges. Document all visual observations.

References

Fred Senese, General Chemistry Online! Available at:
<http://antoine.frostburg.edu/chem/senese/101/acidbase/faq/natural-indicators.shtml>

Figure available at: http://en.wikipedia.org/wiki/PH_indicator