

Student experiment  
(5th - 10th grade)

## Red cabbage indicator

🕒 Time: max. 20 min.

### Safety:

safety glasses



### Instruments:

- beaker (400ml)
- knife
- hotplate (or Bunsen burner, tripod and mesh)
- funnel with filter paper
- 3 test tubes
- test tube rack

### Chemicals:

- red cabbage
- sodium carbonate solution (H: 319; P: 260-305+351+338)
- lemon juice

### Experiment:

- Dice some red cabbage into tiny pieces and place them in a beaker. Add enough water to cover the pieces and boil the mixture for a few minutes, until a red solution forms.
- Filter the mixture and save the filtrate. The solids can be thrown away.
- Add roughly 2 cm of the filtrate to three separate test tubes.
- Add 1ml of lemon juice to the first test tube, 1ml of sodium carbonate solution to the second and nothing to the third.
- Compare the colors in each of the three test tubes.

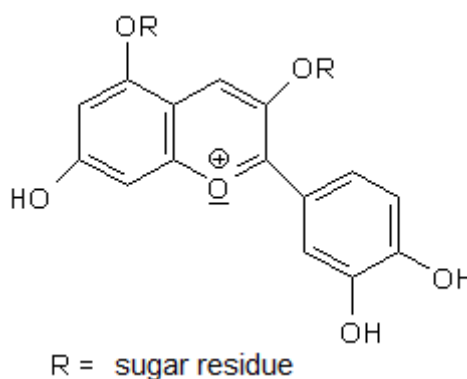
### Observations:

The three test tubes have different colors.

### Results:

The reason for the color change is that the pigment in red cabbage is a chemical indicator. This substance reacts differently to pH acidic, neutral and basic ("alkali") solutions. The red cabbage indicator even has two color change points: one in the neutral range (pH 7) and one above pH 10 (the alkali or basic range).

Cyanidin belongs to the anthocyanadin family of plant pigments, which are able to change their color. Its molecule is a very complex one with several OH groups, which can release protons into solution. This is what causes the color changes of its solutions.

**Results:**

The blue and yellow colorations are reversible; add acid and the solution turns red again. The green color is a mix of blue and yellow. The yellow pigment, however, slowly reacts to form another compound, which cannot be changed back to blue or red. This is why fresh cabbage must be used: after a certain time, the yellow color becomes permanent.

**Disposal:**

The red cabbage waste can be put in the normal trash receptacle.

**Advice for the teacher:**

Several common household substances can be used to build a color series for our cabbage indicator:

- lemon juice (or decalcifying solution for water cookers)
- vinegar
- tap water
- Marseille soap in methylated spirits or ethanol
- Marseille soap in water
- saturated sodium hydrogen carbonate solution
- saturated heavy duty detergent solution
- saturated Sodium hydroxide solution