

Qualitative identification of starch (iodine), glucose (Benedict's) and protein (biuret)

Introduction

The identification of the different food types can be carried out using different chemical tests. A positive result for each food type is determined by a colour change. In this activity you will carry out the chemical tests for starch, glucose and protein.

Apparatus

3 × test tubes
 3 × dropping pipettes
 3 × 5 cm³ syringe
 iodine solution with dropping pipette
 Benedict's reagent with dropping pipette
 biuret reagent with dropping pipette
 starch solution
 glucose solution
 albumen (protein) solution

Test for Starch

1. Add 2 cm³ of the starch solution to a test tube.
2. Add 2 drops of iodine solution and record the colour change.

Test for Glucose

1. Mix 2 cm³ of the glucose solution with 2 cm³ of the Benedict's reagent.
2. Heat the mixture in a water bath at a temperature of 60°C.
3. Observe and record the colour changes.

Testing for Protein

1. Mix 2 cm³ of the protein solution with the 2 cm³ of biuret reagent.
2. Record the colour change.

Use these three tests to identify the contents of three unknown samples and some different types of food.

Risk Assessment

| Hazard | Risk | Control measure |
|-----------------------|---|--|
| Biuret is an irritant | Could splash onto hands or into eyes when transferring to a test tube | Wear gloves/eye protection |
| Hot water can burn | Splashing water onto skin when using water bath could burn | Care must be taken when removing tubes from the water. Avoid splashing hot water onto the skin |

Benedict's and iodine solutions are classed as low hazard by CLEAPSS at these concentrations.

Teacher / Technician notes

Iodine solution

Iodine is only sparingly soluble in water (0.3g per litre); it is usual to dissolve it in potassium iodide solution (KI) to make a 0.01 M solution (by tenfold dilution of a 0.1 M solution) to use as a starch test reagent. Refer to CLEAPSS recipe card 33.

Benedict's reagent

Benedict's reagent can be purchased from a laboratory supplier or it can be made.

1 dm³ of Benedict's reagent contains:

- 100g anhydrous sodium carbonate
- 173g sodium citrate
- 17.3g copper(II) sulfate pentahydrate.

Biuret reagent

Biuret reagent can be purchased from a laboratory supplier or potassium hydroxide and dilute copper(II) sulfate could be used as an alternative.

Once students are familiar with the tests and positive results they could be asked to investigate unknown samples or real foods for their chemical make-up by grinding small portions of the food in water and carrying out the three tests.

The semi-quantitative nature of the Benedict's test could be discussed or further investigated.

| Concentration of Glucose (%) | Colour of precipitate |
|-------------------------------------|------------------------------|
| 0.5 | Green |
| 1 | Yellow |
| 1.5 | Orange |
| 2 | Brick Red |

Standards of these precipitates could be useful for students investigating real foods to estimate the amount of glucose in the foods tested rather than just its presence or absence.

Practical techniques covered

- B2 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater.
- B3 Use of appropriate apparatus and techniques for the observation and measurement of biological changes and or processes.
- B8 Use of appropriate techniques and qualitative reagents to identify biological molecules and processes in more complex and problem solving context including continuous sampling in an investigation.