Natural polymers: The hydrolysis of starch by acid and enzyme Transcript

Starch is an example of a complex carbohydrate and natural polymer, a long chain molecule made up of smaller units called monomers. The monomer units that make up starch are called simple sugars.

Complex carbohydrates like starch are formed by joining lots of simple sugars together by condensation polymerisation. This experiment shows the hydrolysis of starch using hydrochloric acid and enzyme. It also shows the tests for the presence of starch and simple sugars.

First a water bath is set up using a beaker of water and a Bunsen burner. The water is heated until it boils.

Two test-tubes, labelled 1 and 2, are placed in the test tube rack. The labels need to be at or near the neck of the test tube otherwise they will come off during boiling.

Starch solution is added to each of the test-tubes using the five centimetres cubed syringe. Then, one centimetre cubed of dilute hydrochloric acid is added to test-tube 1.

And one centimetre cubed of water is added to test-tube 2. This will be the control.

The test-tubes are carefully transferred into the boiling water for ten minutes. The boiling can be controlled using the Bunsen air hole if needed.

After ten minutes the test-tubes are transferred to the racks using a test-tube holder and left to cool for one minute. The water is left boing as it will be used again later.

A tiny amount of sodium hydrogen carbonate is added using a spatula to only test-tube 1. This will neutralise any unreacted acid. This process is repeated until no more bubbles of gas are produced in the test-tube.

The solutions can now be tested for starch and simple sugars. Iodine solution is used to test for starch. A small amount of liquid from each test-tube is transferred using a pipette to an individual dimple in the dimple tray.

Then five drops of the brown iodine solution is added to each and the colour recorded.

The brown colour observed for the sample from test-tube 1 means no starch is present. The blue-black colour observed for the sample from test-tube 2 shows there is still starch in the sample.
To test for simple sugars, 20 to 25 drops of the blue Benedict's solution is added to each of the test-tubes.

The test-tubes are added to the boiling water bath which can now be turned off. When any colour change occurs the test-tubes should be removed using the test-tube holder. The test-tubes should not be left in the water bath.

A brick-red coloured precipitate is observed in test-tube 1. There is no change to test-tube 2. The hydrochloric acid has hydrolysed the starch in test-tube 1 producing simple sugars.

The next experiment is the enzymatic hydrolysis of starch using amylase.

In this experiment at water bath is set up at 37 degrees. Two test-tubes, labelled 3 and 4, are placed in the rack. Five centimetres cubed of the one per cent starch solution is added to each of the test-tubes using a syringe.

Then, one centimetre cubed of the amylase solution is added to test-tube 3.

And one centimetre cubed of water is added to test-tube 4. This will be the control.

The test-tubes are then placed in the water bath and held there using clamps.

These are left for ten minutes. As in the acid hydrolysis experiment the presence of starch or sugars can be determined.

Some of the sample from each test-tube is transferred using a pipette to an individual dimple in the dimple tray. Then, five drops of brown iodine solution is added to each and the colour recorded.

A brown colour indicates that there is no starch present in test-tube 3. A blue-black colour indicates that there is starch present in test-tube 4.

To test for the presence of simple sugars, twenty to twenty-five drops of the blue Benedict's solution is added to each of the test-tubes.

The test-tubes are added to the boiling water bath, which can now be turned off. When any colour change occurs the test-tubes are removed.

An orange coloured precipitate is observed in test-tube 3. There is no change in test-tube 4. Both hydrochloric acid and amylase can be used to hydrolyse starch into simple sugars.

Starch is a condensation polymer made up of simple sugar monomer units Starch molecules are too large to pass into the bloodstream and are therefore hydrolysed during digestion by acid and enzyme.