

ADVANCED SUBSIDIARY GCE

APPLIED SCIENCE

Cells and Molecules

G623/INSERT

PLAN FOR AN INVESTIGATION

INSERT

For issue on or after: **WEDNESDAY 17 NOVEMBER 2010**



INFORMATION FOR CANDIDATES

- The abstracts on pages 2 and 3 of this insert are to give you some background that you might find helpful in planning for the task that follows. Not all the information included will be directly relevant and you are expected to select the information that is relevant to the task.
- This document consists of 4 pages. Any blank pages are indicated.

'PROVE IT!'

Bread making is one of the oldest examples of biotechnology, with accounts of leavened (risen) bread dating from ancient Egypt (4000 BC). In the UK, bread is traditionally made from a dough of wheat flour, water, salt and possibly fat, depending on the recipe. This forms a matrix in which yeast (*Saccharomyces cerevisiae*) is trapped. Enzymes such as amylases are present in the moistened flour. These convert starch to glucose, which provides nutrients for the immobilised yeast cells.

In addition, the yeast requires a source of nitrogen. Peptones and amino acids are provided by the partial hydrolysis of flour protein (collectively called gluten). This type of protein is found in the cereals wheat, rye and barley.

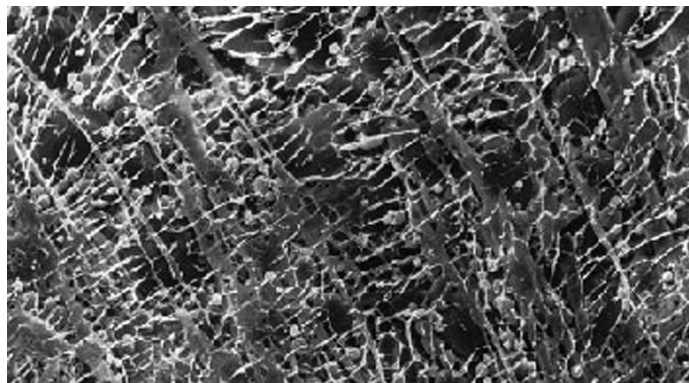
Gluten contributes to the elasticity and plasticity of the dough, ensuring that the carbon dioxide remains trapped as it enlarges the air bubbles within the dough, causing it to rise.

The Science behind bread making

To make good bread, dough made by any process must be extensible enough for it to relax and to expand while it is rising. A good dough is extensible if it will stretch out when pulled. It also must be elastic, that is, have the strength to hold the gases produced while rising, and stable enough to hold its shape and cell structure. Two proteins present in flour (gliadin and glutenin) form gluten when mixed with water. It is gluten that gives dough these special properties.

Bread making involves the following basic steps:

1. **Mixing.** This distributes ingredients evenly and allows the development of the gluten network. Too much mixing produces a dough that is very extensible with reduced elastic properties. Undermixing may cause small unmixed patches which remain unrisen in the bread.
2. **Rising.** Yeast cells multiply and enzymes (α -amylases) begin to convert starch to maltose. In a bread dough where the oxygen supply is limited, yeast cells respire anaerobically (fermentation) to generate carbon dioxide and ethanol. The carbon dioxide produced in these reactions causes the dough to rise, whilst the alcohol evaporates during the baking process.



After two hours rising, gluten strands form a lattice as the dough reaches the required size (Electron microscope view).

3. **Kneading.** Any large gas pockets that may have formed during rising are released by kneading ('knock back'). A more even distribution of both gas bubbles and temperature also results. The dough is allowed to rise again and kneaded if required. During the final rising (proving), the dough fills with more bubbles of carbon dioxide before being transferred to the oven for baking.

'Gluten-free' living

Coeliac disease (pronounced see-lic) is an auto-immune disease. It is not an allergy or simple food intolerance. In people with coeliac disease, this immune reaction is triggered by gluten, a protein common in some cereal plants. In coeliac disease, eating gluten causes the lining of the gut (small intestine) to become damaged and may affect other parts of the body.

The symptoms of coeliac disease vary from person to person and can range from mild to severe. Not all effects of coeliac disease relate to the intestine. Possible symptoms include bloating, constipation, abdominal pain, diarrhoea, nausea, tiredness, headaches, hair loss and skin rashes.

A gluten-free diet is the treatment for coeliac disease. Taking gluten out of the diet allows the damage caused to the gut lining to heal and symptoms of coeliac disease to resolve. Foods that are naturally gluten-free include rice, potatoes, polenta, millet, maize, plain meat, fish, eggs, cheese, milk, fruit, vegetables and pulses. Gluten-free substitute products such as breads, pastas and flour mixes are specially manufactured and available on prescription from the doctor, in health food shops, by mail order, 'free-from' ranges in the supermarket or via the internet.

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