Oxford Cambridge and RSA

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AS GCE APPLIED SCIENCE

G623/01/INSERT Cells and Molecules

PLAN FOR AN INVESTIGATION

INSERT

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INFORMATION

- The abstracts on pages 2 and 3 of this insert are to give you some background information 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.

Garlic Blues

Garlic purée has been a commercial food product for over forty years. It is produced by breaking garlic bulbs into cloves, cleaning and then grinding them. Some garlic bulbs produce purées which are dark green to blue green in colour, instead of cream. This product cannot be sold commercially because of the green colour.

Garlic on press

The discolouration seen in garlic is a phenomenon called 'greening'. It is the result of some complicated chemistry which involves garlic's flavour compounds.

The flavour of garlic is generated when an enzyme, called alliinase, acts on stable, odourless flavour precursors. These are normally in separate compartments in the cell but can combine if garlic cloves are crushed or damaged, including damage caused by vinegar. The major flavour precursors in garlic are alliin (S-allyl-L-cysteine sulfoxide) and isoalliin (S-1- propenyl-L-cysteine sulfoxide).

Key to the colour change is the production of thiosulfinates during reactions between the flavour precursors and alliinase. It is thought that the thiosulfinates react with amino acids from the ruptured cells to form pyrrole compounds, which are then linked together by di-2-propenyl thiosulfinates to form dipyrroles. These are reddish purple, but as the cross-linking continues, molecules with deeper and bluer hues are formed. Among these are compounds called phycocyanins, which are related to chlorophylls and are found in some algae that are used as blue colouring by the food industry.

The enzyme alliinase is pH dependent. Alliinase has been shown to have an optimum activity between pH 4.5 and pH7 and is partially deactivated at pH values less than 4.

‘Laba Garlic’

Green discolouration during garlic processing is desirable and required for the traditional homemade Chinese ‘Laba’ garlic. Scientists in Beijing carried out a series of experiments in the laboratory to investigate the greening process in garlic. Aged garlic was soaked in 5% ethanoic acid solution. After two days the garlic cloves turned green. Up to four days, pigment(s) diffused from garlic cloves into the pickling solution. The pickling solution exhibited two maximal absorbencies at approximately 440 nm and 590 nm, which corresponds to the yellow and blue pigments, respectively, the combination of which creates the green colouration.

It was also found that storage at low temperatures (less than 10 °C) was required for garlic greening to occur either during processing or in the preparation of ‘Laba’ garlic. Storage at high temperature (higher than 20 °C) inhibited its occurrence.