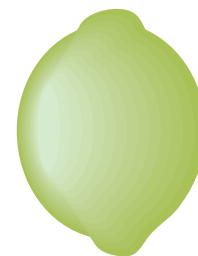


peeling citrus fruits

Enzymatic peeling of fruit is a new technology that is expected to replace older methods that use steam or lye (strong alkali). New enzyme mixtures can produce clean, residue free, segments of citrus fruits with a good texture and flavour for use as fresh, frozen or canned products. Pectinases can also be used to remove the fine skins of stone fruit such as peaches, apricots and nectarines.



Aim

To investigate how pectinase can be used to peel citrus fruits.

Preparation

If you use a water bath for this work, it can save time if you warm it to 35–40 °C before starting.

Timing

It takes about 30 minutes to set this investigation up. The fruit must then be left overnight for the enzyme to act.

Materials and equipment

Needed by each person or group

- Whole citrus fruit *e.g., orange, lemon or grapefruit*
- Novozymes *Pectinex*[™], 15 cm³
- Cling film, to cover jug or beaker
- Jug or large beaker (to hold the whole fruit)
- Small beaker or weight (to fit inside the jug)
- 10 cm³ syringe (without a needle), for dispensing the enzyme
- 500 cm³ measuring cylinder
- Pointed knife or a small piece of sandpaper
- OPTIONAL: Water bath or incubator maintained at 35–40 °C

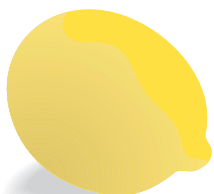
Procedure

1. Score the skin of the fruit lightly all over with a pointed knife, or rub gently with sandpaper. *The surface of the skin needs to be broken to allow the enzyme to penetrate.*
2. Using the syringe, add 15 cm³ of pectinase preparation to the measuring cylinder; make up to 300 cm³ with distilled or deionised water.
3. Label the large beaker or jug, put the fruit in it and cover with the diluted enzyme. Use the small beaker half-filled with water or a weight to keep the fruit submerged beneath the enzyme solution.
4. Cover the beaker with cling film and leave it overnight; ideally in a water bath or incubator maintained at 35–40 °C.
5. Pour off the enzyme solution and wash the remains of the peel away under running water.

Safety

Do not consume the fruit

Although the enzyme used in this protocol is of food grade, it has not been handled aseptically. Therefore treated fruit must *not* be consumed. **Please refer to the general safety guidelines on page 11.**



Further activities

Try altering the enzyme concentration, incubation temperature, pH or type of fruit. Can you use the same method to peel stone fruit (*e.g., peaches or apricots*) — or even grapes? How could the effectiveness of the method be measured?



naked fruit for lazy shoppers

To see this article, which appears in the print version of the booklet, please go to:

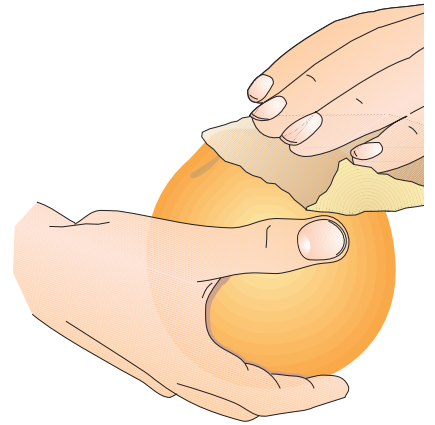
www.newscientist.com

New Scientist 152 (2053) p.26. 26 October 1996.

1

Lightly score the peel of the fruit all over, or rub the peel with sandpaper.

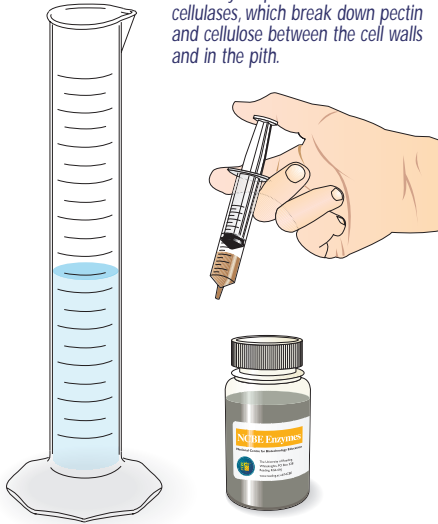
This removes the wax on the peel, allowing the enzyme to enter.



2

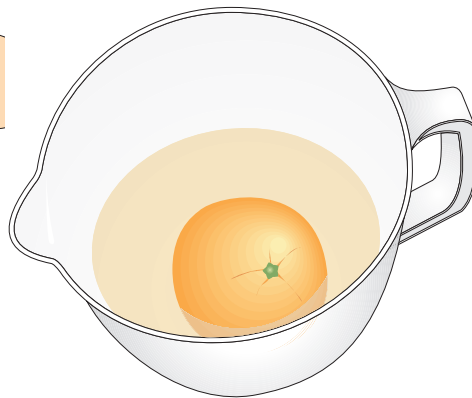
Dilute 15 cm³ of enzyme preparation in 285 cm³ of distilled or deionised water.

The enzyme preparation contains a variety of pectinases and hemicellulases, which break down pectin and cellulose between the cell walls and in the pith.



3

Put the fruit in a large beaker or jug. Add the enzyme solution. You may need to place a weight on top of the fruit to keep it submerged.



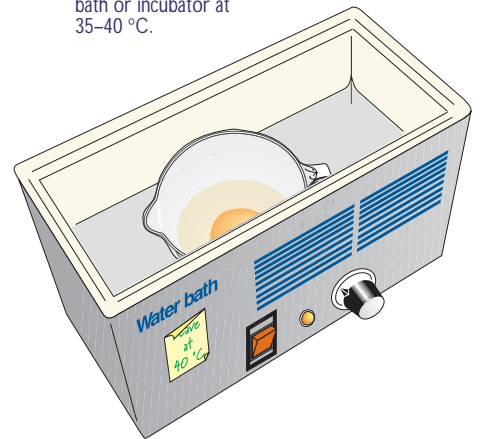
4

Cover the jug with plastic film to stop the liquid from evaporating.

Leave the fruit overnight for the enzyme mixture to act.

OPTIONAL:

You may wish to speed up the process by placing the jug in a warm water bath or incubator at 35–40 °C.

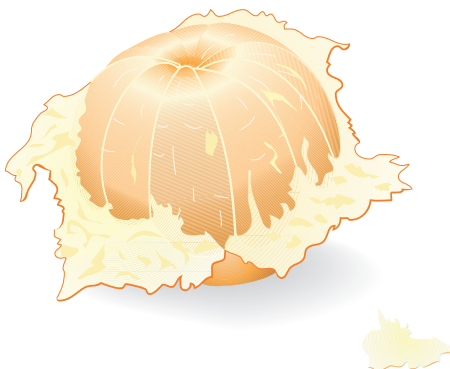


5

Wash the peel from the fruit under running water.

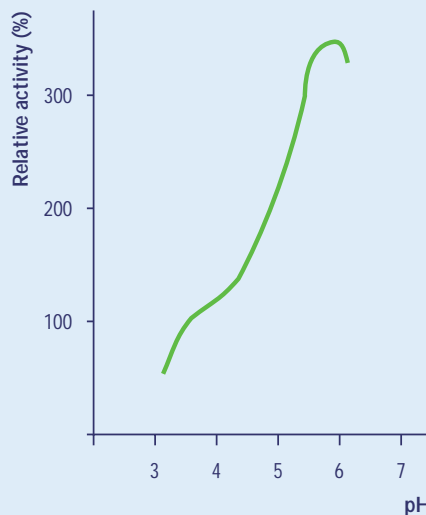
IMPORTANT!

Do not eat the fruit as, although the enzyme preparation is food-grade, it has not been used in aseptic conditions.

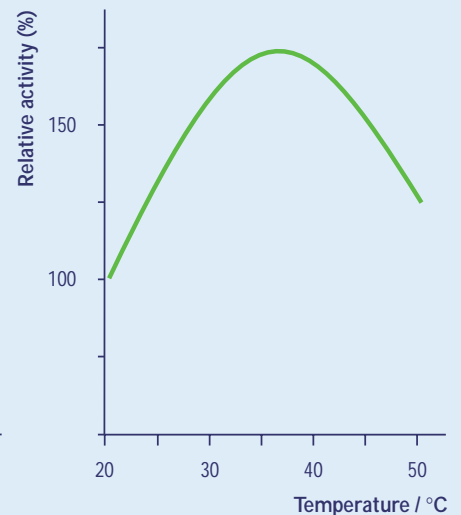


Dean Madden

Enzyme activity at 20 °C



Enzyme activity at pH 3.5



These enzyme activity graphs will help you to optimise the peeling process. They show the activity of polygalacturonase, one of the main enzymes in the pectinase mixture.

Data from Novozymes AS