



Dean Madden

National Centre for Biotechnology Education, University of Reading
Science and Technology Centre, Earley Gate, Reading RG6 6BZ UK | E: D.R.Madden@reading.ac.uk

Taking the pith

Pectinase provides a gentle way to peel citrus fruits

Aim

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

Introduction

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.

This investigation presents a simplified version of the method that is used commercially, using relatively large amounts of enzyme so that results are obtained quickly. Try this procedure with different types of fruit, or at different temperatures or amounts of enzyme.

Equipment and materials

Needed by each person or group

Equipment

- Jug or large beaker, to hold the whole fruit
- Small beaker or weight, to fit inside the jug
- 10 mL syringe (without a needle), for dispensing the enzyme
- 500 mL measuring cylinder
- Pointed knife or a small piece of sandpaper
- OPTIONAL: Water bath or incubator maintained at 35–40 °C

Materials

- Whole citrus fruit *e.g.*, orange, lemon or grapefruit
- Novozymes *Pectinex*TM, 15 mL
- Cling film, to cover jug or beaker



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 mL of pectinase preparation to the measuring cylinder; make up to 300 mL 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.

Fig. 1

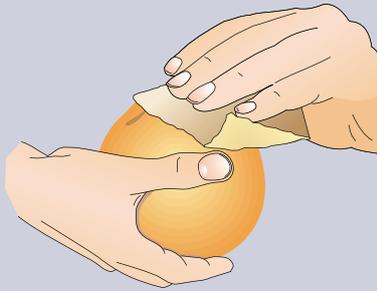


Fig. 2

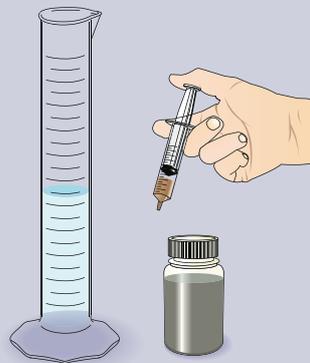
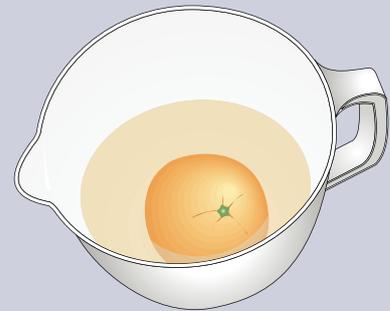


Fig. 3



- 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.

Fig. 4

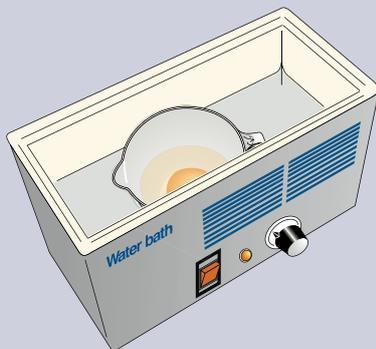


Fig. 5



Safety guidelines



Do not consume the fruit

The enzyme suggested for this work is safe to use, provided it is handled appropriately. While the pectinase preparation suggested is a food-grade product, fruit prepared with it should not be consumed. There are two reasons for this. Firstly, the proportion of the enzyme product used here is far greater than that normally used in the food industry. Secondly, the enzyme has not been handled aseptically, so it (and the products made using it) may have been contaminated.

Readers are advised to refer to any local safety guidelines and to carry out their own risk assessment for any practical work.

General enzyme safety guidelines

As enzymes are water-soluble, water should always be used for their removal if they are spilt.

Do not let liquid enzyme preparations dry up

If liquid preparations are allowed to dry up, there is a risk of dust formation. In susceptible people the repeated inhalation of such dust may provoke asthma or a reaction similar to hay fever. Any spillage — on equipment, on the floor or bench — should immediately be rinsed away with water.

Avoid formation of aerosols

If enzyme-containing aerosols are formed, there is a risk of inhalation of the enzyme. In susceptible people the repeated inhalation of such aerosols may provoke asthma or hay fever. For this reason enzyme preparations should never be sprayed.

Avoid direct skin and eye contact

If, by accident, you get liquid enzyme on your skin or in your eyes, the remedy is plenty of tap water. The same applies to clothing. In the event of a spill on clothes, rinse with water then wash as usual. This treatment will generally prove sufficient, but if symptoms develop in the respiratory passages, on the skin or in the eyes, consult a doctor immediately.



Knives

Care should also be taken when handling knives during this practical procedure. Sandpaper may be used as an alternative method of scoring the fruit if necessary.

Preparation and timing

It takes about 30 minutes to set this investigation up. The fruit must then be left overnight for the enzyme to act. If you use a water bath for this work, it will save time if you warm it to 35–40 °C before starting.

Troubleshooting

Fruits tend to float in the pectinase solution, and may need to be kept submerged by placing a small plate or weight on them. If the fruit is left overnight in a cold room, the enzyme will take longer to work.

Open-ended investigations

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?

Suppliers

The NCBE supplies *Novozymes* enzyme products to schools and colleges in the United Kingdom. Similar arrangements may exist in other countries.

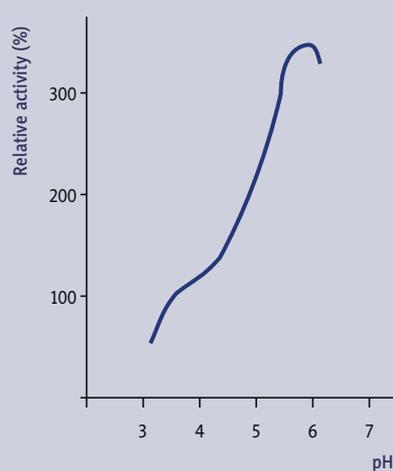
Storage of materials

The enzyme preparations should be stored undiluted, at 3–4 °C.

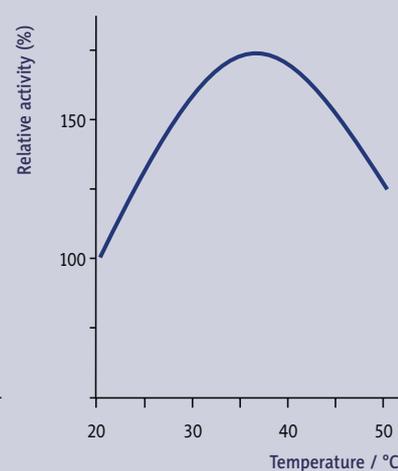
These graphs show the activity of polygalacturonase, one of the main enzymes in the pectinase preparation.

DATA COURTESY OF NOVOZYMES A/S

Enzyme activity at 20 °C



Enzyme activity at pH 3.5



Other sources of information

In a jam and out of juice by Dean Madden (2000) National Centre for Biotechnology Education. ISBN: 0 7049 1373 9.

Coglan, A. (1996) Naked fruit for lazy shoppers *New Scientist*, **152** (2053) 26.

Web site

Novozymes

<http://www.novozymes.com>

Acknowledgement

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