

NEATH PORT TALBOT COLLEGE COLEG CASTELL NEDD PORT TALBOT

School of Maths & Science Science Practical

Better milk for cats

◆ Aim

To investigate the effects of using immobilised enzyme lactase on milk.

◆ Introduction

Lactase (β galactosidase) catalyses the hydrolysis of lactose to glucose and galactose. Both of these sugars taste sweeter than lactose and are more readily-digestible than them. Despite their traditional liking for milk, cats are unable to digest large amounts of lactose. Milk can be treated with the enzyme to make lactose reduced milk suitable for cats or humans who are lactose intolerant.

Although the production of a special ‘cat milk’ may seem trivial, an estimated 75 % of the world’s human population are intolerant of lactose in adulthood — it is lactose tolerance that is unusual. Commercially, the milk is treated by injecting enzyme into the carton as UHT milk is packaged, or by using an immobilised enzyme — an enzyme which has been trapped on an inert material so that it can be used repeatedly.

In this activity you will immobilise the enzyme lactase in calcium alginate beads held within a small column, over which the milk is passed.

◆ Safety

Control Measures



- The wearing of **safety goggles** and a **laboratory coat** at all times will be sufficient to take account of most hazards and significant risks.
- Do not consume the milk.
- The enzyme used for this work is safe to use, provided it is handled appropriately. Novozymes Lactozym® is a food grade product, milk prepared using it should not be consumed because the enzyme has not been handled aseptically, so it (and the product made using it) may have been contaminated.
- As enzymes are water-soluble, any spillage on equipment, floor or bench should immediately be rinsed away with water. Avoid the 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.

Control Measures Cont....

- 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.
- Avoid direct skin and eye contact. In case of contact with your skin or in your eyes rinse immediately with plenty of water.
- In case of contact with clothing, 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.

Hazards



Irritant

Novozymes Lactozym®
Calcium Chloride solution

◆ Equipment

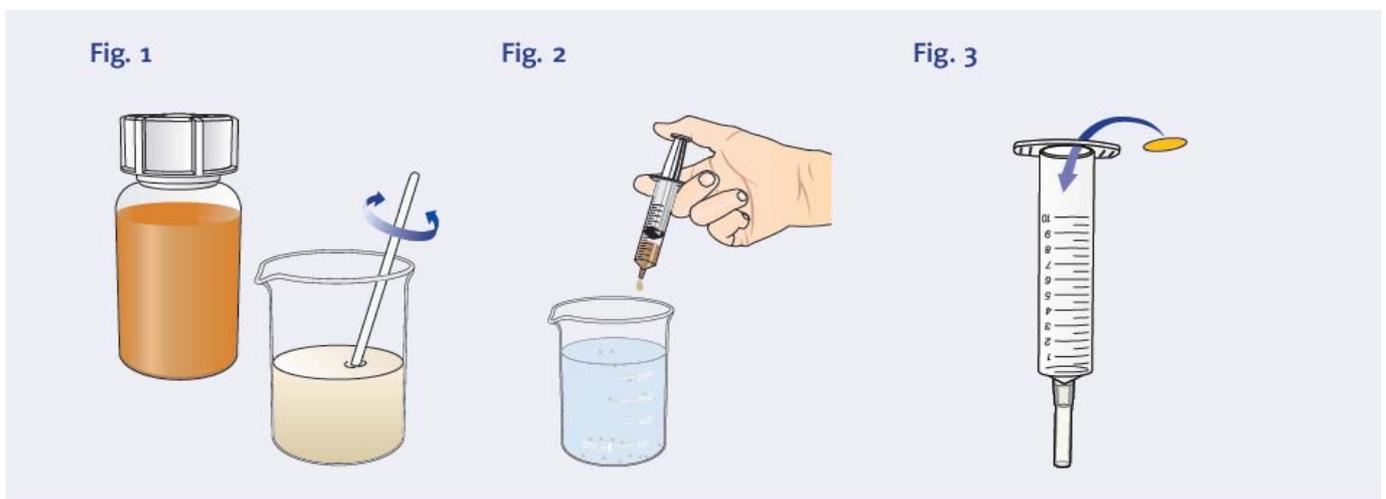
Small piece (about 1 cm²) of nylon gauze *e.g.*, net curtain
10 cm³ plastic syringe (without a needle)
4 mm diameter aquarium airline or silicone tubing, about 7 cm long, to fit syringe
Aquarium airline tap or adjustable laboratory tubing clip (Hoffman clip)
Retort stand, boss and clamp (to support enzyme column)
Small beakers or disposable plastic cups, 2
Tea strainer
Glass stirring rod

◆ Materials

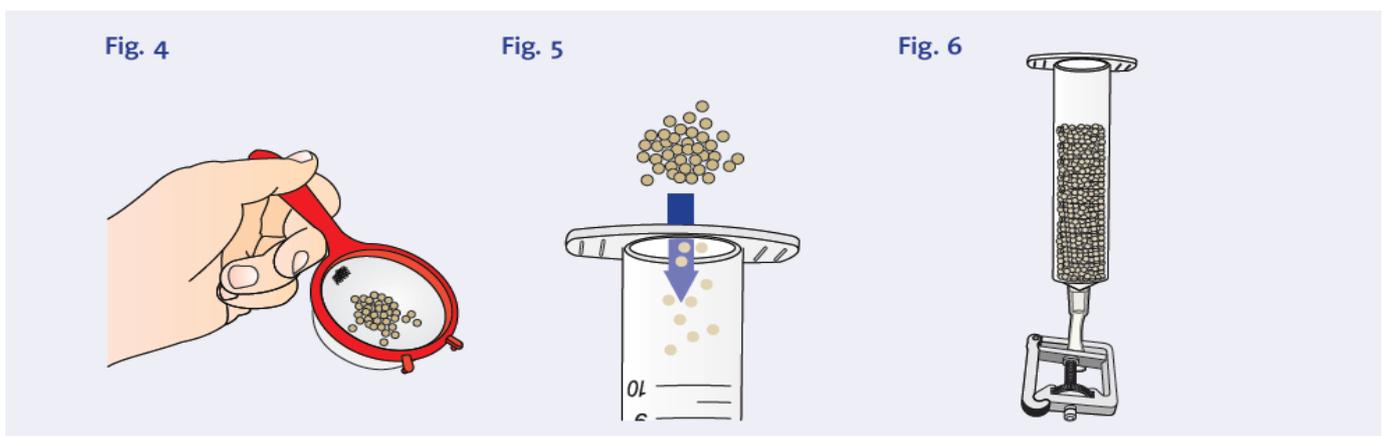
Lactase enzyme, *Novozymes Lactozym®*, 2 cm³
2 % sodium alginate solution, 8 cm³
1.5 % calcium chloride solution, 100 cm³
Milk, 50 cm³, ideally at room temperature (*not* UHT milk)
Semi-quantitative glucose test strips x 2 *e.g.* *Clinistix*

◆ Procedure

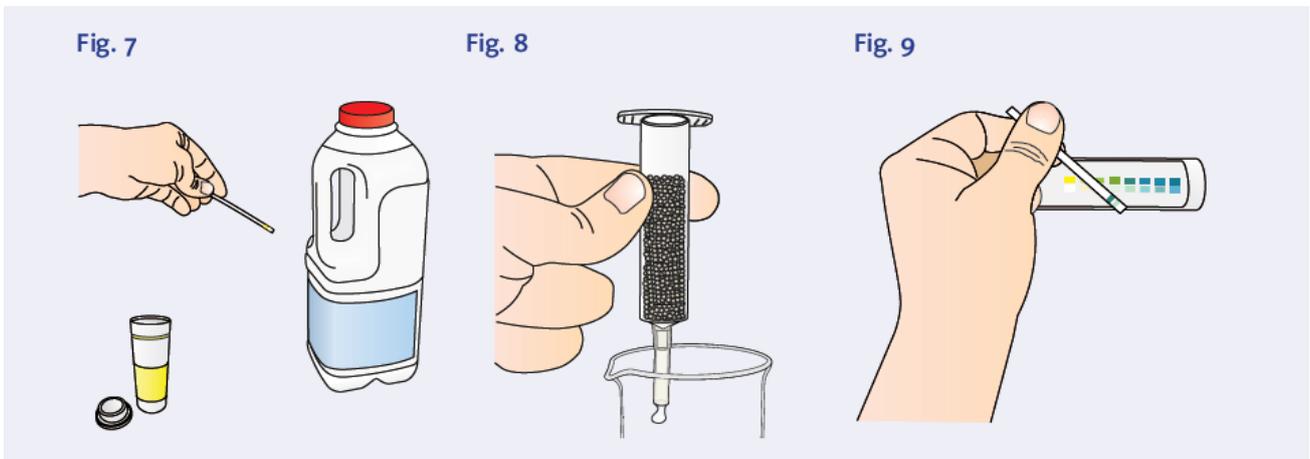
1. Mix the enzyme with the sodium alginate solution, then draw it up into a 10 cm³ syringe.
2. Add the alginate-enzyme mixture a drop at a time from the syringe to the calcium chloride solution. Do not allow the tip of the syringe to come into contact with the calcium chloride solution, as this will cause the alginate to harden, blocking the outlet. The beads, which contain the enzyme immobilised in a matrix of calcium alginate, should be allowed to harden for a few minutes.
3. Attach a short length of tubing to the tip of a syringe barrel. Place a small disc of nylon gauze inside the barrel, to prevent the beads from blocking the syringe outlet.



4. Separate the beads of immobilised enzyme from the liquid with the tea strainer.
5. Carefully tip the beads into the syringe barrel.
6. Close the tubing on the syringe barrel using a tubing clip.



7. Test the milk before treatment using the glucose test strips, to ensure that it does not contain any glucose.
8. Pour a small volume of milk over the enzyme beads, then undo the clip and allow the treated milk to run into a small beaker.
9. Test the milk leaving the column using the glucose test strips. If necessary, return the treated milk to the column until the desired concentration of glucose is achieved.



◆ **Results**

	Colour of Clinistix before testing	Colour of Clinistix after testing	Glucose Present / Absent
Glucose test on milk at start of experiment			
Glucose test on milk at start of experiment after passing through immobilised enzyme			