Effect of Temperature on a Stomach Enzyme

Rennin is an enzyme found in the stomach of new-born mammals. It helps to coagulate (change from a fluid to a curd-like or solid mass) casein, the main protein in milk. In this activity you will investigate the effect of temperature on the activity of rennin.

Materials

rennin enzyme (1 cheese rennet tablet in 200 mL water or 1 junket tablet in 50 mL water)

skim milk ice stopwatch 6 test tubes and rack thermometer water bath

medicine dropper 3 250 mL beakers

Procedure

Part A

- 1. Set up a water bath and start heating 150 mL of water in one of the beakers.
- 2. Label the 6 test tubes a follows: 0°C (E), 0°C (C), 37°C (E), 37°C (C), 100°C (E), 100°C (C). Note that 'E' is for enzyme and 'C' is for control.
- 3. Put about 10 mL of skim milk in each test tube. The exact amount is not as important as all tubes having the same amount.
- 4. Prepare a 150 mL ice bath in one beaker and a 37°C water bath in the other beaker.
- 5. Do not proceed until the water in the third beaker is boiling.
- 6. Place 1 mL of rennin solution into each of the test tubes marked 'E.' Mix well.
- 7. Place the test tubes in the appropriate water bath and record the time.
- 8. Monitor each water bath to maintain a consistent temperature.
- 9. Once each minute for 10 min lift and tilt each tube. Record the time that coagulation occurs.

Part B

- 11. After 10 min remove the 37°C test tubes from the water bath and place the 0°C (E), 100°C (E), and the 100°C (C) tubes in the 37°C water bath for 5 min.
- 12. After 5 min add 1 mL of enzyme solution to the 100°C (C) tube.
- 13. Repeat step 10 for these tubes.

Questions

- 1. What does rennin do to milk at 37°C?
- 2. a) At what temperature does rennin work fastest?
- b) Why do you think this temperature was chosen for the experiment?
- 3. Does cooling rennin to 0°C destroy the enzyme? How do you know?
- 4. a) Does boiling rennin to 100°C destroy the enzyme? How do you know?
- b) Is milk protein completely destroyed at 100°C? How do you know?
- 5. What assumption did you make about the temperature of the milk and the surrounding water?
- 6. What are the 'C' tubes necessary in this experiment?
- 7. a) Predict the effect of boiled amylase on starch.
- b) Predict the best temperature of amylase.
- c) Predict the best temperature for pepsin, lactase, and lipase activity.
- d) Predict the best pH (acid, neutral, basic) for rennin activity. Explain your prediction.
- 8. a) Suggest why rennin is present in the stomachs of new-born mammals but not older mammals.
- b) Which protein digesting enzyme is produced in the stomach of adult mammals?
- 9. How is rennin used commercially?