

03: Rate of an enzyme reaction

Time: 2 h

Evaluated criteria: DCP and CE

Objective:

- To learn a method to measure the rate of an enzyme reaction.
- To investigate if temperature has an influence on the breaking down of H₂O₂ by yeast.

Background information: Baker's yeast (*Saccharomyces cerevisiae*) is the most well-known member of the yeast family of microorganisms, and has lately also become of great importance in biotechnological research due to its simplicity and large variety of purposes. The simplicity and importance of yeasts lies in the fact that they are unicellular organisms with a rather high variety of useful enzymes. One of the molecules produced by yeast is Catalase (produced by almost every living thing). Catalase breaks down Hydrogen peroxide in oxygen gas and water by the following reaction: $2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2$

One molecule of catalase is known to convert over 40 million hydrogen peroxide molecules in oxygen and water in just one second.

Materials:

3% Hydrogen peroxide

1% yeast suspension – one packet of dry yeast (=25g fresh yeast) in 250mL warm water.


A 5.0 cm³ pipette

A manual propipetter

A test tube and a test tube rack

Data logger + temperature probe and gas pressure sensor

Method:

- **Connect** the data logger, sensors and laptop.
- Under Experiment (Experimento)/Data collection (Toma datos) **set** the length of data collection to 2 minutes.
- Set the sampling rate to 60 samples per minute.
- Place the test tube in the beaker.
- Measure 2 cm³ yeast suspension with the pipette using the propipetter, and release it in the test tube.
- Use a different pipette and measure 1cm³ H₂O₂.
- Keep the pipette close to the test tube and ask your classmate to click the 'Collect' button (Tomar datos).
- After 3-4 seconds add the peroxide to the yeast and immediately add the stopper, making sure it is carefully and tightly put.
- Collect data for 2 minutes and then click 'stop'.
- **Calculate the slope** with the data logger program by clicking on: 
- Add the value for *R* to your data table in excel. These values you compare in your data process.
- Click on experiment/Store latest run (Almacenar última serie) to collect more data.
- Do each temperature once and share the data with your classmates

Data process:

- Do a table with the raw and processed data and a graph to compare the slopes.
- Calculate the mean and SD.
- Indicate clearly in the data table which data has been collected by you and write that as a footnote to the table.

Conclusion and evaluation:

- Introduce the substances used.
- Make sure to explain what the slope stands for.
- Explain your results by referring to the reaction and the functioning of the enzyme Catalase.
- Discuss possible weaknesses and for each an improvement.
- Make sure to add the bibliography (APA).