



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024**

- COURSE NAME : ENZYME TECHNOLOGY
- COURSE CODE : BNN 30503
- PROGRAMME CODE : BNN
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER **ALL** QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES.

- Q1.** Enzymes are proteins that act as biological catalysts by accelerating chemical reactions.
- (a) Define the enzyme regulation.
(2 marks)
 - (b) Discuss **THREE (3)** reasons why studying enzyme regulation is important.
(3 marks)
 - (c) Describe **THREE (3)** advantages and **THREE (3)** disadvantages of using enzymes as the biocatalyst in comparison with chemical catalyst.
(6 marks)
 - (d) An enzyme with a K_m of 0.06 mmol/L hydrolyzed a substrate of a concentration 0.03mmol/L. The initial velocity of the reaction was 0.0015 mmol/L.min⁻¹. Calculate the substrate concentration which gives an initial velocity of 0.003 mmol/L.min⁻¹.
(6 marks)
 - (e) A student in Chemical Engineering Technology conducted an experiment to study allosteric enzyme regulation. After collecting data, he created a graph of reaction rate versus substrate concentration. The resulting graph did not align with the typical pattern as Michaelis-Menten kinetics. Analyse and justify his finding.
(8 marks)
- Q2.** Commercial sources of enzymes are obtained from three primary sources, i.e., animal tissue, plants, and microbes.
- (a) Out of approximately 100 enzymes used in industry, more than half come from fungi and yeast, while over a third are derived from bacteria. The rest are split between animal sources (8%) and plant sources (4%). Justify why microbes are preferred compared to plants and animals as sources of enzymes.
(5 marks)

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- (b) **Figure Q2.1** illustrates the production of oligosaccharides from lactose in milk or whey. Where, A is for the kinetically and B is for the equilibrium-controlled process respectively.

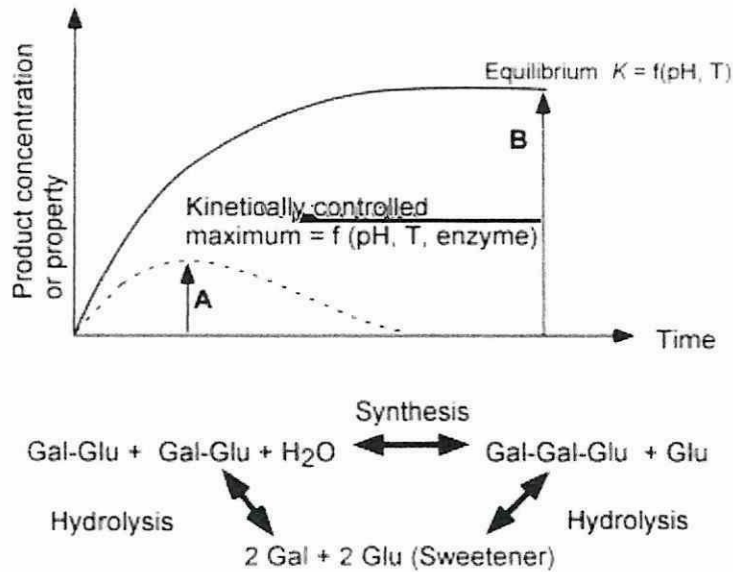


Figure Q2.1 Oligosaccharides production from lactose.

- (i) Explain the relevance of **Figure Q2.1** for enzyme technology. (8 marks)
- (ii) Evaluate which properties of the enzyme and the catalyzed process must be known to minimize by-product formation in the production of oligosaccharides from lactose. (6 marks)
- (c) Propose **THREE (3)** strategies to prevent the allergic and toxic risks due to enzymes usage in enzyme technology. (6 marks)

Q3. Enzyme is the most important feature of biological life activities is metabolism. All life activities are maintained by the normal operation of metabolism, and various chemical reactions in biological metabolism are carried out under the action of various enzymes.

- (a) List **FIVE (5)** factors affecting enzyme activity. (3 marks)

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- (b) **Figure Q3.1** illustrates two methods in downstream processing of industrial enzyme.

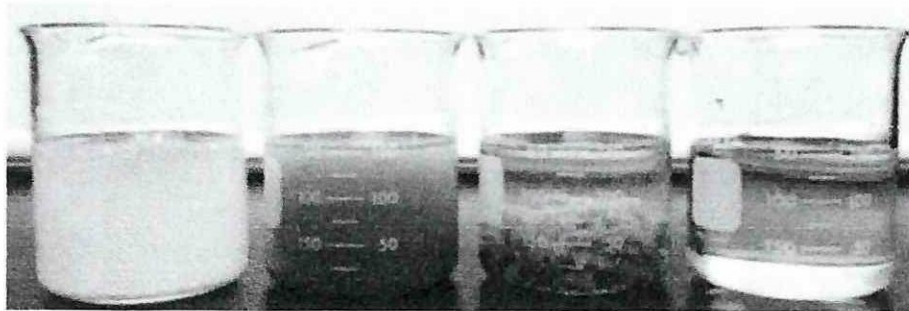


Figure Q3.1 Downstream processing of industrial enzyme.

- (i) Identify the name of the methods in **Figure Q3.1**.
(4 marks)
- (ii) Justify why these methods were chosen instead of centrifugation method in downstream processing of industrial enzyme.
(6 marks)
- (c) Propose **FIVE (5)** factors that must be considered by the experts for the revision of the safety evaluation of enzyme preparations for use in foods.
(10 marks)

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Q4. Industrial enzymes are commercially utilized across a range of industries including pharmaceuticals, chemical manufacturing, biofuels, food and beverage, and consumer goods.

- (a) Illustrate a flow chart the basic procedures to produce industrial enzymes from animal tissue, plant, and microbes.

(7 marks)

- (b) Lactose intolerance is a common condition where individuals lack sufficient levels of lactase, an enzyme responsible for breaking down lactose, the sugar found in milk and other dairy products. To cater to lactose-intolerant consumers, the food industry has developed lactose-free dairy products, and this involves the industrial production of lactase.

High-Throughput Screening (HTS) plays a critical role in the production of lactase for lactose-free dairy products. Propose the framework for utilizing high-throughput screening (HTS) in the manufacturing of lactase for lactose-free dairy products.

(18 marks)

- END OF QUESTIONS -

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