EXPERIMENTAL METHODS IN MODERN BIOTECHNOLOGY

Editors

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CONTENTS

Chapter 4. Factors Affecting Enzyme Assays

Hamzah Mohd Salleh

Chapter 5. Techniques of Extraction and Purification of Fucoxanthin from Brown Seaweeds

Irwandi Jaswir, Dedi Noviendri, Hamzah Mohd Salleh, Muhammad Taher and Kazuo Miyashita

Chapter 6. Fundamentals of Proximate Analysis in Food Products

Irwandi Jaswir and Asiyanbi-Hammed Tawakalit Tope

Chapter 7. Fish Gelatin Production: Extraction Method and Quality Analysis

Irwandi Jaswir, Hammed A. Monsur and Hamzah M. Salleh

Chapter 8. Application of Fourier Transform Infrared Spectroscopy Edible Fats and Oils Analysis

Mohamed Elwathig Saeed Mirghani

Chapter 10. Homology Modelling Of Pyranose-2-Oxidase from Phanerochaete Chrysosporium

Ibrahim Ali Noorbatcha, Azratul Ashimah Nur Mohd Dom, Ahmad Sidqi Harithuddin and Hamzah Mohd Salleh

Chapter 11. Liquid-Liquid Extraction and its Application for Separation of Organic Acids

Parveen Jamal

CHAPTER 1:

Immobilization of Enzymes

Faridah Yusof

1. Introduction

As enzymes are biological catalysts that promote the rate of reactions but are not themselves consumed in the reactions, they may be used repeatedly for as long as they remain active. However, in most of the processes, enzymes are mixed in a solution with substrates and cannot be economically recovered after the reaction and are generally wasted. Thus, there is an incentive to use enzymes in an immobilized or insolubilized form so that they may be retained in a biochemical reactor for further catalysis. This is done by enzyme immobilization which may be defined as the process whereby the movement of enzymes, cells, organelles, etc. in space is completely or severely restricted usually resulting in a water-insoluble form of the enzyme.

2. Scope of This Chapter

This chapter is intended to be an introductory to enzyme or biocatalyst immobilization research. It starts with highlighting the salient features of enzyme immobilization, giving some advantages and disadvantages of this technique. A few methods of enzyme immobilization are discussed in brief; however the detailed version of each method can easily be assessed from many reviews, textbooks or journal papers. The author also includes the discussion of the carrier-free enzyme immobilization technique, a method which is recently becoming more popular, as it can offer the advantages of highly concentrated enzyme activity combined with high stability and low production cost owing to the exclusion of expensive carriers. The chapter ends by presentation of two enzyme immobilization methods, immobilization with carrier, entrapment, and another carrier-free, Cross-Linked Enzyme Aggregates (CLEA).

3. Salient Features of Enzyme Immobilization

Immobilized enzyme system has many good features. Some of the salient features of immobilized enzymes are as follows:

- The enzyme phase is the carrier phase which is water insoluble but hydrophilic porous polymeric matrix, e.g. agarose, cellulose, etc.
- The enzyme phase may be in the form of fine particulate, membranous, or microcapsule.
- The enzyme in turn may be bound to another enzyme via cross linking.
- A special module is produced employing immobilization techniques through which fluid can pass easily, transforming substrate into product and at the same time facilitating the easy removal of catalyst from the product as it leaves the reactor.
- The support or carrier utilized in immobilization technique is not stable at particular pH, ionic strength, or solvent conditions; hence, may be disrupted or dissolved releasing the enzyme component after the reaction.

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