CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME III

Editors:

Md. Zahangir Alam
Ahmed Tariq Jameel
Azura Amid

IIUM PRESS

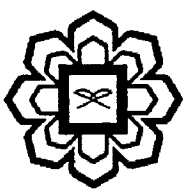
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

(*VOLUME III*)

Editors:
Md. Zahangir Alam
Ahmed Tariq Jameel
Azura Amid

Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Md. Zahangir Alam, Ahmed Tariq Jameel & Azura Amid: Current Reasearch and Development in Biotechnology Engineering at IIUM Volume III

ISBN: 978-967-418-144-4

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

CONTENTS

CHAPTER 27

DESIGN AND DEVELOPMENT OF A LAB SCALE BIOREACTOR FOR HEAT INDUCIBLE ENZYME EXPRESSION SYSTEM

[1]Daud Adam, [2]Ahmad Faris Ismail and [1]Hamzah Mohd. Salleh

[1]Department of Biotechnology Engineering,
[2]Department of Mechanical Engineering,
Faculty of Engineering, International Islamic University Malaysia,
P.O. Box 10, 50728 Kuala Lumpur, Malaysia

ABSTRACT

Bioreactors are very important for cell growth and mass production of intended product, for example enzyme. Considerations of the process such as the level of agitation, aeration without cell damage, temperature optimization, good control environment, cell concentration, optimized medium utilization must be taken into consideration. Design and selection for this design project depends on cell specific demand, regulatory and economics. In order to find the suitable bioreactor for instant temperature change, heat transfer and thermodynamics concept are implemented. Thus this project aspires to design an automated bioreactor system whereby its major function is both instantaneous heating and cooling for the production of a recombinant enzyme as the induction temperature is shifted from 37°C to 55°C and returning it back to 37°C. An extra controller which has similarities to the concept of heat exchanger is applied to the design of a lab scale bioreactor. The equipment is known to be twin thermo circulator. The higher the mass flow rate of the fluid from the twin thermo circulator contributes to high heat transfer, higher efficiency, and greater temperature change. The disadvantage is the higher the mass flow rate, the greater the pressure loss and a bigger pump is needed.

Keywords: Heat Inducible System, Enzyme, Bioreactor Design

INTRODUCTION

The key issues for bioreactor design system are related to a series of concepts which must be clarified for each specific case, among which optimal cell concentration, specific rates of product synthesis, specific rate of oxygen uptake and specific rates of heat evolution are most important (Asenjo, 1995). In the case of microbial growth in a bioreactor, the microorganisms are able to perform their desired function when subjected to optimum conditions, the bioreactor's environmental conditions such as gas, air, oxygen, nitrogen, and carbon dioxide flow rates, temperature, pH and dissolved oxygen levels, and agitation speed and circulation rate need to be closely monitored and controlled. Various types of