

Copyright © Universiti Malaysia Pahang, 2015

First Print 2015

All right reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher. Penerbit Universiti Malaysia Pahang.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Lakhveer Singh

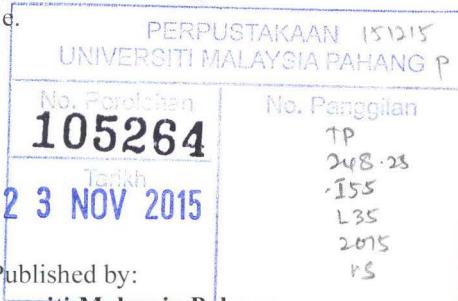
APPLICATION OF IMMOBILIZED CELL SYSTEMS IN BIO HYDROGEN PRODUCTION / Lakhveer Singh, Zularisam Ab Wahid.

ISBN 978-967-0691-52-7

1. Immobilized cells. 2. Hydrogen--Biotechnology.

I. Zularisam Ab. Wahid. II. Title.

665.81



Published by:

Penerbit Universiti Malaysia Pahang

Lebuh Raya Tun Razak

26300 Gambang, Kuantan,

Pahang Darul Makmur.

Tel: 09-5493320 Fax: 09-5493381

penerbitilmiah@ump.edu.my

Printed by:

Syarikat Percetakan Inderapura Sdn. Bhd. (8763 H)

Jalan Tanjung Api Off Jalan Telok Sisek

25050 Kuantan, Pahang Darul Makmur.

Tel: 09-5177225, 5177031 & 5177025

Fax: 09-5139434

CONTENTS

APPENDICES.....	x
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xiii
LIST OF ABBREVIATIONS/SYMBOLS.....	xvii
PREFACE.....	xxi
ACKNOWLEDGEMENT.....	xxiii
CHAPTER 1: INTRODUCTION.....	1
1.1 Introduction.....	1
1.2 Background.....	1
1.2.1 Palm Oil Industry in Malaysia.....	1
1.2.2 The Palm Oil Mill Effluent.....	2
1.2.3 POME as Fermentation Media.....	3
1.2.4 Cell Immobilization.....	4
1.2.5 Up-Flow Anaerobic Sludge Blanket (UASB) Reactor.....	5
1.2.6 Biohydrogen Production.....	6
1.3 Problem Statement.....	8
CHAPTER 2: LITERATURE REVIEW.....	11
2.1 Introduction.....	11
2.2 Palm Oil Mill Effluent.....	11
2.2.1 Environmental Regulations of POME Discharge...	14
2.2.2 Cleaner Production as a Sustainable Strategy for POME Management.....	16
2.2.3 Bioenergies Production from POME.....	17
2.2.4 Palm Oil Mill Flow Description.....	20
2.2.5 Sterilization of Fresh Fruit Bunches.....	20