

# RECENT DEVELOPMENT OF MICROCARRIER FOR CELL CULTURE ENGINEERING

*Edited By*  
Maizirwan Mel  
Yusilawati Ahmad Nor  
Iis Sopyan  
Ahmad Fadli



IIUM Press

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
© IIUM Press, IIUM

All rights 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 prior written permission of the publisher.

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Recent Development Of Microcarrier For Cell Culture Engineering  
Maizirwan Mel  
Include Index

ISBN 978-967-418-009-6

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 Ihsan

# Contents

---

<b>FOREWORD</b>	<b>vii</b>
<b>SYNOPSIS</b>	<b>ix</b>
<b>CHAPTER</b>	
<b>1 UV/Ozone Treatment System for Polystyrene Beads Modification</b>	<b>1</b>
<i>Yusilawati Ahmad Nor, Maizirwan Mel, Iis Sopyan, Hamzah Mohd Salleh, Ng Kim Hooi, Wong C.S</i>	
<b>2 Ultraviolet/Ozone Treatment for Polystyrene Beads Modification and Its Effect on Gelatin Coating</b>	<b>11</b>
<i>Yusilawati Ahmad Nor, Maizirwan Mel, Iis Sopyan, Hamzah Mohd Salleh, Ng Kim Hooi, Wong C.S</i>	
<b>3 The Study of Immobilized Bovine and Fish Gelatin on Carboxyl Containing Polystyrene Beads for Vero Cell Culture</b>	<b>23</b>
<i>Yusilawati Ahmad Nor, Maizirwan Mel, Hamzah Mohd Salleh, Ng Kim Hooi, Wong C.S</i>	
<b>4 The Effect of Hydroxyapatite Addition on Biocompatibility of Porous Alumina Microcarriers for Vero Cell Culture</b>	<b>33</b>
<i>Ahmad Fadli, Iis Sopyan, Maizirwan Mel</i>	
<b>5 Biocompatibility of Porous Hydroxyapatite Microcarrier for Vero Cell Culture Application</b>	<b>43</b>
<i>Maizirwan Mel, Iis Sopyan, Ahmad Fadli</i>	
<b>6 Evaluation on Biological Performance of Porous Pure and Magnesium-Doped Biphasic Calcium phosphate Ceramics using Vero Cell Culture</b>	<b>51</b>
<i>Toibah Abd Rahim, Iis Sopyan, Maizirwan Mel, Ahmad Fadli</i>	
<b>7 Locally Processed Serum Performance in Vero Cell Culture: Part I</b>	<b>61</b>
<i>Yusilawati Ahmad Nor, Jaafar Nuhu Jaafar, Maizirwan Mel</i>	

<b>8</b>	<b>Locally Processed Serum Performance in Vero Cell Culture: Part II</b>	<b>73</b>
	<i>Yusilawati Ahmad Nor, Jaafar Nuhu Jaafar, Maizirwan Mel</i>	
<b>9</b>	<b>The Vero Cells Growth in Different Type of Microcarriers</b>	<b>85</b>
	<i>Yusilawati Ahmad Nor, Nurul Hafizah Sulong, Maizirwan Mel, Hamzah Mohd Salleh, Iis Sopyan</i>	
<b>10</b>	<b>The Growth Culture of BRIN-BD11 Producing Insulin in Different Type of Microcarriers</b>	<b>97</b>
	<i>Maizirwan Mel, Mohamed Ismail Abdul Karim, Siti Aisyah Mohd Yusuf, Yumi Zuhanis Has-yun Hashim, Yusilawati Ahmad Nor</i>	
<b>11</b>	<b>The Growth Rate and Viability of DF1 Cell in Different Culture Media</b>	<b>111</b>
	<i>Mohd Azmir Arifin, Maizirwan Mel, Raha A.R, Sharifah Syed Hassan, Aini Ideris</i>	
<b>12</b>	<b>The Growth Study of DF1 Cell in Microcarrier Based Bioreactor</b>	<b>121</b>
	<i>Mohd Azmir Arifin, Maizirwan Mel, Raha A.R, Sharifah Syed Hassan, Aini Ideris</i>	
<b>13</b>	<b>Cell Attachment Study of Chicken Fibroblast Cell (DF-1) using Ceramic Microcarrier Granule in Bioreactors</b>	<b>131</b>
	<i>Maizirwan Mel, Iis Sopyan, Yusilawati Ahmad Nor</i>	
<b>14</b>	<b>Optimization of Process Conditions for High Cell Density Proliferation Of DF-1 Cells in Bioreactor</b>	<b>141</b>
	<i>Maizirwan Mel, Mohd Azmir Arifin, Hajar Naemah Sohif, Sharifah Syed Hassan</i>	
<b>15</b>	<b>The study of NDV Titer Using Different Cell Lines in T-Flask Culture</b>	<b>149</b>
	<i>Jaafar Nuhu Ja'afar, Maizirwan Mel, Mohd Ismail Abdul Karim, Sharifah Syed Hassan, Aini Ideris</i>	
<b>16</b>	<b>Newcastle Disease Virus Propagation in Stirred Tank Bioreactor: Part I</b>	<b>159</b>
	<i>Mohd Azmir Arifin, Siti Hajar Salim, Maizirwan Mel</i>	
<b>17</b>	<b>Newcastle Disease Virus Propagation in Stirred Tank Bioreactor: Part II</b>	<b>171</b>
	<i>Mohd Azmir Arifin, Siti Hajar Salim, Maizirwan Mel</i>	

# Chapter 3

## The Study of Immobilized Bovine and Fish Gelatin on Carboxyl Containing Polystyrene Beads for Vero Cell Culture

*Yusilawati Ahmad Nor, Maizirwan Mel, Hamzah Moh Salleh,  
Ng Kim Hooi, Wong C.S*

---

### 1. Introduction

Biomaterials are material which able to replace or restore biological functions and exhibit a pronounced compatibility with their application in biological environment (Drotleff et al., 2004). Since the proliferation of anchorage-dependent cells can be only occurred after adhesion to a suitable culture surface, it is important to use surfaces of biomaterial and culture procedures that enhance all of the steps involved in adhesion (Grinnell, 1997). Polystyrene (PS) are widely used polymer as a core substrate for MCs because of its favorable properties such as low specific weight, high chemical resistance, mechanical flexibility and biocompatible (Murakami et al., 2005).

Gelatin on the other hand has domains of arginine-glycine-aspartic acid (RGD) peptide sequences that mimic many features of the extracellular matrix (ECM) in their molecules which can be recognized as ligands that can be specifically bind with integrin on cell membranes. These properties can effectively introduce specific interaction with the cell receptor and accelerate cell attachment and spread (Hu et al., 2009). Mammalian gelatins such as porcine and