

University of Groningen

Unlocking microalgal treasures

Azimatun Nur, Muhamad

DOI:
[10.33612/diss.126441666](https://doi.org/10.33612/diss.126441666)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2020

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):
Azimatun Nur, M. (2020). *Unlocking microalgal treasures: Utilization of palm oil mill effluent as growth medium for the production of value-added microalgal compounds*. University of Groningen. <https://doi.org/10.33612/diss.126441666>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Unlocking microalgal treasures

Utilization of palm oil mill effluent as growth medium for the production of value-added microalgal compounds

Muhamad Maulana Azimatun Nur

Unlocking microalgal treasures

Utilization of palm oil mill effluent as growth medium for the production of value-added microalgal compounds.

Muhamad Maulana Azimatun Nur
PhD Thesis
Ocean Ecosystems,
Energy and Sustainability Research Institute,
University of Groningen

June 2020

Cover design and artwork: M.M. Azimatun Nur
Layout: Proefschriftmaken
Printed by: Proefschriftmaken
ISBN: 978-94-034-2524-5
ISBN (electronic version): 978-94-034-2523-8



lembaga pengelola dana pendidikan

The research reported in this thesis was carried out at the department of Ocean Ecosystems, Energy and Sustainability Research Institute Groningen (ESRIG) of the university of Groningen (the Netherlands), according to the requirements of the Graduate School of Science and Engineering. This research was funded by Lembaga Pengelola Dana Pendidikan (LPDP), Ministry of Fund, Republic of Indonesia.

© 2020 M.M. Azimatun Nur

All rights reserved. No part of this thesis may be reproduced, stored, or transmitted in any form or by means, without permission of the author, or when applicable, of publishers of the scientific papers.



university of
 groningen

Unlocking microalgal treasures

Utilization of palm oil mill effluent as growth medium for the production of
 value-added microalgal compounds

PhD thesis

to obtain the degree of PhD at the
 University of Groningen
 on the authority of the
 Rector Magnificus Prof. C. Wijmenga
 and in accordance with
 the decision by the College of Deans.

This thesis will be defended in public on
 Monday 8 June 2020 at 16.15 hours

by

Muhamad Maulana Azimatun Nur

born on 29 October 1988
 in Semarang, Indonesia

Supervisors

Prof. A.G.J. Buma

Prof. K.R. Timmermans

Assessment Committee

Prof. H.J. Heeres

Prof. H. Hadiyanto

Prof. I. Angelidaki

To my family, my friends, my teachers,

"Hope is a good thing, maybe the best of things, and no good thing ever dies."

-Stephen King in The Shawshank Redemption

Table of contents

Chapter 1	Introduction and Thesis Outline	9
	1. Palm Oil Mill Effluent	10
	2. Microalgae for value added products	11
	3. Cultivation of microalgae on POME	13
	4. Pretreatment of wastewater for microalgal growth	24
	5. Potency of microalgae as a source of bioactive compounds growing on POME	25
	6. Thesis Outline	26
Chapter 2	Environmental and nutrient conditions influence fucoxanthin productivity of the marine diatom <i>Phaeodactylum tricornutum</i> grown on palm oil mill effluent	31
	Abstract	32
	1. Introduction	33
	2. Material and Methods	34
	2.3. Analyses	39
	3. Results	40
	4. Discussion	44
	5. Conclusion	49
	Acknowledgment	49
Chapter 3	Sulfated exopolysaccharide production and nutrient removal by the marine diatom <i>Phaeodactylum tricornutum</i> growing on palm oil mill effluent	51
	Abstract	52
	1. Introduction	53
	2. Material and Methods	55
	3. Results	60
	4. Discussion	66
	5. Conclusion	71
	Acknowledgment	71
	Supplementary data	71
Chapter 4	Enhancement of C-phycoyanin productivity by <i>Arthrospira platensis</i> when growing on palm oil mill effluent in a two-stage semi-continuous cultivation mode	75
	Abstract	76
	1. Introduction	77
	2. Material and methods	78
	3. Results	85
	4. Conclusion	95
	Acknowledgment	95
	Supplementary data	96

Chapter 5	Removal of color and phenolic compounds from palm oil mill effluent by <i>Arthrospira platensis</i>	101
	Abstract	102
	1. Introduction	103
	2. Materials and Methods	104
	3. Results	112
	4. Discussion	120
	5. Conclusion	124
	Acknowledgment	124
	Supplementary	125
Summary		127
	1. Summary	127
	2. Implications and recommendations	130
	3. Concluding remarks (Future outlook)	132
Samenvatting		133
	1. Samenvatting	133
	2. Implicaties en aanbevelingen	136
	3. Slotopmerkingen (toekomstperspectief)	138
Ringkasan		139
	1. Ringkasan	139
	2. Implikasi dan rekomendasi	142
	3. Kesimpulan	143
References		145
Acknowledgments		165
About the author		169
List of publications or projects during PhD study		171