شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

جامعة عين شمس

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MONA MAGHRABY

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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PHOTOBIOSTIMULATION OF GREEN ALGAE *Chlorella sorokiniana* USING RED LASER RADIATION FOR BIODIESEL PRODUCTION

By

MARYAM ELSAYED MUHAMMED FARIED
B.Sc. Agric. Engineering, Fac. Argic., Cairo Univ., 2014

THESIS

Submitted in Partial Fulfillment of Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences
(Agricultural Engineering)

Department of Agricultural Engineering
Faculty of Agriculture
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SUPERVISION SHEET

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Title of Thesis: Photobiostimulation of green algae *Chlorella sorokiniana* using red laser radiation for biodiesel production.
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Department: Agricultural Engineering **Approval: 14 / 9/ 2020**

ABSTRACT

At present, energy dependence on petrol fuels has been identified as a future challenge owing to the expected depletion of fossil fuel reserves and fast increasing consumption over recent years and thus could be said the increasing need for sustainable energy calls for the development of renewable and cost-effective alternative energy sources to reduce the use of fossil fuels. The ability of microalgae to produce high amount of lipid with fast growth rate made it superior biodiesel producers. Daily and diurnal cyclic changes in weather conditions, dramatic fluctuations of light intensity, limited capabilities of harvesting light and self-shading of microalgae are the most important problems. The objective of this study was to increase biodiesel production from green microalgal ***Chlorella sorokiniana*** biomass using Gas laser, (Red He-Ne laser 632.8 nm). The present study investigated the effect of monochromatic Light Emitting Diodes (*LEDs*) and He-Ne laser on the growth of the green microalgae ***Chlorella sorokiniana***. The irradiation of microalgal cell with laser source was hypothesized to enhance the accumulated of lipid, which increases the biodiesel production. The photobiostimulating effects of laser irradiation on biodiesel was investigated by irradiating the microalgal biomass two hours with 632.8 nm He-Ne red laser source compared with two hours white light as a control. The results showed that under He-Ne red laser irradiation the oil content was three times the white light as a control which yielded 1.2 g Oil L^{-1} Microalgae, 0.4 g Oil L^{-1} Microalgae. Also, the results showed that under He-Ne red laser irradiation the yield of biodiesel was three times the white light as a control which yielded 0.06 g Biodiesel L^{-1} Microalgae, 0.02 g Biodiesel L^{-1} Microalgae respectively. Both of He-Ne red laser and blue *LED* were the best in terms of increasing the total lipid and yield of biodiesel which yielded 1.2 g Oil L^{-1} Microalgae, 0.6 g Oil L^{-1} Microalgae respectively and 0.06 g Biodiesel L^{-1} Microalgae, 0.04 g Biodiesel L^{-1} Microalgae respectively. The total lipid and yield of biodiesel from microalgae significantly increased under He-Ne red laser, blue *LED*, green *LED*, white light and red *LED* respectively.

Keywords: Microalgae, Biodiesel, Laser, Light Emitting Diodes, Irradiation, Photobiostimulation, Renewable energy.

DEDICATION

This thesis is dedicated to my mother, father's soul, brothers (Abduallah and Abdurahman), sisters (Rana and Maha), as well as my nephews (Lulia and Slim). My thanks also go out to my uncles and my best friend (Fatma).

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LIST OF ABBRIVIATIONS

Acetyl-CoA	Acetyl Coenzyme
ACP	Acetyl Carrier Protein
AD	Anaerobic Digestion
ATB	Adenosine Triphosphate
ASTM	American Society for Testing and Materials
BDF	Biodiesel Fuel
BP	British Petroleum
CN	Cetane Number
CPR	Closed Pond Photobioreactor
DAG	Diacylglycerol
DCW	Dry Cell Weight
DHA	Docosahexaenoic Acid
DGAT	Diacylglycerol Acyltransferase
DW	Dry Weight
EDTA	Ethylenediaminetetraacetic acid
EPA	Eicosapentaenoic Acid
ER	Endoplasmic Reticulum
EROEI	Energy Return on Energy Investment
EN	European Standards
FAME	Fatty Acid Methyl Ester
FAS	Fatty Acid Synthase
FFA	Free Fatty Acids
FW	Fresh Weight
GC-MS	Gas Chromatography-Mass Spectrometry
G3P	Glycerol-3-Phosphate
GPAT	Glycerol-3-Phosphate Acyltransferase
GHGs	Greenhouse Gases
HFI	High Fluctuating Intensity
HRT	Hydraulic Retention Time
HLT	Hydrothermal Liquefaction Technology
HTP	Hydrothermal hydrolysis Pretreatment
LCA	Life Cycle Analysis
LCL	Lower Control Limit
LDPE	Low-Density Polyethylene
LEDs	Light Emitting Diodes
LPA	Lysophosphatidic acid

LPAT	Lysophosphatidic Acid Acyltransferase
NMR	Nuclear Magnetic Resonance
Ops	Open Ponds
PA	Phosphatidic Acid
PAP	Phosphatidic Acid Phosphatase
PAR	Photosynthetically Active Radiation
PBRs	Photobioreactors
PCA	Principle Component Analysis
PCs	Principal Components
PGA	Phosphoglycerate
PDH	Pyruvate Dehydrogenase
STP	Standard Temperature and Pressure
SCMA	Supercritical Methyl Acetate
TGAs	Triacylglycerol Triacylglycerols
UCL	Upper Control Limit
WLE	Wet Lipid Extraction

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