# بسم الله الرحمن الرحيم

Ain Shams University Information Network

جامعة عين شمس

شبكة المعلومات الجامعية

@ ASUNET

# شبكة المعلومات الجامعية
# التوثيق الالكتروني والميكروفيلم

# BIOFUEL PRODUCTION FROM ALGAE

**By**

**FATMA MOHAMED IBRAHIM NASR**
**B.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Cairo Univ., 2011**

**THESIS**
**Submitted in Partial Fulfillment of the**
**Requirement for the Degree of**

**MASTER OF SCIENCE**

**In**

**Agricultural Sciences**
**(Microbiology)**

**Department of Agricultural Microbiology**
**Faculty of Agriculture**
**Cairo University**
**EGYPT**

**2021**

**Format Reviewer** **Vice Dean of Graduate Studies**

SUPERVISION SHEET

# BIOFUEL PRODUCTION FROM ALGAE

**M.Sc. Thesis**
**In**
**Agricultural Sci. (Agricultural Microbiology)**

**By**


**FATMA MOHAMED IBRAHIM NASR**
**B.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Cairo Univ., 2011**


SUPERVISION COMMITTEE


**Dr. MAHMOUD.W. SADIK**
**Professor of Microbiology, Fac. Agric., Cairo University**

**Dr. SAYED ABDEL KADER FAYED**
**Professor of Agriculture Biochemistry, Fac. Agric., Cairo University**

**Dr. NASHWA ABD ELALIM HASSAN FETYAN**
**Head Researcher in Soils, Water and Environment Research Institute, Agricultural Research Center**

## *DEDICATION*

*This work is dedicated to My family, Aspecial feeling to my Dad and my Mom for their words of encouragement and pray and their support along the period of my life. My dear Brothers, My dear husband and my lovely sons. with my love and respect.*

# *ACKNOWLEDGEMENT*

*I would like to express sincere gratitude and thanks to **Dr. Mohammed Zakaria Sedik,** Professor of Agricultural Microbiology, Faculty of Agriculture, Cairo University for his efforts to complete the research plan. My deepest thanks and gratefulness are due to **Dr. Mohmoud. W. Sadik** Professor of agricultural Microbiology, Fac. Agric., Cairo University for his help and supervision of this work.*

*My deepest thanks are also extended to Prof. **Dr. Nashwa A. H. Fetyan**, Professor of agricultural microbiology, Soils, Water and Environment Research Institute, Agricultural Research Center for her great guidance encouragement, throughout the work in the thesis.*

*Special thanks are extended to **Dr. Sayed abdelkader** Professor of Agricultural Biochemistry, Faculty of Agriculture, Cairo University. For, excellent guidance, honest cooperation of this work.*

*I would like to express my greatest appreciation to Prof. **Dr. Abo El-Khair B. El-Sayed,** Professor of Algal Biotechnology, Head of Algal Biotechnology Unit, National Research Centre (NRC), for suggesting and planning the work, guidance, revision, continuous help and encouragement.*

*I am also extremely thankful to **Dr.Mohamed Hassoub, Amr Mostafa, Mostafa Zohair, Aya and Mohamed Sami**r for their great help and co-operation in the work and solving the problems I faced.*

*The work as supported by a grant from the Academy of Scientific Research and Technology **(ASRT)**, Master scholarship, Scientist for Next Generation (SNG) program*

**Name of Candidate**: Fatma Mohamed Ibrahim Nasr **Degree**: M.Sc.

**Title of Thesis**: Biofuel production from algae

**Supervisors**: Dr. Mahmoud Wafik Ahmed Sadik
Dr. Sayed Abdel kader Fayed
Dr. Nashwa Abd elalim Hassan Fetyan

**Department**: Agricultural Microbiology **Approval: 10 / 4 / 2021**


## ABSTRACT

In response to the world energy crisis, micro algal biodiesel production has received much interest in an effort to search for sustainable development. Beside, algae nutrition seems to be the most limiting factor concerning proper growth and economy cost. The main figure in this respect is carbon nutrition. Growth was performed using F2 growth medium for inoculum preparation and sub-culturing; while artificial growth medium was applied in order to enhance both dry weight and lipid productivities. The major properties of the produced biodiesel was investigated , moreover the residual defatted biomass *of Nannochloropsis oculata* alga was used as a fermentation feedstock for bioethanol production after hydrolysis under varying conditions of acid concentration and/or constant enzyme dosage.

Results showed that a high nutritional composition of bagasse extract as an alternative source of organic carbon (98.9% of total cell carbon) was obtained by cultures grown with full F2 growth medium enriched by 10% of bagasse extract. Chemical composition reveled the relatively high content of carbohydrates (26.6%) and oils (11.9%) on the expense of protein content (32.8%) and the maximum figure of ash content (2%) goes back to sodium ions.

Results of bioethanol production from defatted biomass of *N. oculata* indicated optimal conditions for hydrolysis process were 30 hours using a commercial enzyme that includes two stages: liquefaction process using diluted sulphoric acid (3.0% v/v) at 121°C for 15 minute followed by incubation in commercially available hydrolytic enzymes α-amylase 1000 IU /g at 95°C with a pH of 6, while for the scarification process using commercially available enzyme mixtures contain multiple enzyme activities, mainly exoglucanase, endoglucanase, hemi-cellulose, and beta-glucosidase. The hydrolysis was carried out by incubating the mixture at 60 °C, pH 5.5, for 24 hrs. gave a maximum yield of sugar (232.39 mg.g-1 ) for defatted biomass cultivated vegetative and multi factor stresses conditions. The fermentation of hydrolysate using Saccharomyces cerevisiae gives ethanol yield of 0.26 g.g-1 reducing sugar in the highest yield scenario observed during current study.



**Key words:** *Nannochloropsis oculata*, Bagasse, Biodiesel, Fuel properties, Defatted microalgal biomass, Hydrolysate, Bioethanol.

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES