Declaration

I hereby declare that the work presented in this Thesis titled *Simultaneous Wastewater Treatment and Generation of Value-added Products in Photosynthetic Microbial Fuel Cells* submitted to the Indian Institute of Technology Jodhpur in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy, is a bonafide record of the research work carried out under the supervision of Professor Meenu Chhabra. The contents of this thesis in full or in parts, have not been submitted to, and will not be submitted by me to, any other Institute or University in India or abroad for the award of any degree or diploma.

Arti Sharma

P19BB010

Certificate

This is to certify that the thesis titled *Simultaneous Wastewater Treatment and Generation of Value-added Products in Photosynthetic Microbial Fuel Cells*, submitted by *Arti Sharma* (P19BB010) to the Indian Institute of Technology Jodhpur for the award of the degree of *Doctor of Philosophy*, is a bonafide record of the research work done by her under my supervision. To the best of my knowledge, the contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Meenu Chhabra
Ph.D. Thesis Supervisor

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I do apologize if I missed any names in this section.

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List of Symbols

Symbol	*Description*
A	Ampere
C	Celsius
Cm	Centimeter
Da	Dalton
E	Cell Potential
F	Faraday Constant
GT	Gigaton
GW	Gigawatt
I	Current
Kg	Kilogram
M	Molar
P	Power
R	Resistance
T	Temperature
V	Volt/ Volume
W	Watt
bp	Base Pair
cm	Centimeter
d	Day
g	Gram
h	Hour
kb	Kilobase
l	Liter
m	Meter
m^2	Square Meter
m^3	Cubic Meter
ml	Milli liter
nm	Nanometer
pH	Hydrogen Ion Concentration
s	Second
α	Alpha
β	Beta
γ	Gamma
ε	Epsilon
η	Eta
μ	Micro
μg	Microgram
μl	Microliter
ζ	Zeta
Ω	Ohm
ω	Omega

List of Abbreviations

Abbreviation	*Full form*
ABME	Algae Biomass Methanol Extract
aph7	Aminoglycoside Phosphotransferase gene
BBM	Bold's Basal Medium
BG-11	Blue Green-11
bkt	β-Carotene Ketolase
BME	B-mercaptoethanol
BSA	Bovine Serum Albumin
CE	Coulombic Efficiency
CCV	Closed-Circuit Voltage
CFFP	Cold Filter Plugging Point
COD	Chemical Oxygen Demand
CTAB	Cetyl Trimethyl Ammonium Bromide
CV	Cyclic Voltammetry
crt/*chy*B	β-Carotene Hydroxylase
DCW	Dry Cell Weight
DEWATS	Decentralized Wastewater Treatment System
DMAPP	Dimethylallyl Diphosphate
DMSO	Dimethyl Sulfoxide
DO	Dissolved Oxygen
EDTA	Ethylenediaminetetraacetic Acid
EET	Extracellular Electron Transfer
EIS	Electrochemical Impedance Spectroscopy
EPS	Exopolysaccharide
GAE	Gallic Acid Equivalent
GC	Gas Chromatography
GGPP	Geranylgeranyl Pyrophosphate
GM	Genetically Modified
GRAS	Generally Regarded As Safe
HPLC	High Performance Liquid Chromatography
HYG	Hygromycin B
IC50	Half-maximal Inhibitory Concentration
IPP	Isopentenyl Pyrophosphate
pds	Phytoene Desaturase
psy	Phytoene Synthase
PUFA	Polyunsaturated Fatty Acid
LB	Luria-Bertani
LCA	Life Cycle Analysis
*lcy*E	Lycopene-ε-Cyclase
*lcy*B	Lycopene-β-Cyclase
MEP	Methylerythritol Phosphate
MFC	Microbial Fuel Cell
MoClo	Modular Cloning
NTC	No Template Control
OCV	Open Circuit Voltage
ORR	Oxygen Reduction Reaction
PBR	Photobioreactor
PCR	Polymerase Chain Reaction

PMFC	Photosynthetic Microbial Fuel Cell
RUBISCO	Ribulose-1,5-bisphosphate Carboxylase/Oxygenase
SEM	Scanning Electron Microscopy
SHE	Standard Hydrogen Electrode
TAP	Tris Acetate Phosphate
TEM	Transmission Electron Microscopy
TP	Tris Phosphate
UTR	Untranslated Region
VAP	Value-Added Product
WT	Wild Type
zds	ζ- Carotene Desaturase
zep	Zeaxanthin Epoxidase