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THE INFLUENCE OF MICROBIAL MUTUALISTIC INTERACTIONS AND BIOFILM FORMATION ON THE PERFORMANCE OF MICROBIAL FUEL CELL

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MOHAMMED AMIRUL ISLAM

Thesis submitted in fulfillment of the requirements
for the award of the degree of
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LIST OF SYMBOLS

x_1	Inoculum composition
x_2	Substrate pH
x_3	Operational time
x_4	Initial chemical oxygen demand (COD) of substrate
y_1	Power density of microbial fuel cell performances (W/m^3)
y_2	COD removal efficiency
F	Faraday's constant
h	Hour
I	Current
P	Power
R_Ω	Ohmic resistance
R_{ct}	Charge transfer resistance
R_{dif}	Diffusion resistance
V	Voltage
W	Watt
E_e^{anode}	Anode potential
$E_e^{cathode}$	Cathode potential
Σ_η^{anode}	Anode overpotential
$\Sigma_\eta^{cathode}$	Cathode overpotential
ΔE_η	Overpotential difference between anode and cathode
ΔE_Ω	Ohmic voltage losses
ΔE	Real cell voltage
b_i	Linear coefficient
b_o	Constant coefficient
b_{ii}	Quadric coefficient
b_{ij}	Interaction of coefficient, x_i, x_j coded values
Σ	Summation

LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
ATP	Adenosine triphosphate
AEM	Anion exchange membrane
APHA	American Public Health Association
BES	Bio electrochemical system
COD	Chemical oxygen demand
CE	Coulombic efficiency
CEM	Cation exchange membranes
CV	Cyclic voltammetry
DET	Direct electron transfer
DNA	Deoxyribonucleic acid
DGGE	Denaturing gradient gel electrophoresis
dNTP	Deoxynucleotide triphosphate
EAB	Electrochemically Active Bacteria
EET	Extracellular electron transfer
EIS	Electrochemical impedance spectroscopy
EPS	Extracellular polymeric substances
FAD	Flavin-adenine dinucleotide
PACF	Poly acrylonitrile carbon felt
g/L	Gram per liter
GC-MS	Gas chromatography mass spectrophotometry
kΩ	Kilo ohm
LB	Luria Bertani
µA	Micro ampere
µg	Micro gram
MFC	Microbial Fuel Cell
MEA	Membrane electrode assembly
mg/L	Milligram per litre
mM	Milli mole
mV	Millivolt
mW	Milliwatt

NAD	Nicotinamide-adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide
NADPH	Nicotinamide adenine dinucleotide phosphate
NCBI	National center for biotechnology
OCV	Open circuit voltage
OD	Optical density
PEM	Proton exchange membrane
FESEM	Field emission scanning electron microscopy
RNA	Ribonucleic acid
RSM	Response surface methodology
rpm	Revolutions per minute
rRNA	Ribosomal ribonucleic acid
SD	Standard deviation
SHE	Standard hydrogen electrode
UV	Ultraviolet
VFA	Volatile Fatty Acid