Cultivating blue-green algae in wastewater for soil bio-fertilizers production and application on some vegetable crops in Egypt and Tunisia

By

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Abbreviations list

ANOVA	Analysis of Variance
Bio-mix	Biofertilizer from cyanobacteria (*Spirulina platensis*, *Nostoc muscorum* and *Anabaena oryzae*) in olive mill wastewater
Bio-Spi	Biofertilizer from *Spirulina platensis* in olive mill wastewater
BSCs	biological soil crusts
Ca	Calcium
CSYE	cattle standing yard effluents
CEC	Cation exchange capacity
cm	Centimeter
CO_2	Carbon dioxide
Cu	Copper
CMC	Chlorella mixed cultures
CH_4	Methane
COF	commercial organic fertilizer
DE	dairy effluents
EC	electrical conductivity
Fe	Iron

FPW	fish processing wastewater
G	Gram
HRT	hydraulic retention time
K	Potassium
Kg	Kilogram
LSD	least significant difference
MPE	milking parlor effluents
m^3/ton	Cubic meter per ton
Mg	Magnesium
mg/L	milligrams per liter
Mn	Manganese
N	Nitrogen
NPK	nitrogen, phosphorus and potassium
OM	Organic matter
OMW	Olive milling wastewater
OMWW	Olive milling wastewater
OD	optical density

PNSB	purple nonsulfur bacteria
P	Phosphorus
PIW	Potato industry wastewater
PIW-Mix	Biofertilizer from cyanobacteria (*Spirulina platensis*, *Nostoc muscorum* and *Anabaena oryzae*) in potato industry wastewater
PIW- Spi	Biofertilizer from *Spirulina platensis* in potato industry wastewater
ppm	Part per million
RME	Rice mill effluent
S	Sulfur
SMC	Scenedesmus mixed cultures
TCOD	total chemical oxygen demand
TWW	treated of wastewater
SWERI	Soils, Water and Environment Research institute
Zn	Zinc
%	Percentage
µg/g	Microgram per gram
µs/cm	Micro Siemens per centimeter
µg/L	Micro gram per liter

ABSTRACT

In the present study, the possibility of growing cyanobacteria in wastewaters from olive oil production (OMW) and potatoes industry (PIW) was investigated. *Nostoc muscorum*, *Anabaena oryzae* and *Spirulina platensis* were chosen as three blue-green algae for the present study. The three cyanobacteria were cultivated over 30 days period on olive effluent (OMW), diluted effluent (OMW 50%) and PIW. The growth of the three strains was achieved in the three media as indicated by their total chlorophyll, optical density and biomass dry weight. The initial phenols concentration in OMW wastewater was reduced by 50-60% in 15 days, and more than 80% of phenols were removed by day 30. The cyanobacteria grown on wastewater were formulated into biofertilizers and were applied on a sandy soil to grow celery and lettuce plants under different replacement levels (25, 50 and 75%) of the recommended chemical fertilizers, while the control did not receive any fertilizers in a greenhouse experiment. The results indicated that application of biofertilizers led to a significant ($p<0.05$) increase in the height of plant, root and stem lengths over the control group. The numbers of leaves per plant as well as chlorophyll content were highest in the treatments of biofertilizers (25 and 50%). Also, these treatments increased the total macro- and micro-nutrients of celery and lettuce plants. There was very remarkable enhancement in some recorded sandy soil properties after harvest i.e., pH, total organic matter, total nitrogen, phosphorus and potassium by the treatments of Bio-Mix with 25 and 50%.

The present study concluded that 1/4 or 1/2 of the recommended dose of NPK fertilizers could be saved for celery and lettuce growth by using biofertilizers produced from cyanobacteria grown on olive milling or potatoes industry wastewaters as promising eco-friendly bio-organic fertilizers.

Keywords: Cyanobacteria; *Anabaena oryzae*; *Nostoc muscorum*; *Spirulina platensis*; biofertilizer; celery; lettuce; agro-food wastewater.