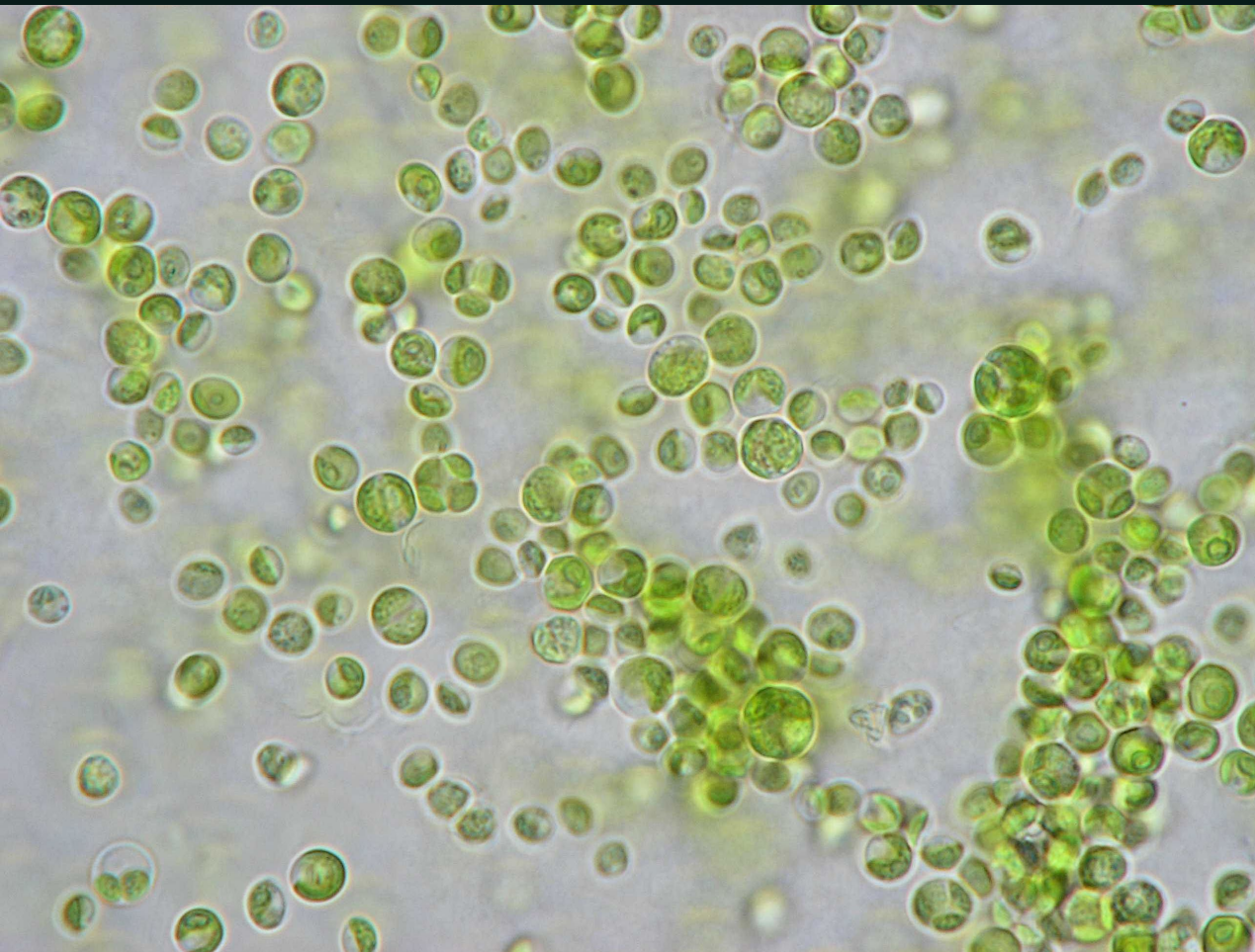


# How Microalgae Can Clean Your Wastewater

AMANDA LOPEZ, M.S.







LIKE NOWHERE ELSE • ALL IN ONE PLACE • SO CLOSE

GALAPAGOS • PACIFIC COAST • ANDES • AMAZON

A circular graphic divided into four quadrants. The top-left quadrant shows a large tortoise on a sandy beach. The top-right quadrant shows a gnarled tree branch against a yellow sky. The bottom-left quadrant shows a bird in flight over water. The bottom-right quadrant shows a condor in flight over a snowy mountain range.

**ALL YOU  
NEED IS  
ECUADOR  
TRAVEL**





# Motivation

Ecuador's capital city treats only 3.5% of its wastewater



In 2018, our research group at San Francisco de Quito University (USFQ) started **sampling wastewater** at the main discharge point of our campus.

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# WASTEWATER QUALITY

---

CBOD5

PHOSPHOROUS

NITROGEN

[mg L<sup>-1</sup>]



---

229

31

259

---

CBOD<sub>5</sub>

PHOSPHOROUS

NITROGEN

[mg L<sup>-1</sup>]



---

# DISCHARGE LIMITS: ECUADOR

---

229

31

259

---

CBOD5

PHOSPHOROUS

NITROGEN

[mg L<sup>-1</sup>]



---

100

10

10

---

229

31

259

---

CBOD5

PHOSPHOROUS

NITROGEN

[mg L<sup>-1</sup>]

# DISCHARGE LIMITS: LAFAYETTE, IN

---

100

10

10

---

229

31

259

---

CBOD<sub>5</sub>

PHOSPHOROUS

NITROGEN

[mg L<sup>-1</sup>]

25

1

5

---

100

10

10

---

229

31

259

---

CBOD<sub>5</sub>

PHOSPHOROUS

NITROGEN

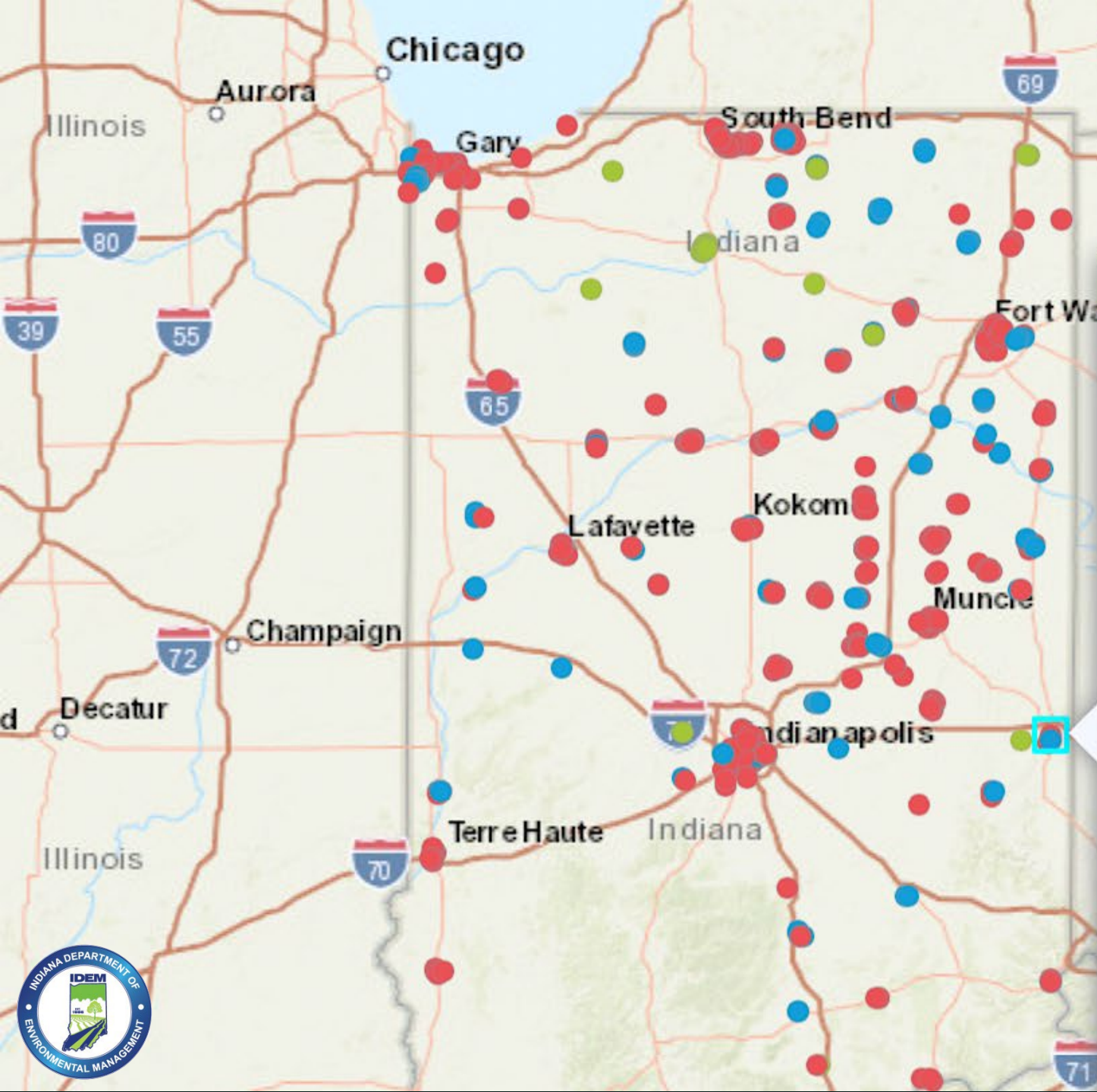
[mg L<sup>-1</sup>]





Wastewater is a global challenge





(1 of 9) ▶ □ ✕

Watershed	Burnett Creek-Wabash River
Wastewater Type	Untreated CSO
X Coordinate	-86.89
Y Coordinate	40.43

**Photo Credit: Marc Hancock**

*Click image to see larger picture.*



[Zoom to](#)



# SOLUTION NEEDS TO BE

Cost-effective

+

technologically accessible





# Microalgae

# Alternative Wastewater Treatment



Nutrient Sponge (N,P)



Carbon Capturer



Oxygen Generator





G  
a  
l  
a  
p  
a  
g  
o  
s

A  
m  
a  
z  
o  
n

A  
n  
d  
e  
s







Non-sterilized Wastewater  
(NSWW)

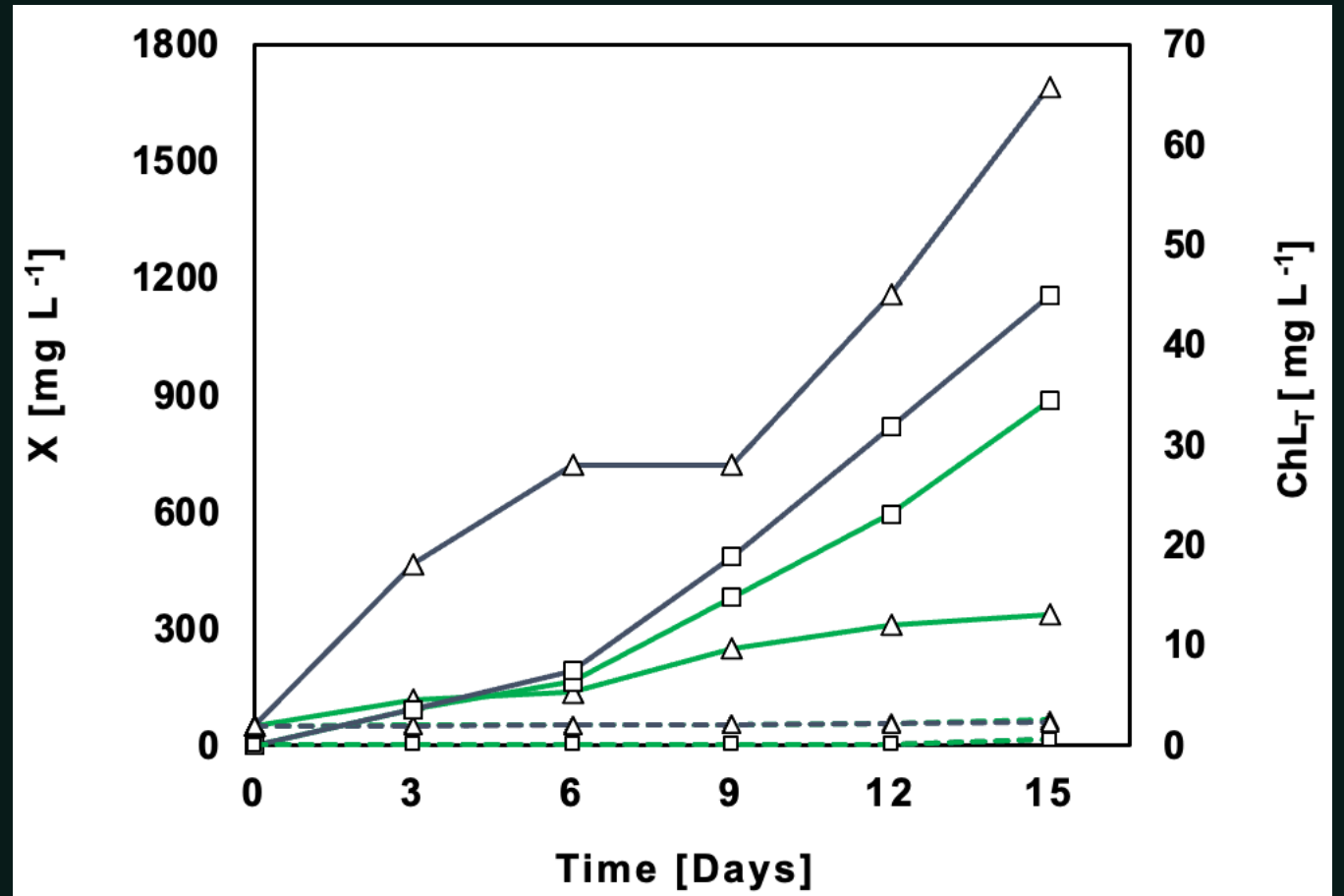


(SWW)  
Sterilized Wastewater

# How well do microalgae grow in wastewater?

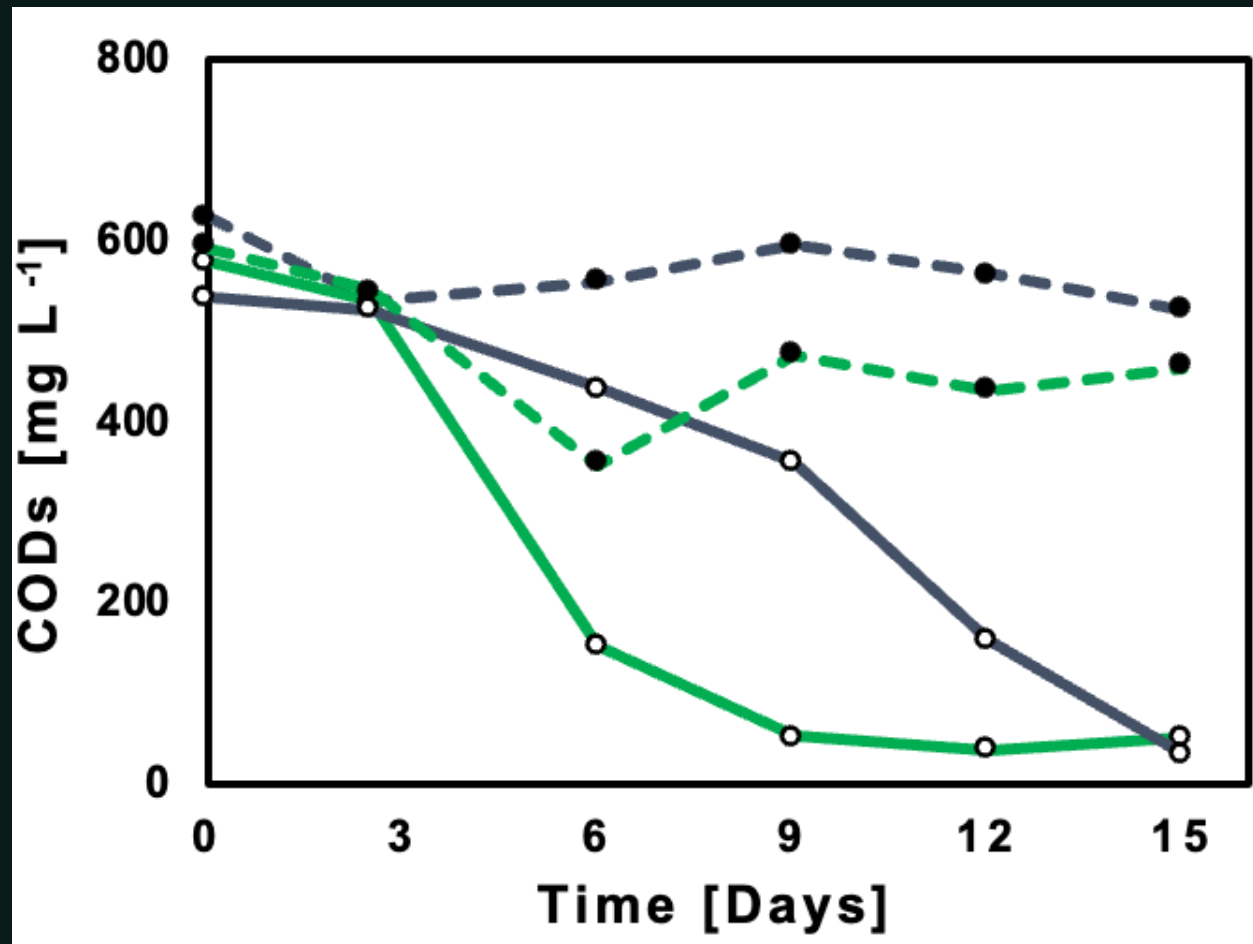


- ▲ Biomass SWW
- ▲ Biomass NSWW
- Chlorophyll SWW
- Chlorophyll NSWW
- Abiotic Controls



# Microalgae remove C from wastewater!

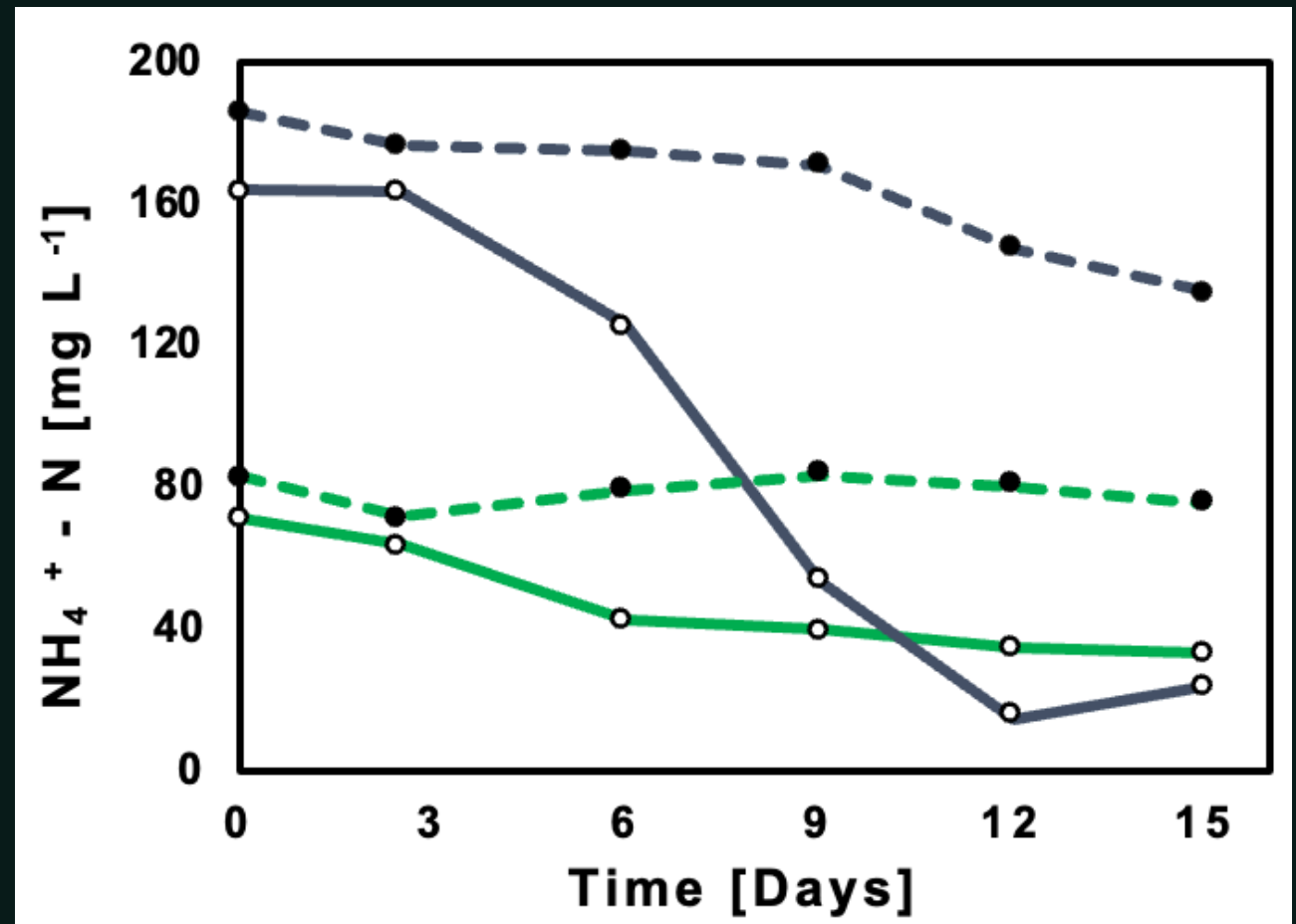
- [CODs] SWW
- [CODs] NSWW
- -○- - Abiotic Control SWW
- -○- - Abiotic Control NSWW



# Microalgae remove N from wastewater!



- [N] SWW
- [N] NSWW
- - -○- - - Abiotic Control SWW
- - -○- - - Abiotic Control NSWW

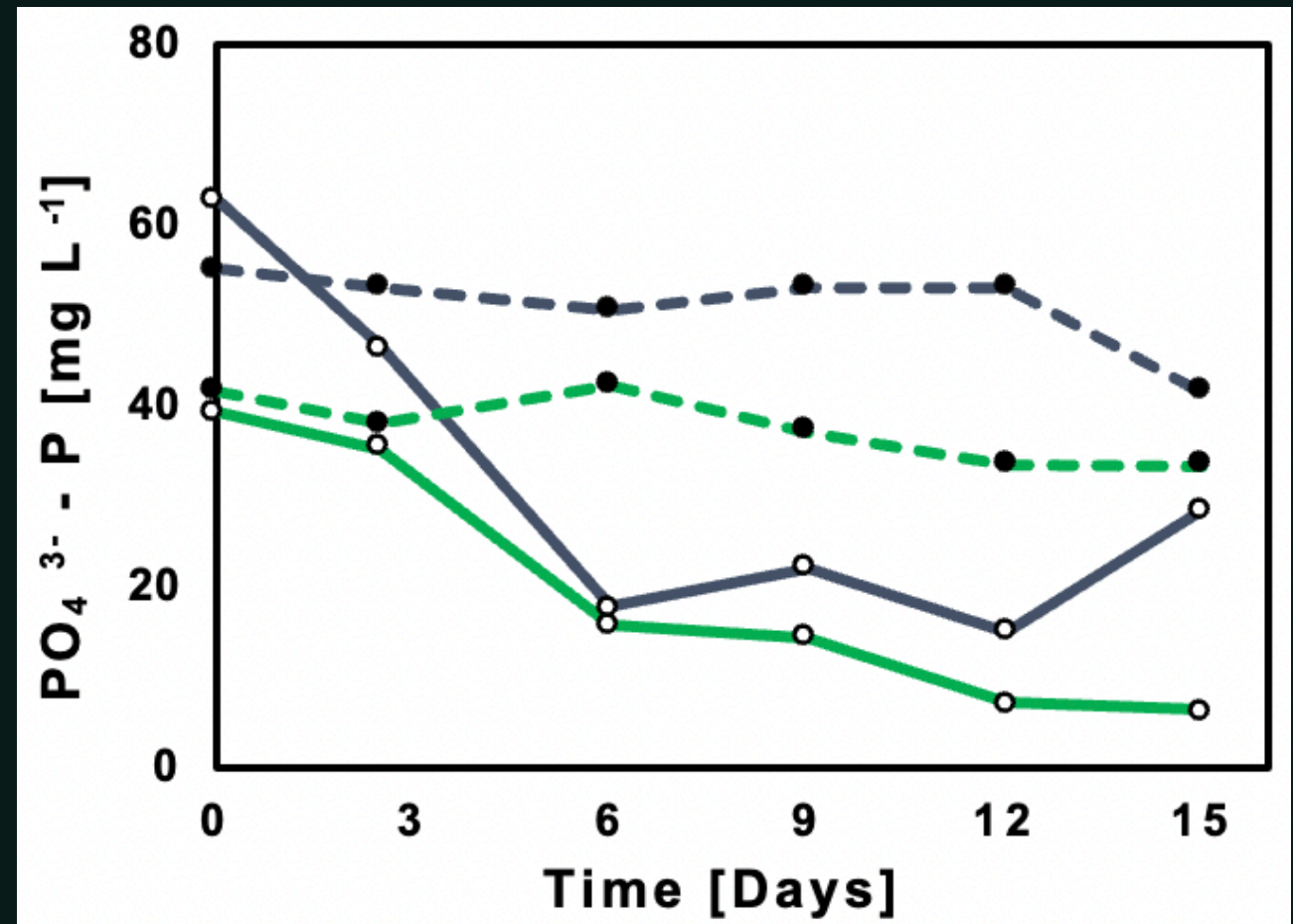




# Microalgae remove P from wastewater!



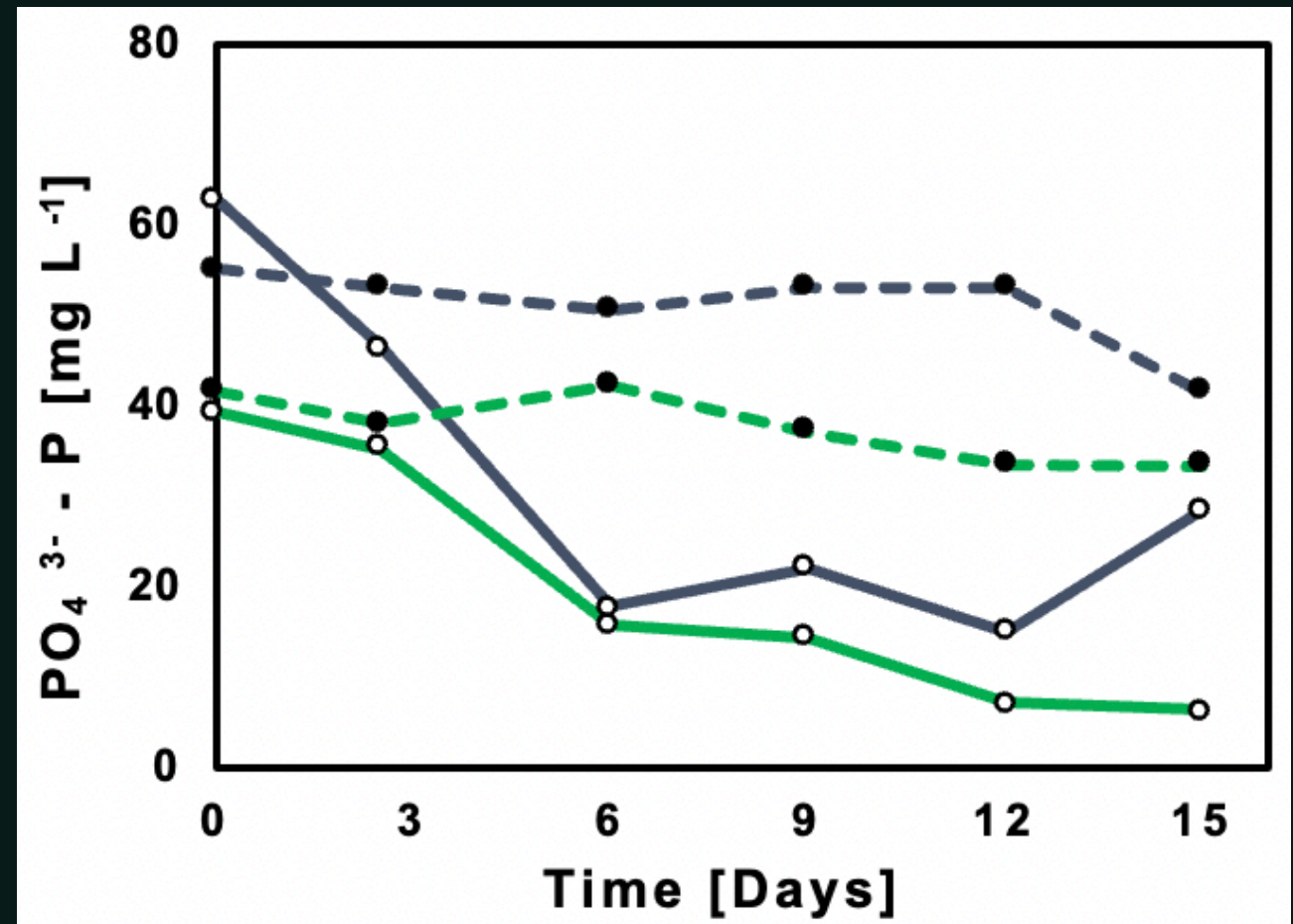
- [P] SWW
- [P] NSWW
- - -○- - - Abiotic Control SWW
- - -○- - - Abiotic Control NSWW



# Microalgae remove P from wastewater!



- [P] SWW
- [P] NSWW
- - -○- - - Abiotic Control SWW
- - -○- - - Abiotic Control NSWW



Wait, what?!

# Oooh, it's the pH!

## A

Microalgae



[P] SWW



[P] NSWW



pH SWW

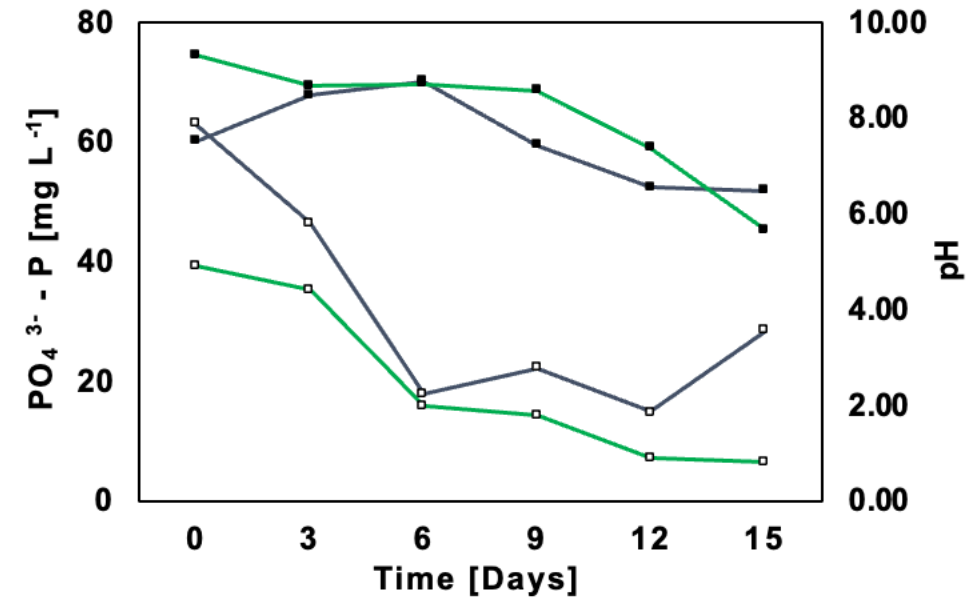


pH NSWW

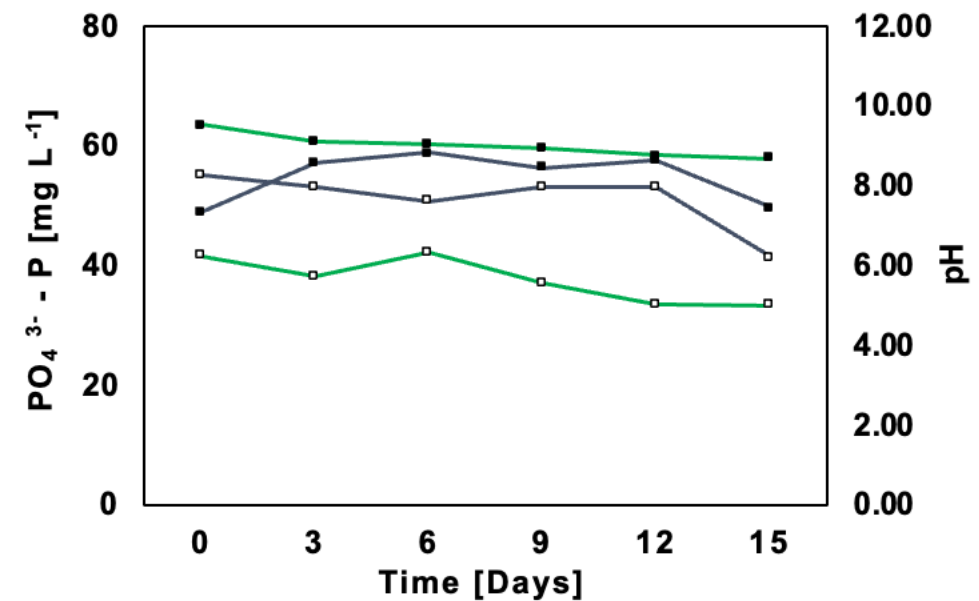
## B

Abiotic Control

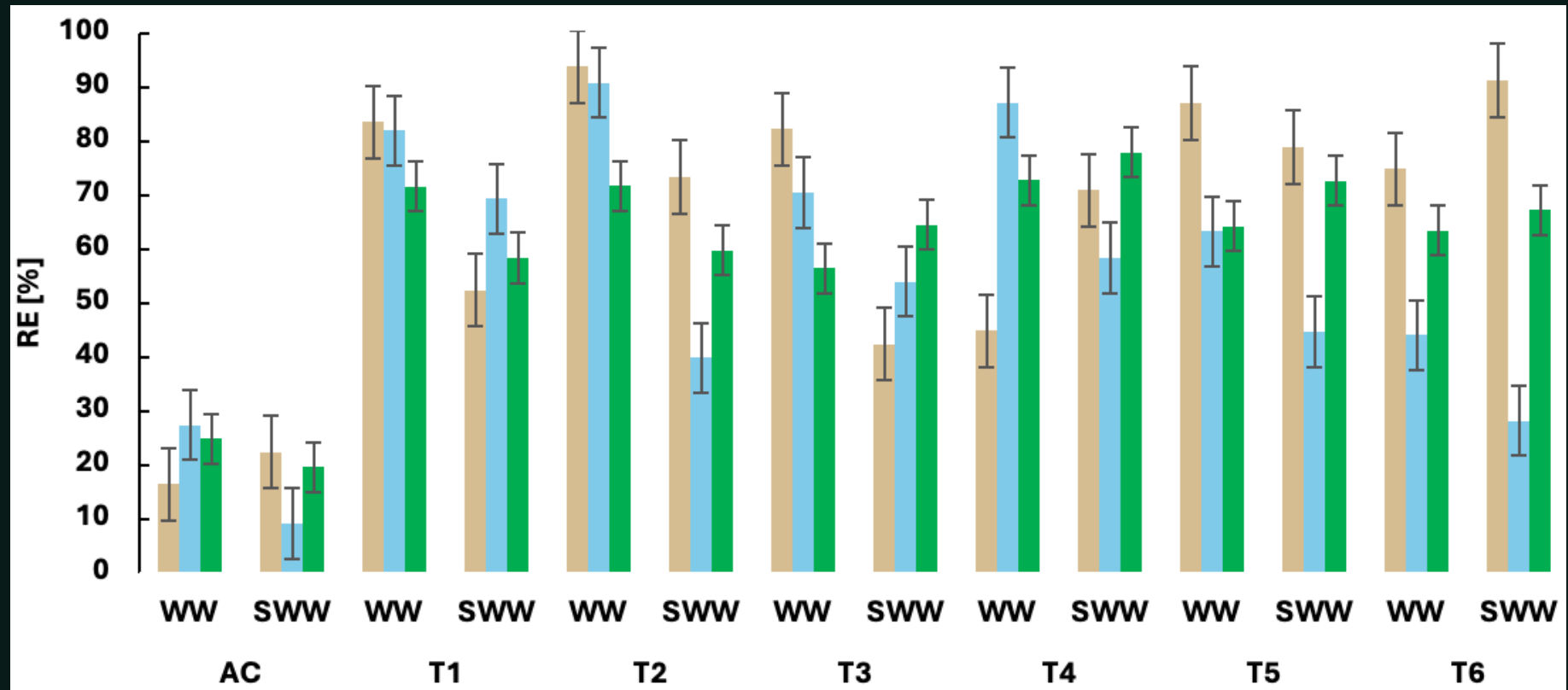
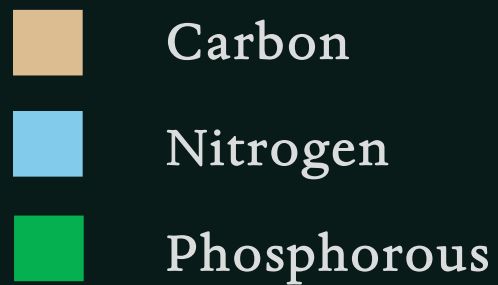
## A



## B



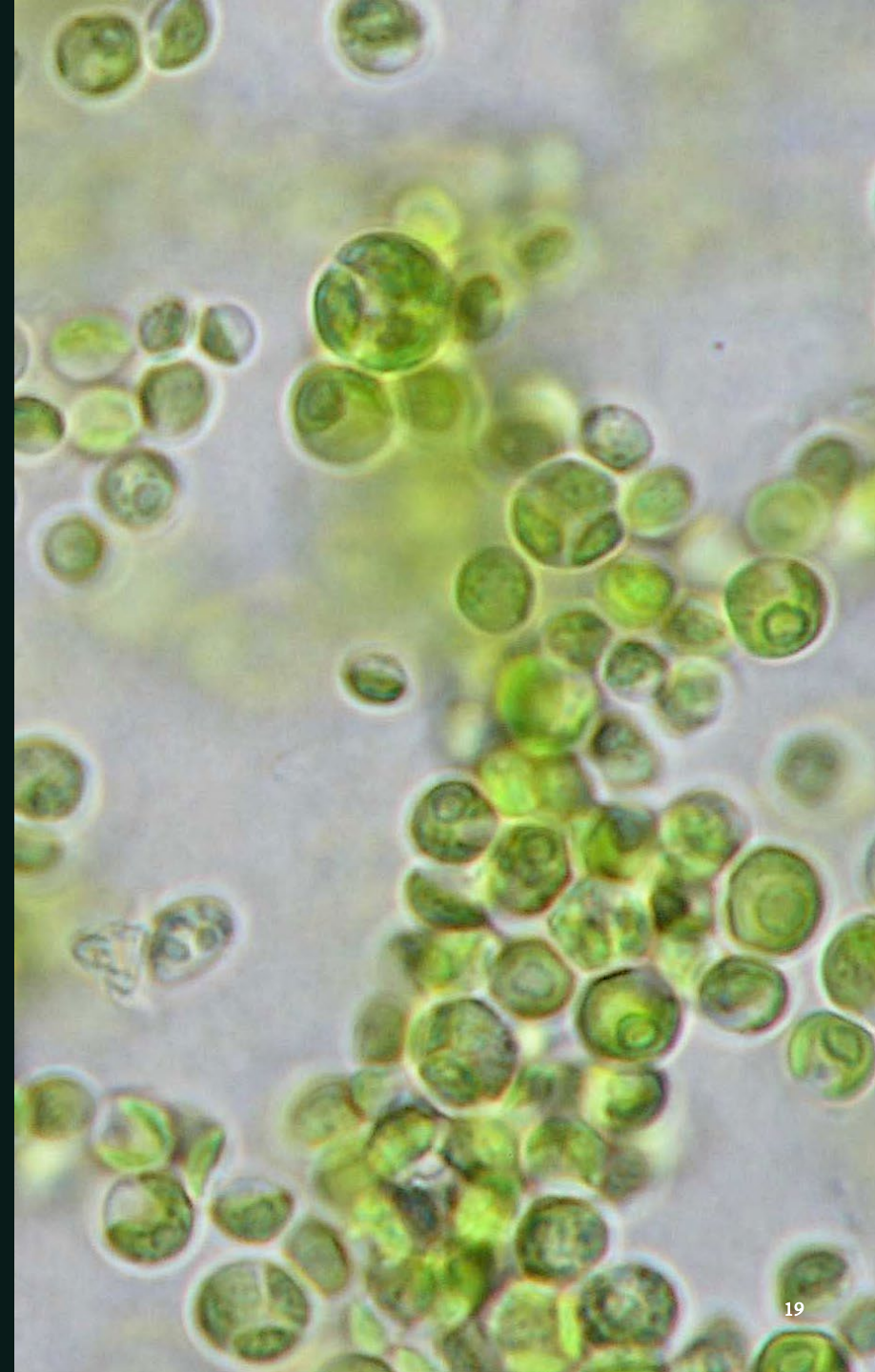
# Microalgae Removal Efficiencies (RE, %) in Wastewater



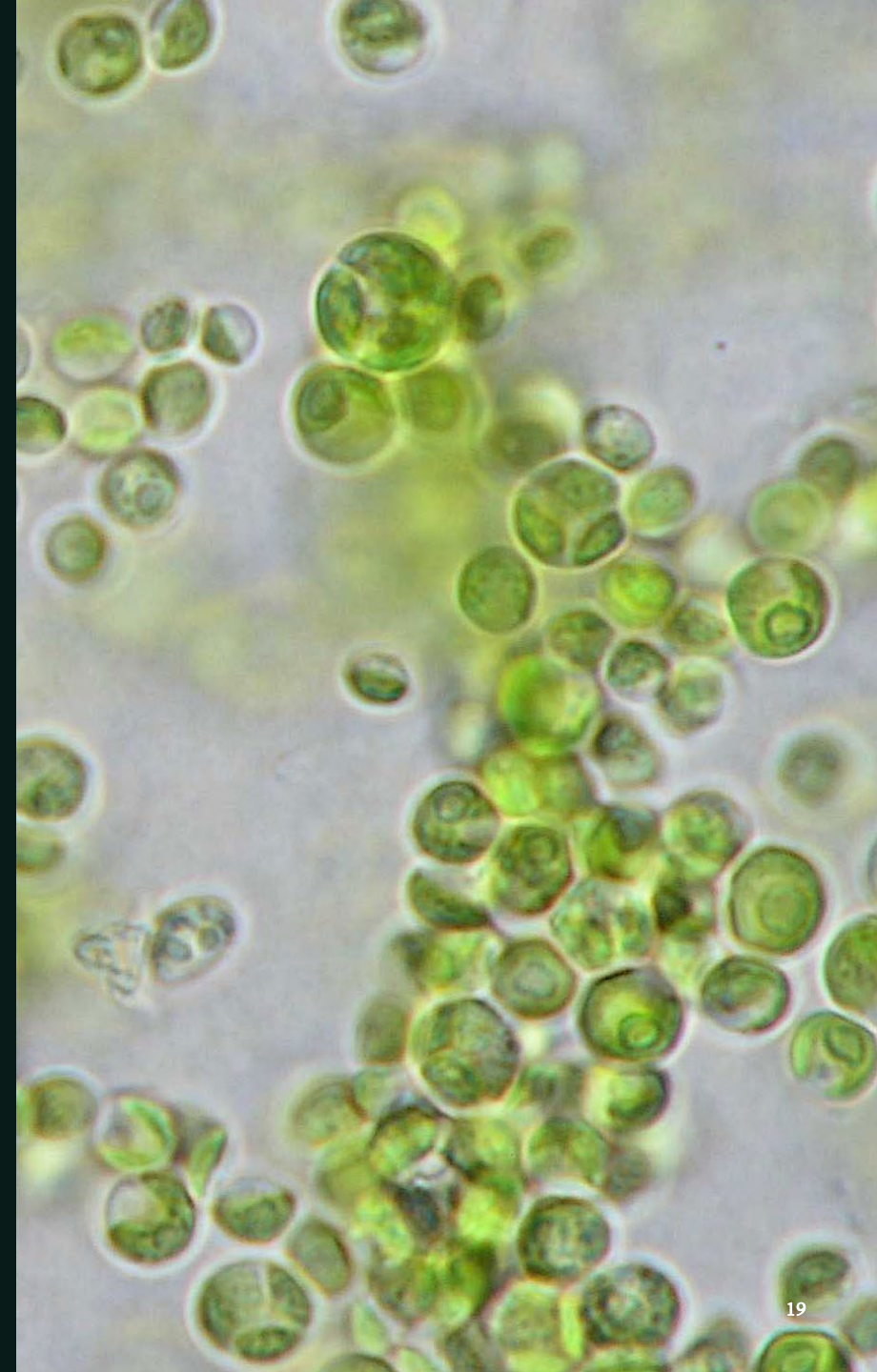
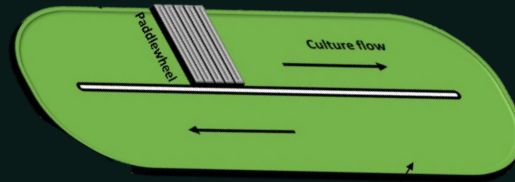
\*T: Microalgae sample from different locations in Amazon Region, Ecuador; AC: Abiotic Control



Low Cost,  
High Efficiency

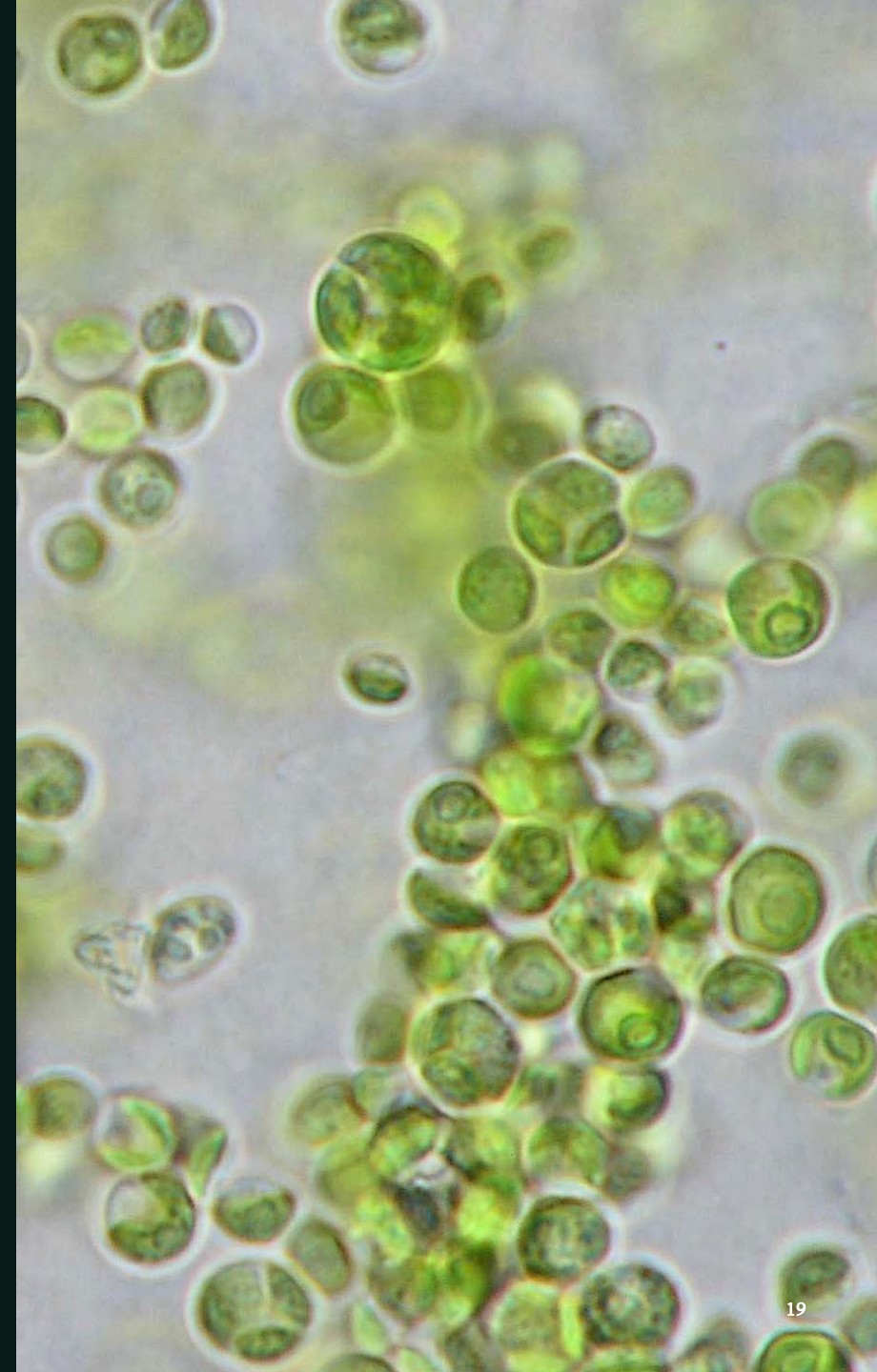
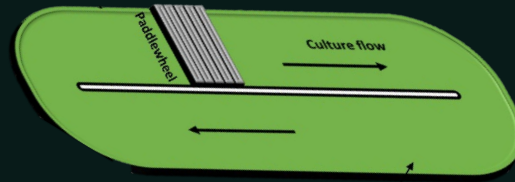


Low Cost,  
High Efficiency  
Simple Setup,  
Big Impact



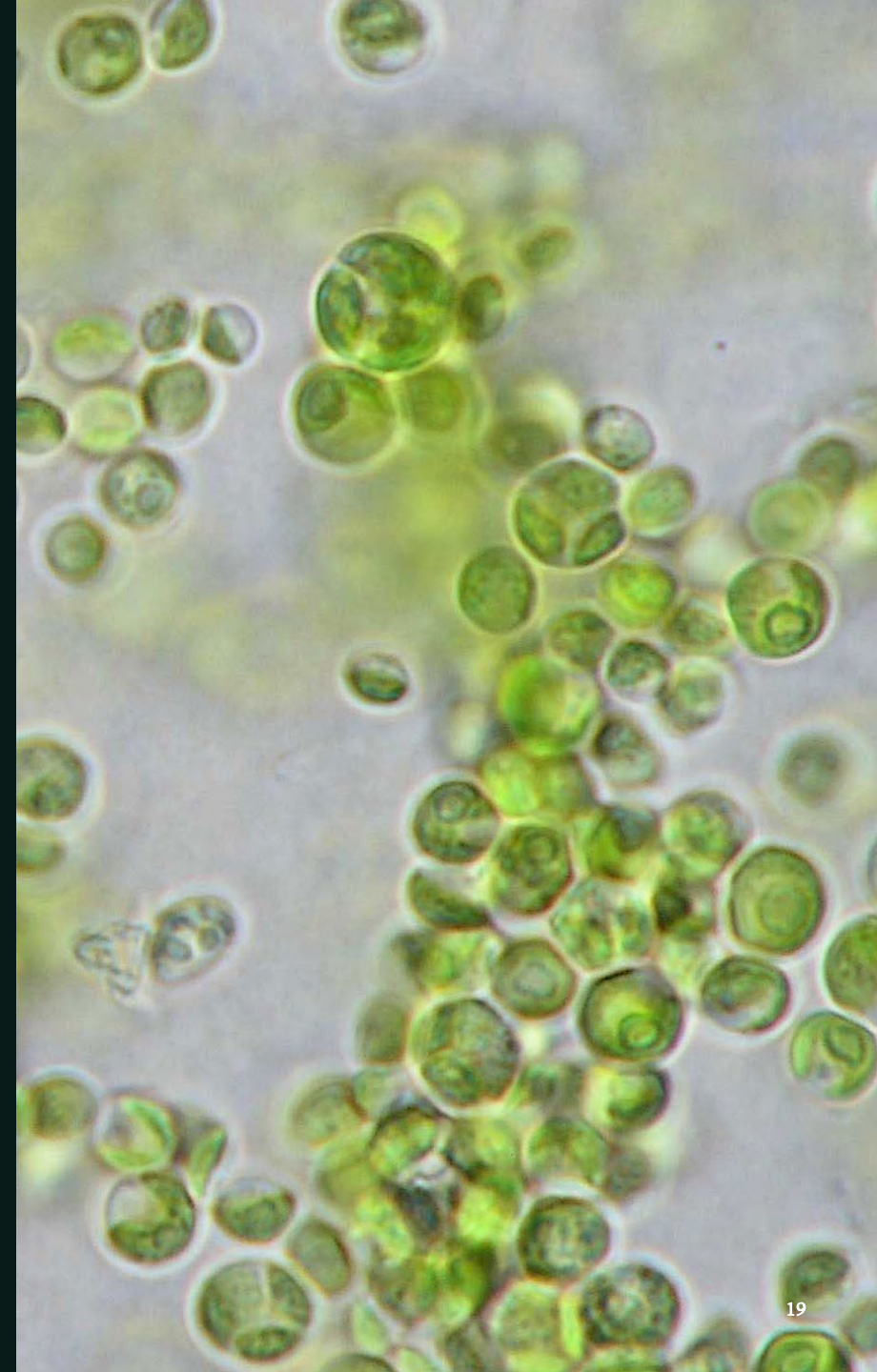
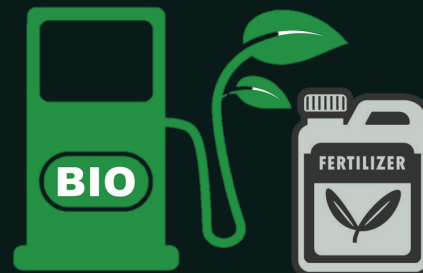
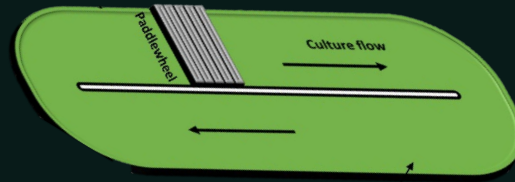


Low Cost,  
High Efficiency  
Simple Setup,  
Big Impact  
Low Carbon  
Footprint





Low Cost,  
High Efficiency  
Simple Setup,  
Big Impact  
Low Carbon  
Footprint  
Turn Waste into  
Revenue





# Native microalgal-bacterial consortia from the Ecuadorian Amazon region: an alternative to domestic wastewater treatment

Amanda M. López-Patiño<sup>1</sup>, Ana Cárdenas-Orrego<sup>2</sup>,  
Andrés F. Torres<sup>3</sup>, Danny Navarrete<sup>1</sup>, Pascale Champagne<sup>4</sup> and  
Valeria Ochoa-Herrera<sup>1,5,6\*</sup>

<sup>1</sup>Colegio de Ciencias e Ingeniería, Universidad San Francisco de Quito USFQ, Quito, Ecuador, <sup>2</sup>Instituto de Microbiología, Universidad San Francisco de Quito USFQ, Quito, Ecuador, <sup>3</sup>Colegio de Ciencias Biológicas y Ambientales, Universidad San Francisco de Quito USFQ, Quito, Ecuador, <sup>4</sup>Department of Civil Engineering, Queen's University, Kingston, ON, Canada, <sup>5</sup>Department of Environmental Sciences and Engineering, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, <sup>6</sup>Escuela de Ingeniería, Ciencia y Tecnología, Universidad del Rosario, Bogotá, Colombia







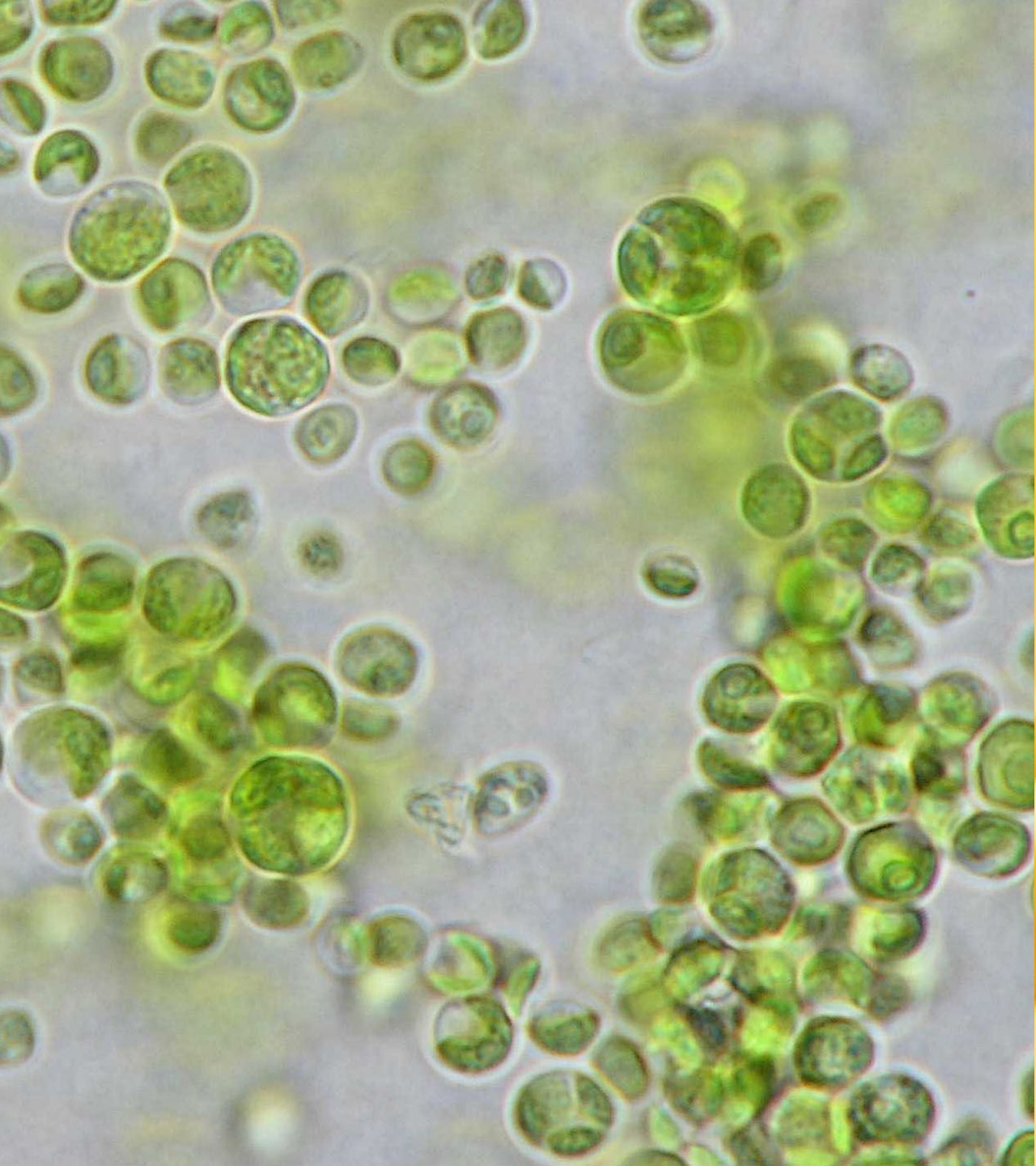
Proud Purdue Grad  
Master's in  
Environmental Engineering



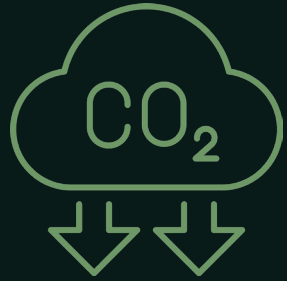


Proud Purdue Grad  
Master's in  
Environmental Engineering

AND YES, I KEEP WORKING  
WITH MICROALGAE!

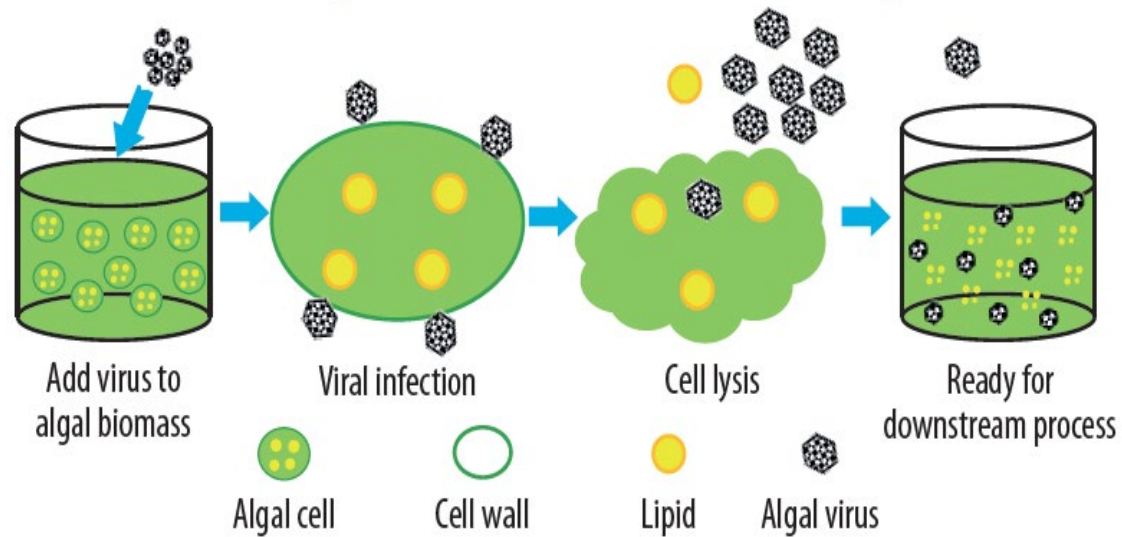




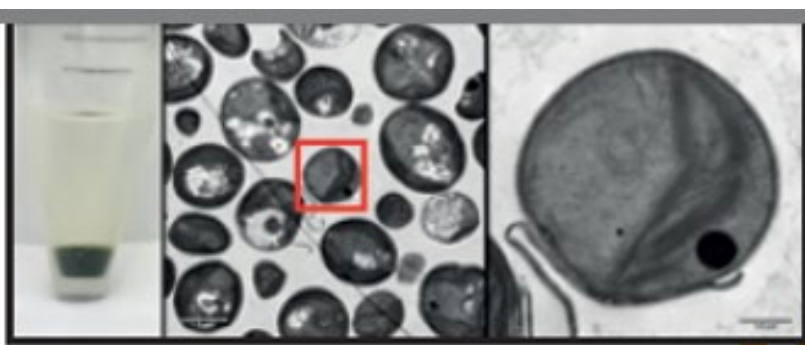


# Fueling the future, with microalgae

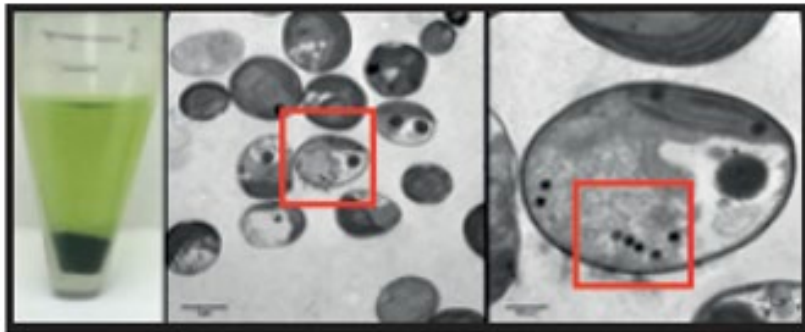




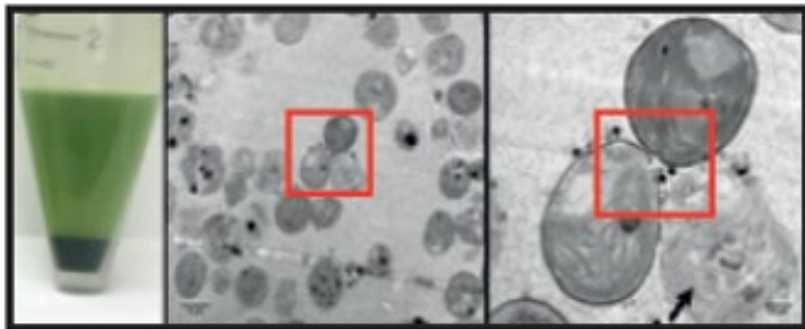
Microalgae lipids,  
a sustainable source  
of renewable  
energy



Before inoculation

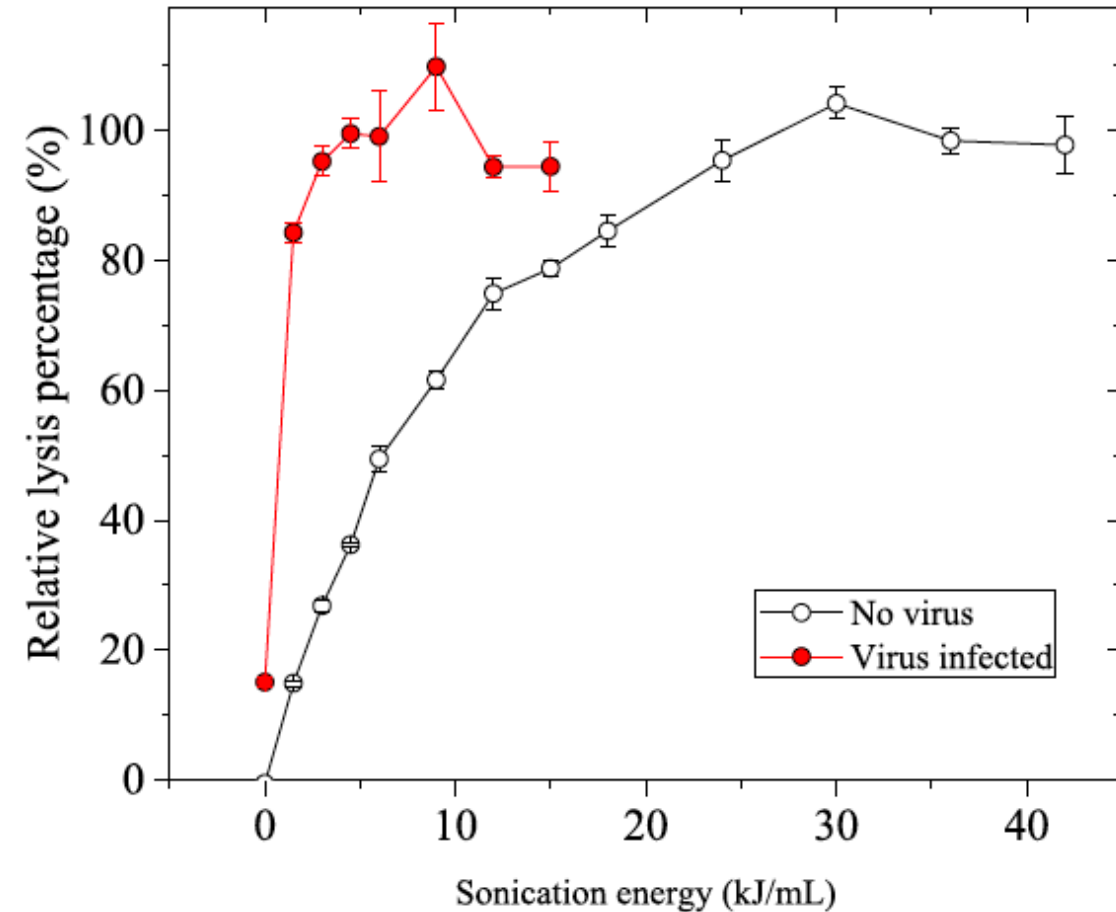


43 hours post infection



54 hours post infection

# Lipids extraction patented process



Cost-effective method  
92% Energy  
and Money  
Savings





Amanda M. Lopez  
lopez594@purdue.edu



**Linked** 

## References

López-Patiño AM, Cárdenas-Orrego A, Torres AF, Navarrete D, Champagne P and Ochoa-Herrera V (2024), Native microalgal bacterial consortia from the Ecuadorian Amazon region: an alternative to domestic wastewater treatment. *Front. Bioeng. Biotechnol.* 12:1338547.

**DOI: [10.3389/fbioe.2024.1338547](https://doi.org/10.3389/fbioe.2024.1338547)**

Zhe Sun, Zhi Zhou, Nature-inspired virus-assisted algal cell disruption for cost-effective biofuel production, *Applied Energy*, Volume 251, 2019, 113330, ISSN 0306-2619,

**DOI: [10.1016/j.apenergy.2019.113330](https://doi.org/10.1016/j.apenergy.2019.113330).**