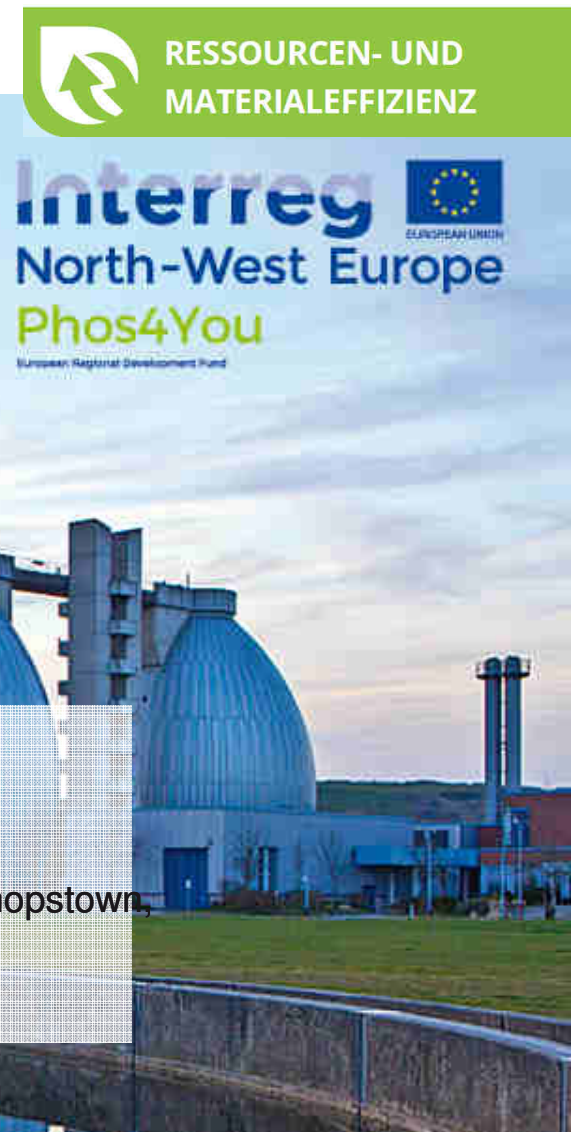


We deliver Phosphorus made in Europe





Chlamydomonas acidophila as an alternative for Phosphorous recovery from wastewater

Environ 2018 - 28.03.2018, Cork Institute of Technology, Rossa Avenue, Bishopstown,
Cork, T12 P928, Ireland

Lena-Dorothea Reichelt

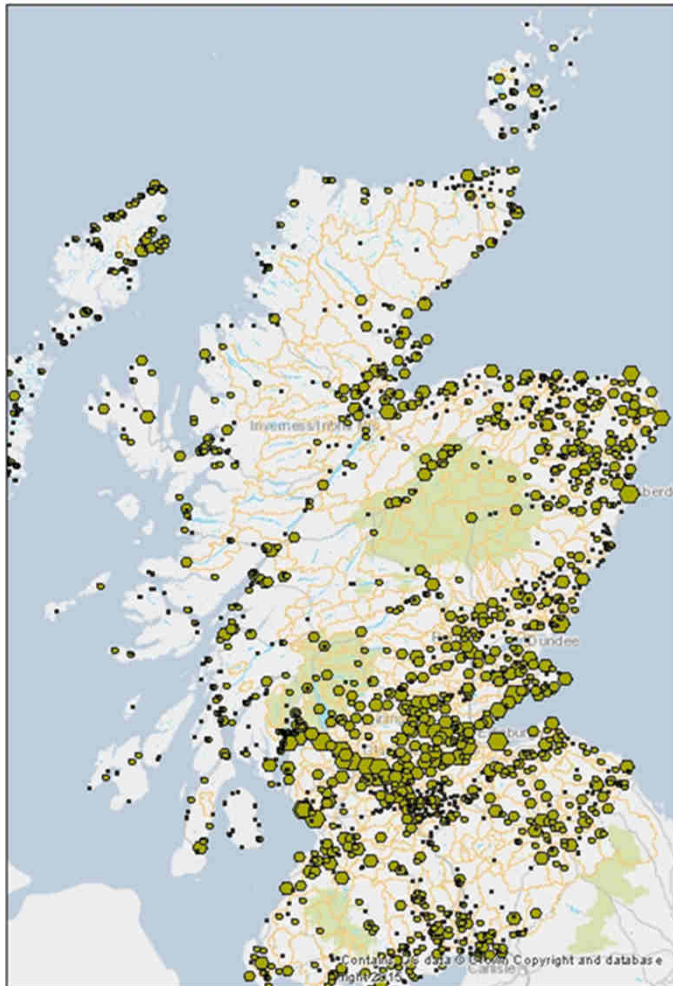
We cooperate to close P-cycle



University of Applied Sciences and Arts Northwestern Switzerland
School of Life Sciences



Waste Water Treatment in Scotland



Capacity (PE)

- 0 – 50
- 51 – 500
- 501 – 5000
- 5001 – 50 000
- 50 001 – 150 000
- > 150 000

Scotland is:

- 97% rural
- 70% remote rural

Waste Water Treatment in Scotland

Capacity			Number of WWTPs
Between	0 and	50 PE	964
Between	51 and	500 PE	584
Between	501 and	5,000 PE	267
Between	5,001 and	50,000 PE	111
Between 50,001 and 150,000 PE			15

 1,600 WWTP capacity lower than 500 PE



Why microalgae ?

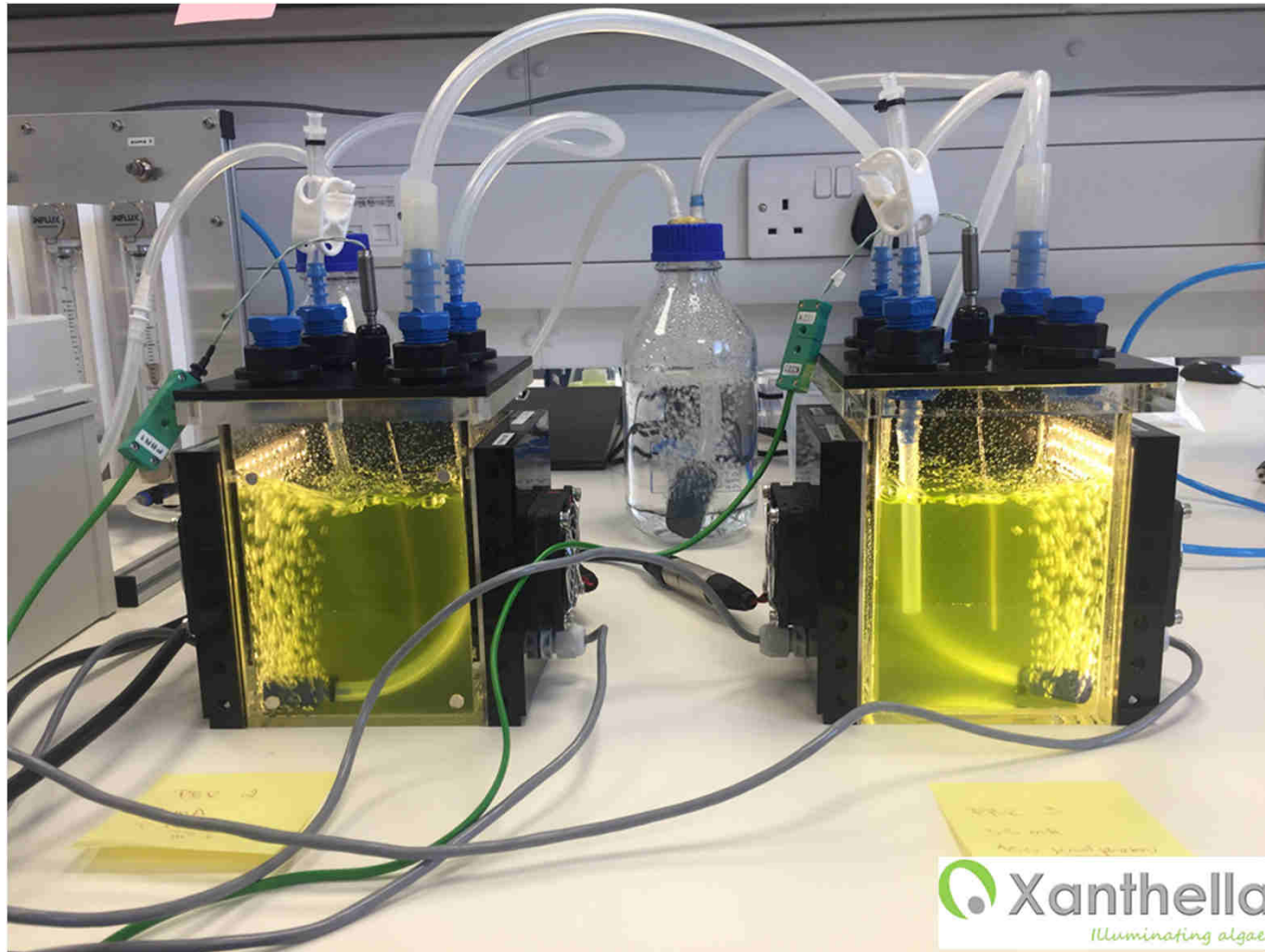
- world population increases , more people connected to WWTPs
- Recovering P is challenging in small WWTP's due to many variations in P concentrations
- P in liquid discharge stream can cause environmental problems (eutrophication)
- new technologies required to clean and recover P from the liquid stream
- microalgae consume N and P as nutrient

Chlamydomonas acidophila

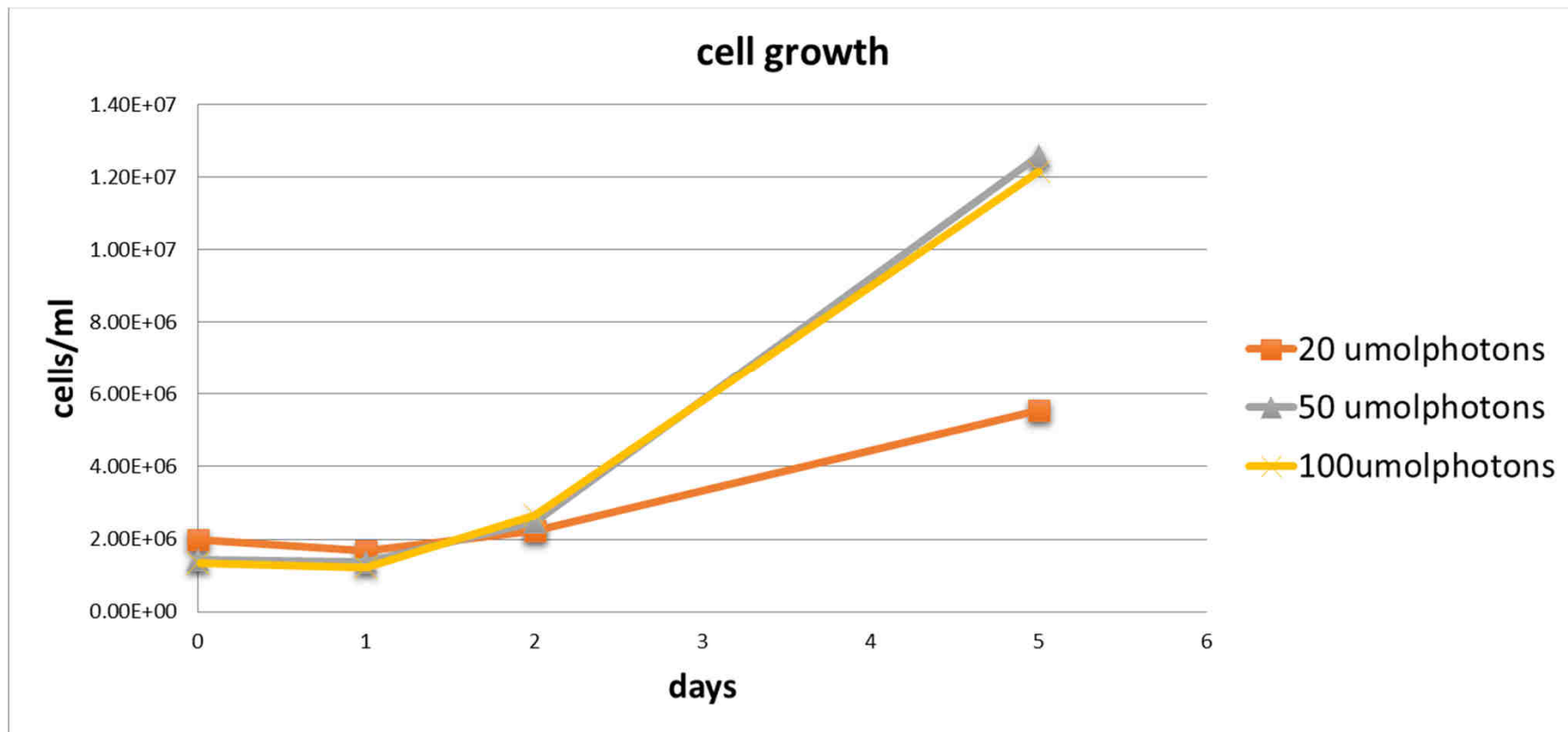


- unicellular green algae
- Acidophilic: grows at pH 2-3
- Accumulates luteins
- very resistant
- mixotrophic

Light intensity

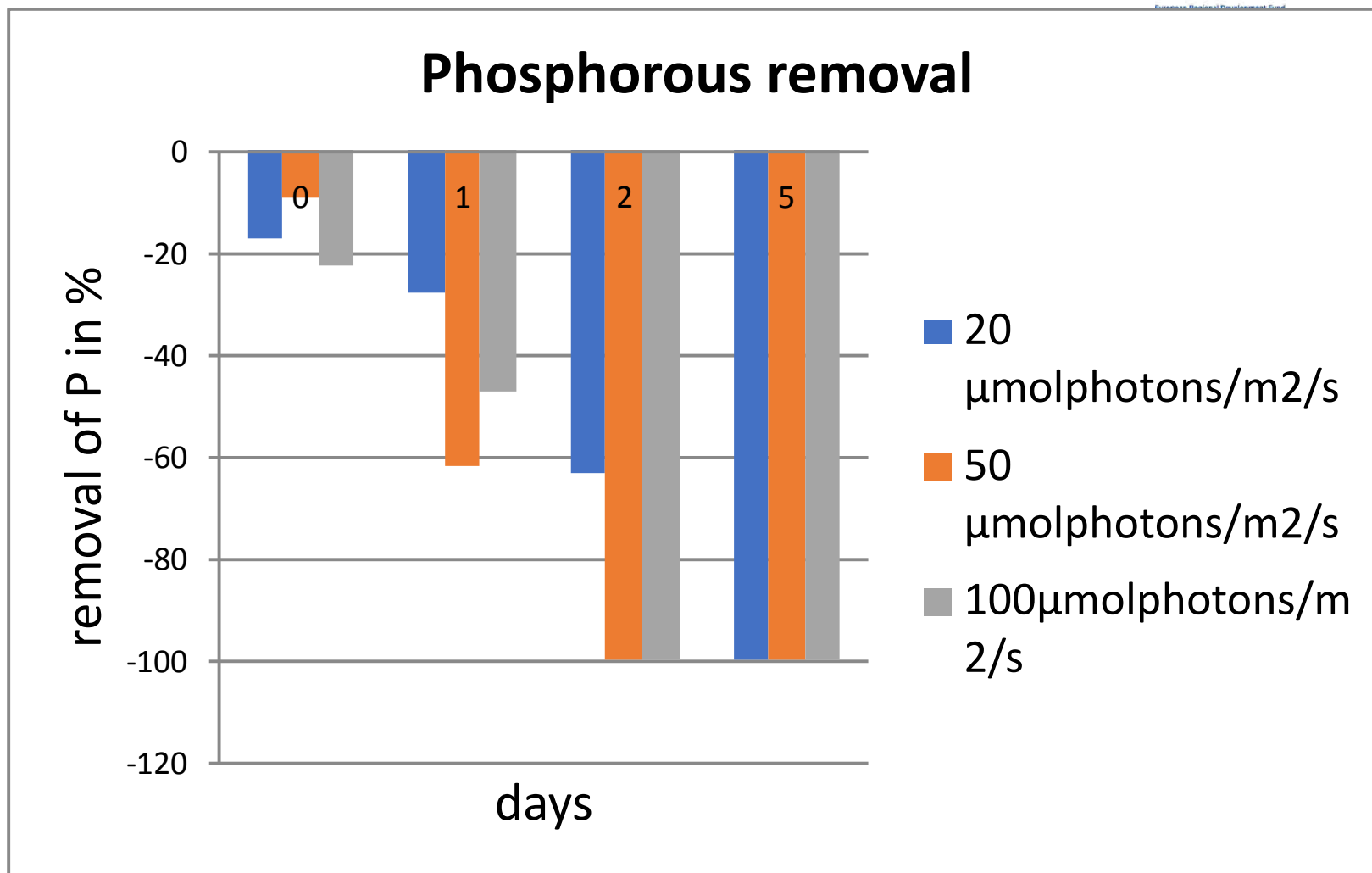


Light intensity

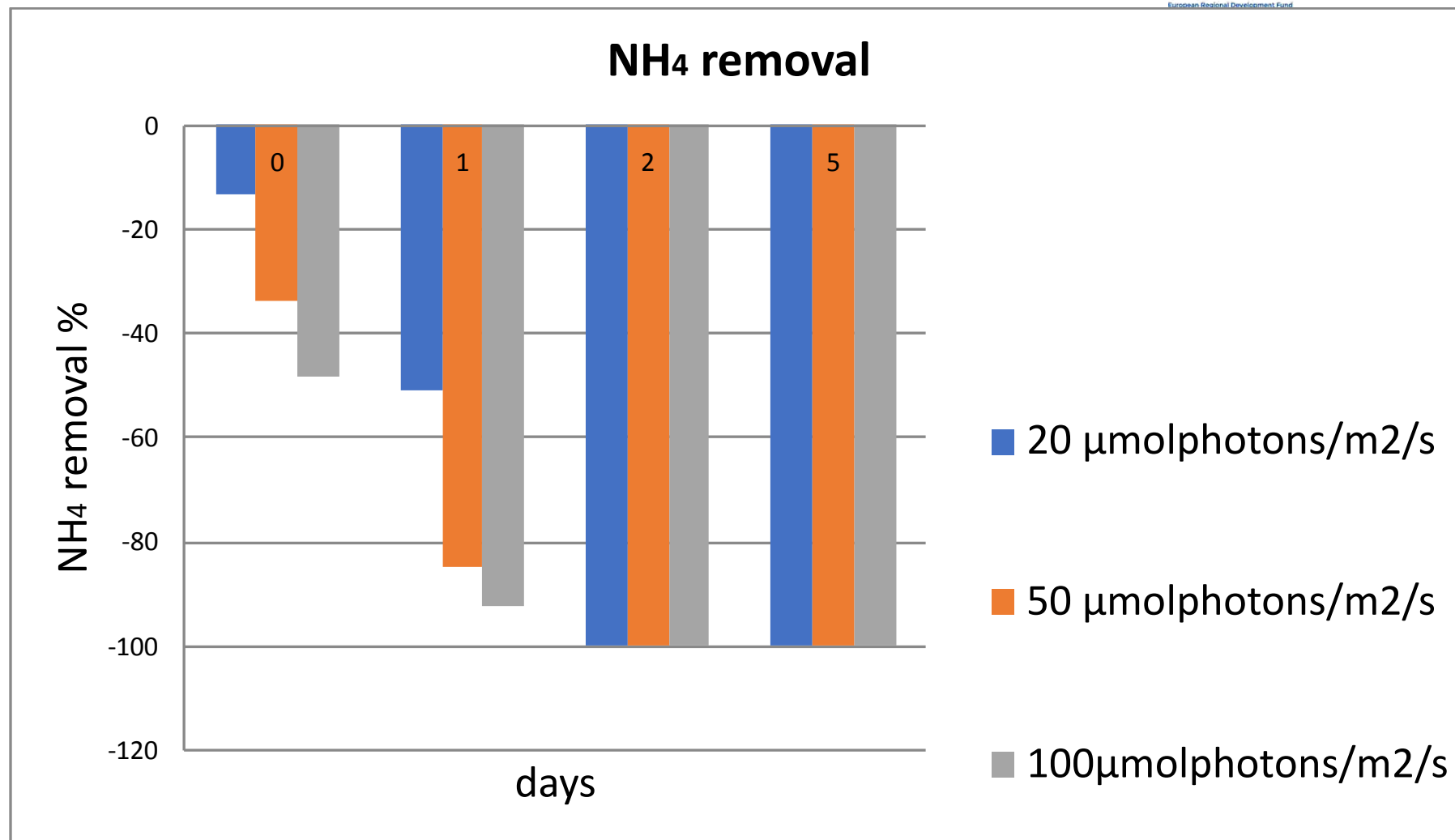


- Growth at low light intensities
- at higher light intensities, similar growth pattern

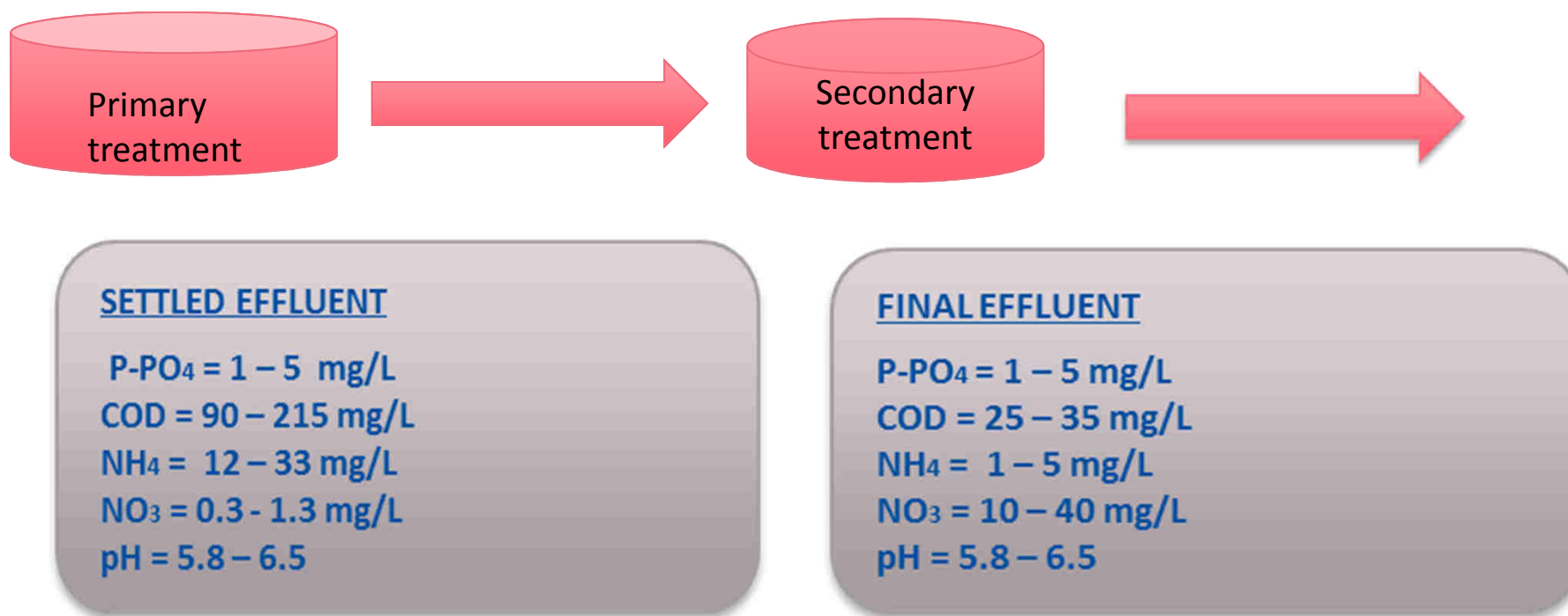
Light intensity



Light intensity

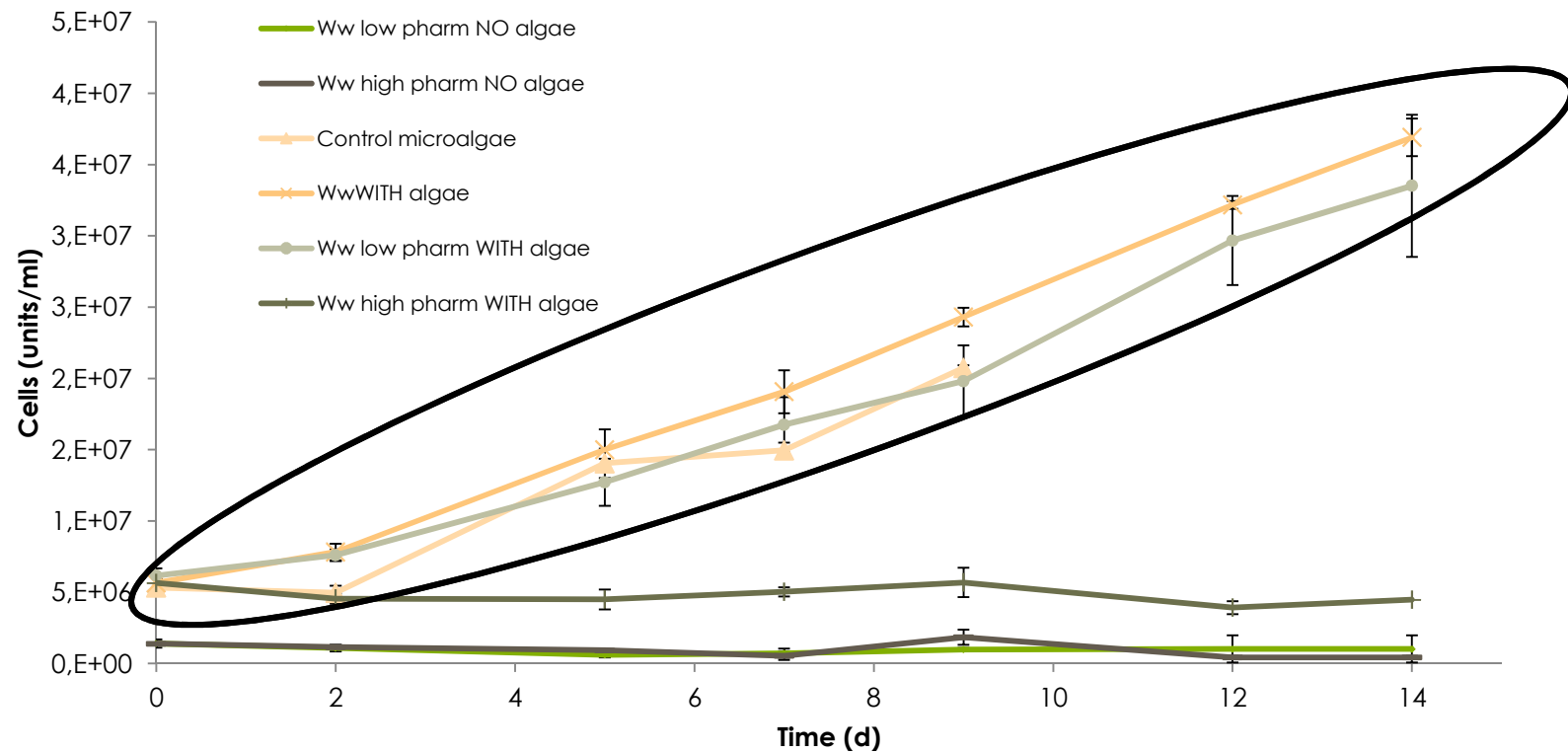


Carbon source



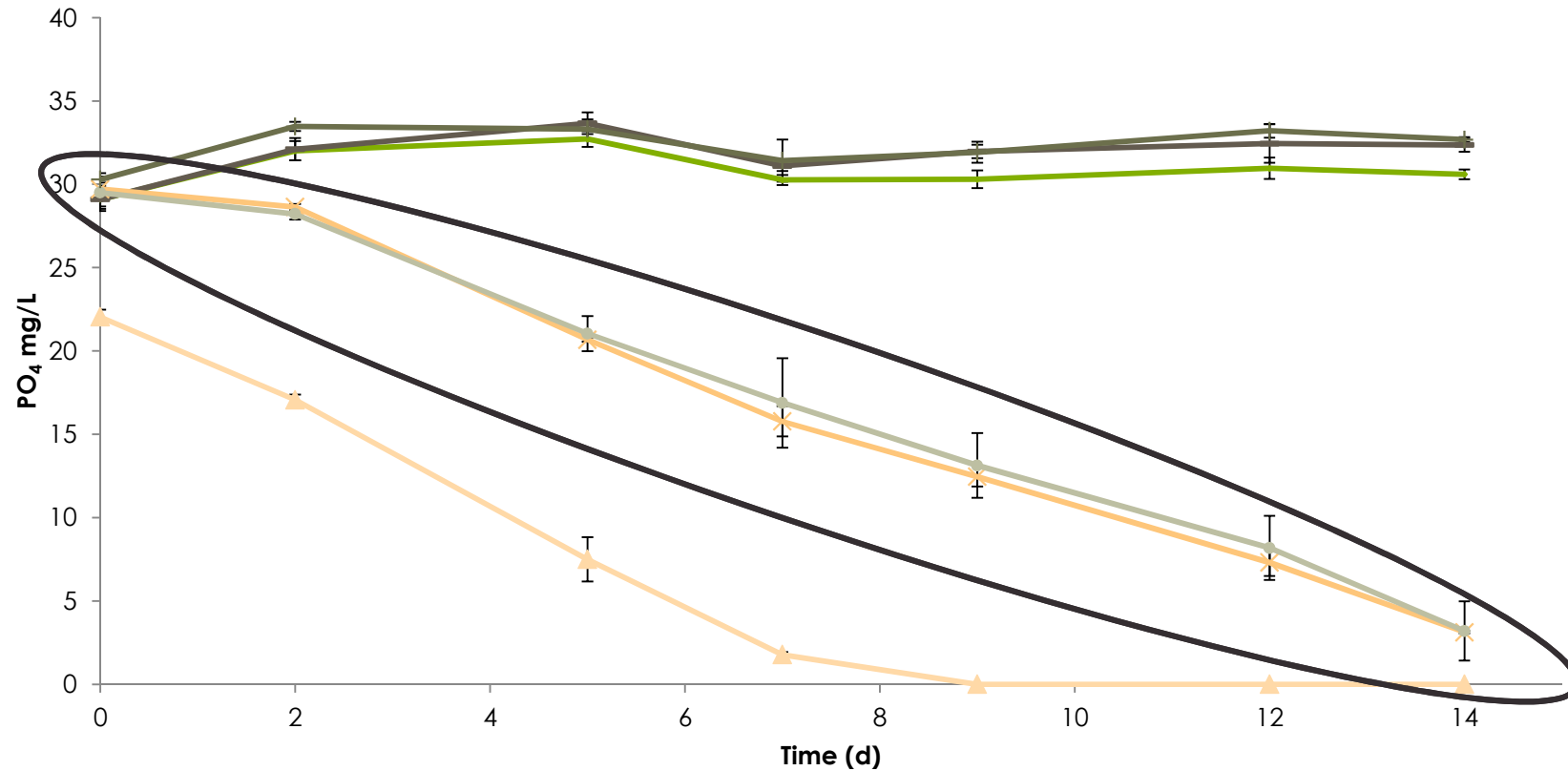
- higher removals in settled effluent due to a higher COD and NH₄ content
- Settled effluent : 100% of P removed in 5d
- Final effluent : 96% of P removed in 5d
- In growing media : 40% of P removed in 5d

Resistance



-*C.acidophila* exposed to 1000 times the lowest concentrations of pharmaceuticals reported in literature

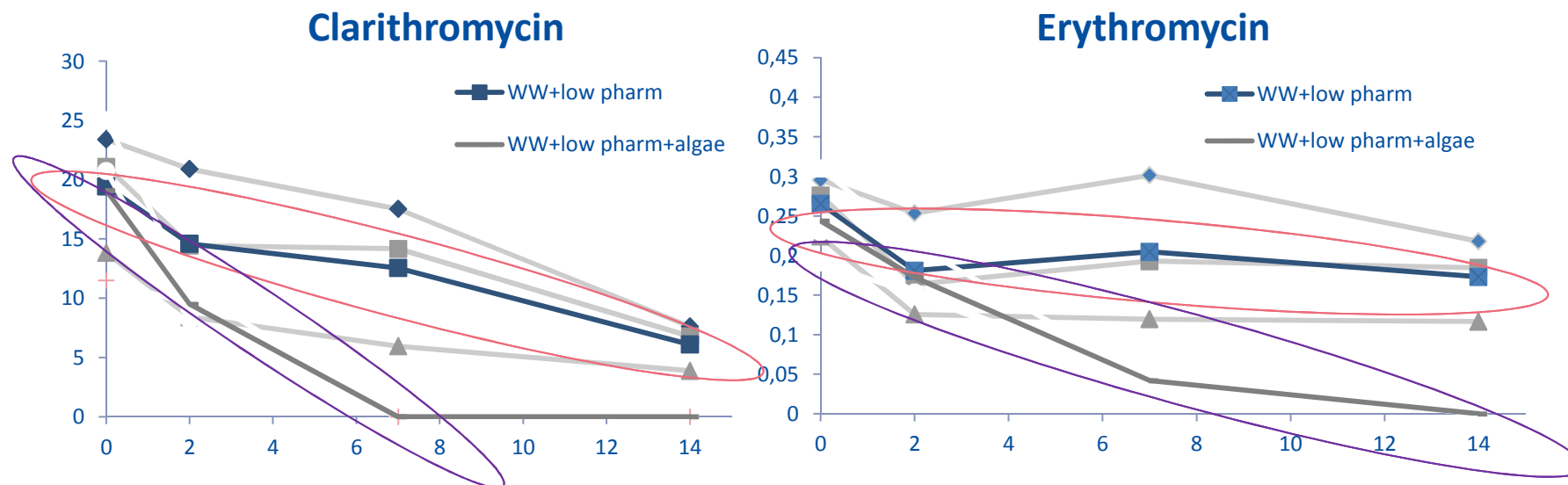
Resistance



-samples with high dose of pharmaceuticals : no growth and nutrient consumption

-similar growth and nutrient consumption in samples with and without pharmaceuticals

Resistance



→ Clarithromycin and Erythromycin concentrations significantly different in presence of microalgae

Compound	Low Concentration *1000 (µg/L)	High Concentration *1000 (µg/L)
Atenolol	350	6,030
Bezafibrate	35	6,000
Caffeine	680	54,700
Ciprofloxacin	17	17,500
Clarithromycin	40	8,000
Carbamazepine	160	820
Erythromycin	14	2,300
Lidocaine	70	770
Propanolol	30	510
Simvastatin	900	8,500

Conclusion

- *Chlamydomonas acidophila* appears to be a promising agent for the removal of nutrients from wastewater
- *C. acidophila* requires low light intensities and above 50 $\mu\text{mol photons m}^{-2}\text{s}^{-1}$ the removal efficiency doesn't seem to improve significantly
- The presence of organic carbon and NH_4 instead of NO_3 improves the nutrient recovery efficiency
- *C. acidophila* is very resistant in the presence of pharmaceuticals

Thank you !



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