Isolating autochthonous microalgae for real wastewater remediation applications

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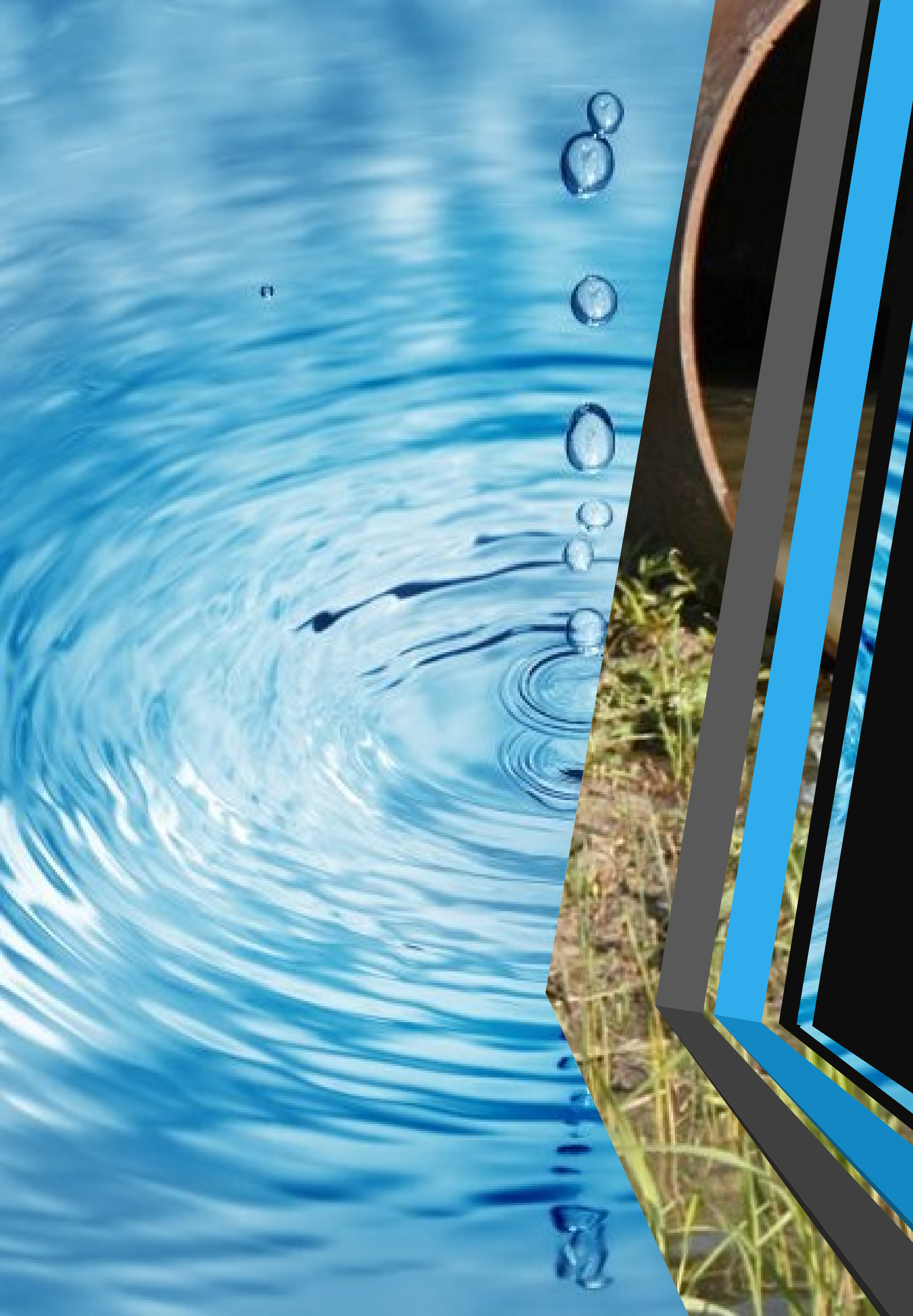
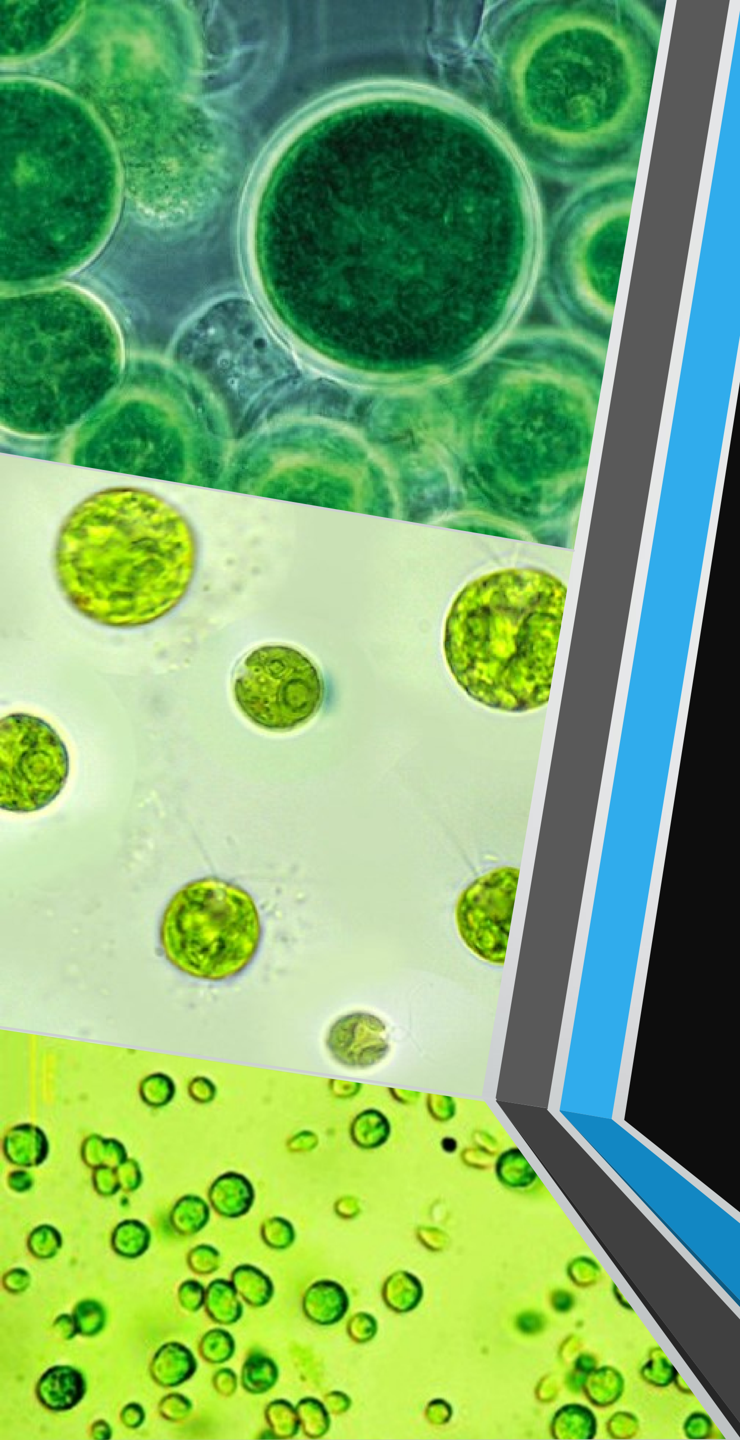


Sewage Treatment Goals:

- Suspended constituents removal
- Decrease of chemical oxigen demand (COD) and of biological oxigen demand (BOD)
- Nutrient removal (NO^-_3 – N, NO^-_2 –N,NH_4^+ -N, e PO_4^{3-} -P)
- Bacteria and pathogens removal
- Haevy metal removal



Microalgae for sewage treatment

- Because of the ability of microalgae to use inorganic compounds such as nitrates and phosphates as nutrients for their growth they can be well applied to the treatment of wasters.

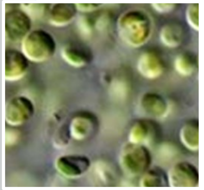
Goals:

- Biotreatment of sewage
- Microalgal biomass production

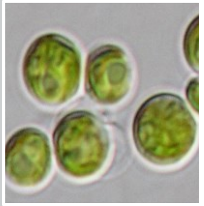
Aim of this work

- To test the ability of four different microalgal strains (two from culture collections and two environmental isolates from Sicily) in taking part in secondary treatment of municipal sewage.
- To test growth performance and biomass composition of obtained microalgae.
- To analyse BOD, COD, total nitrogen and total phosphorous to check the efficiency in wastewater treatment.
- To select the best candidate and test its ability in remediation in combination with sewage sludge in different ratios

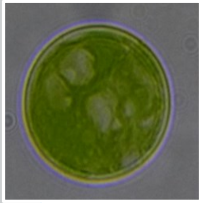
Employed strains



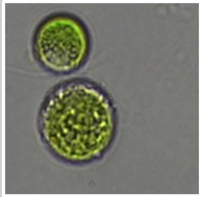
N. gaditana



Chlorella sorokiniana



Chlorella sp. (pozzillo)

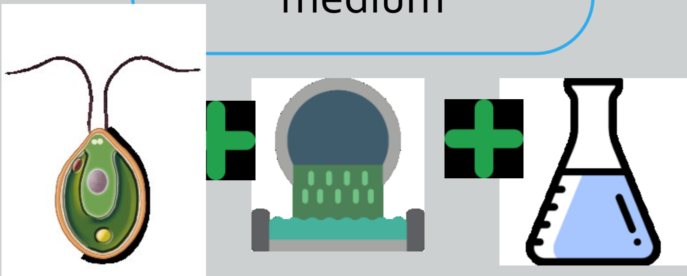


Consortium of *Chlorella sp. and Dunaliella sp.* (vergine maria)

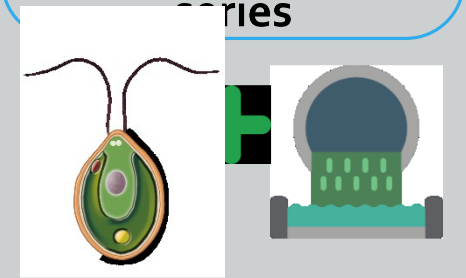
Isolated from Sicilian coasts

Method

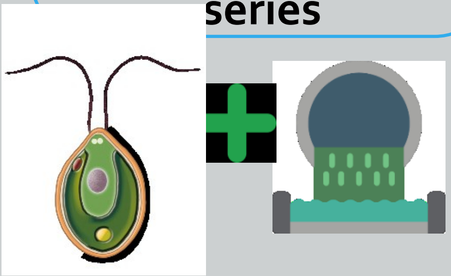
Acclimation of microalgae in 50% municipal sewage and 50% growth medium



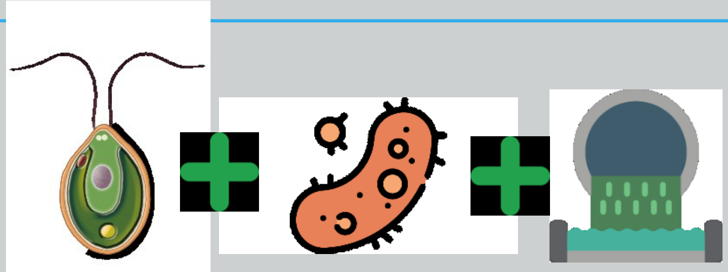
Use this inoculum for inoculating municipal sewage 100% for growing the **1° cultivation series**



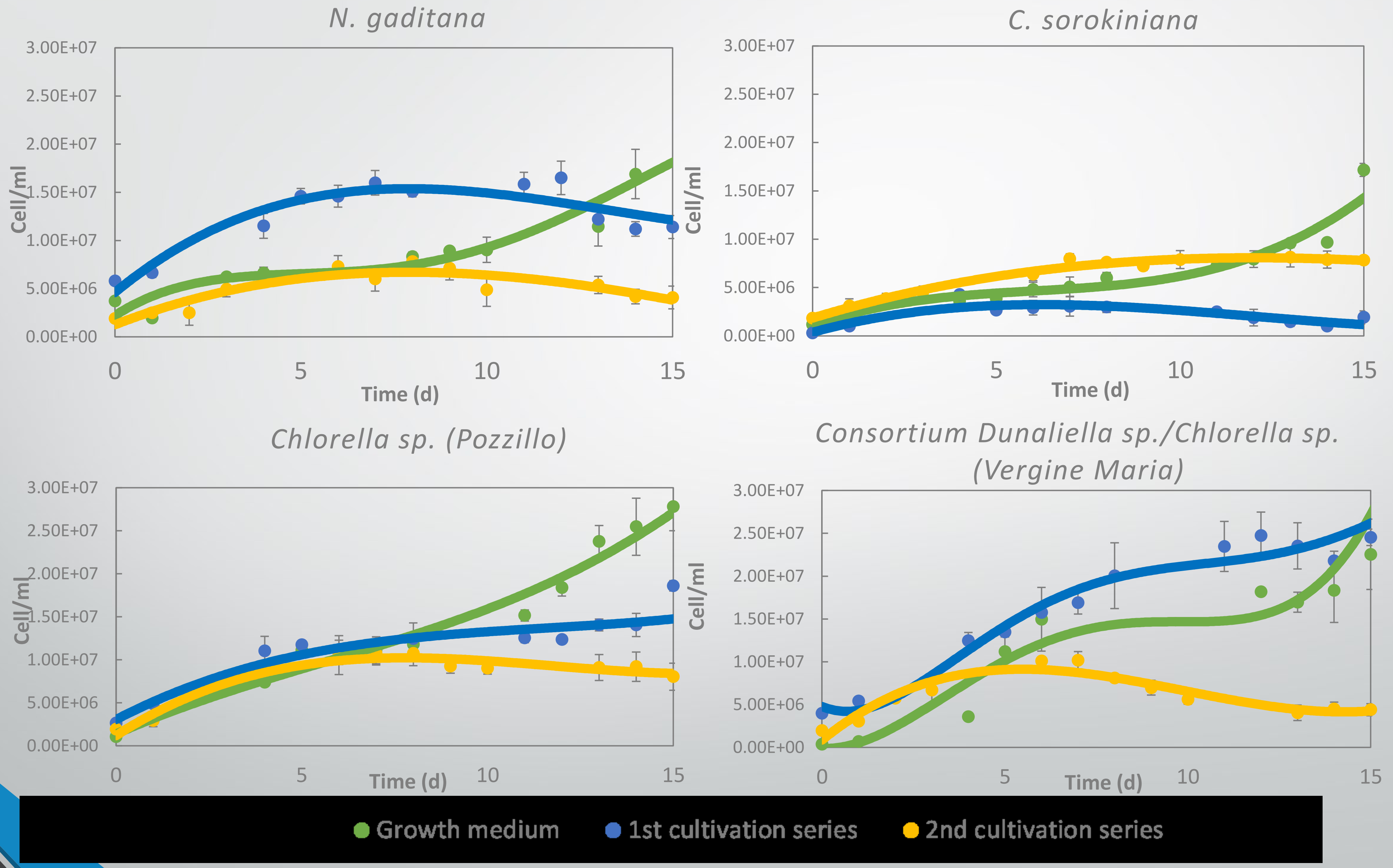
Use this inoculum for inoculating municipal sewage 100% for growing the **2° cultivation series**



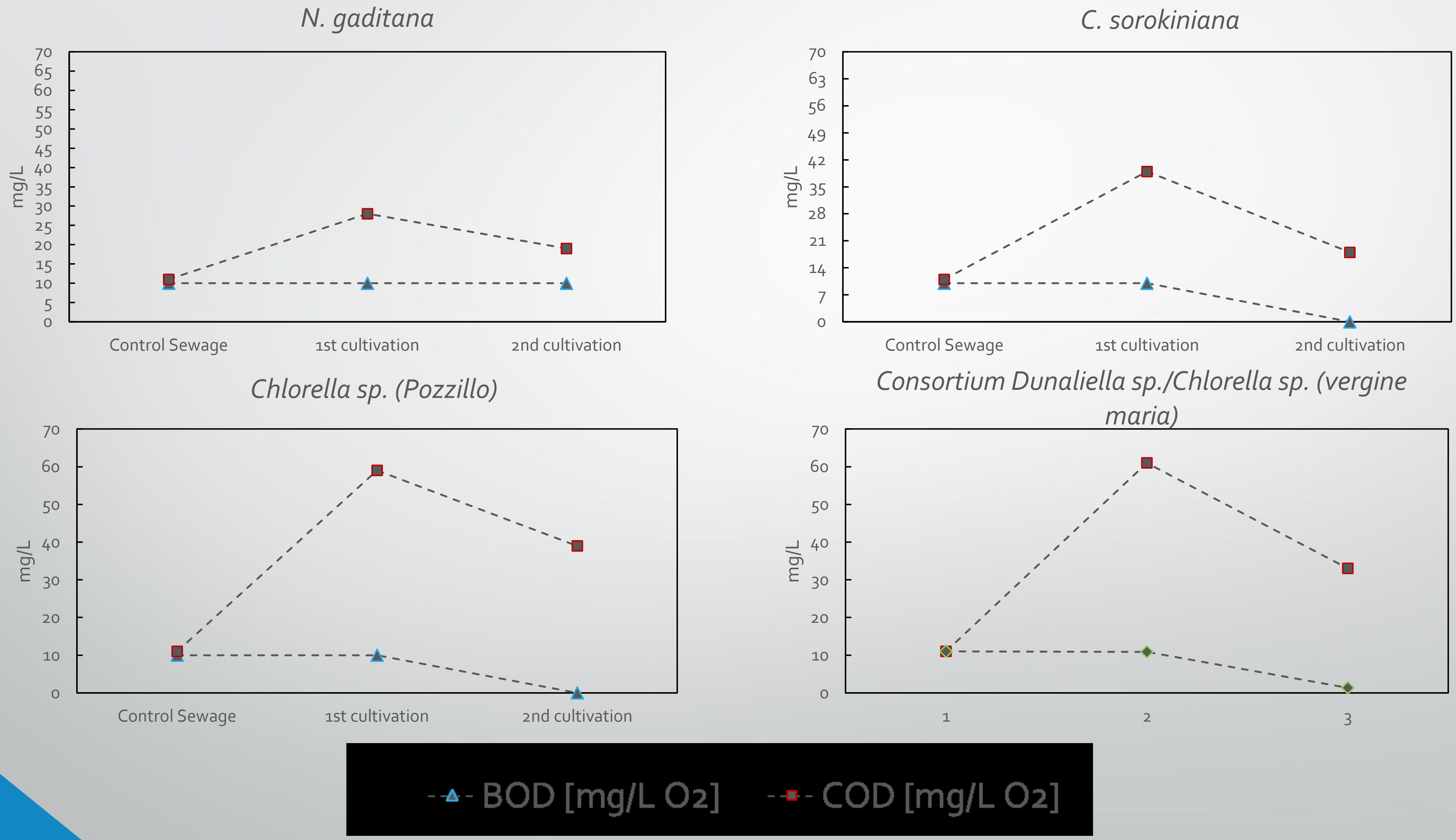
Selecting the best microalgae for growth with bacterial sludge in municipal sewage



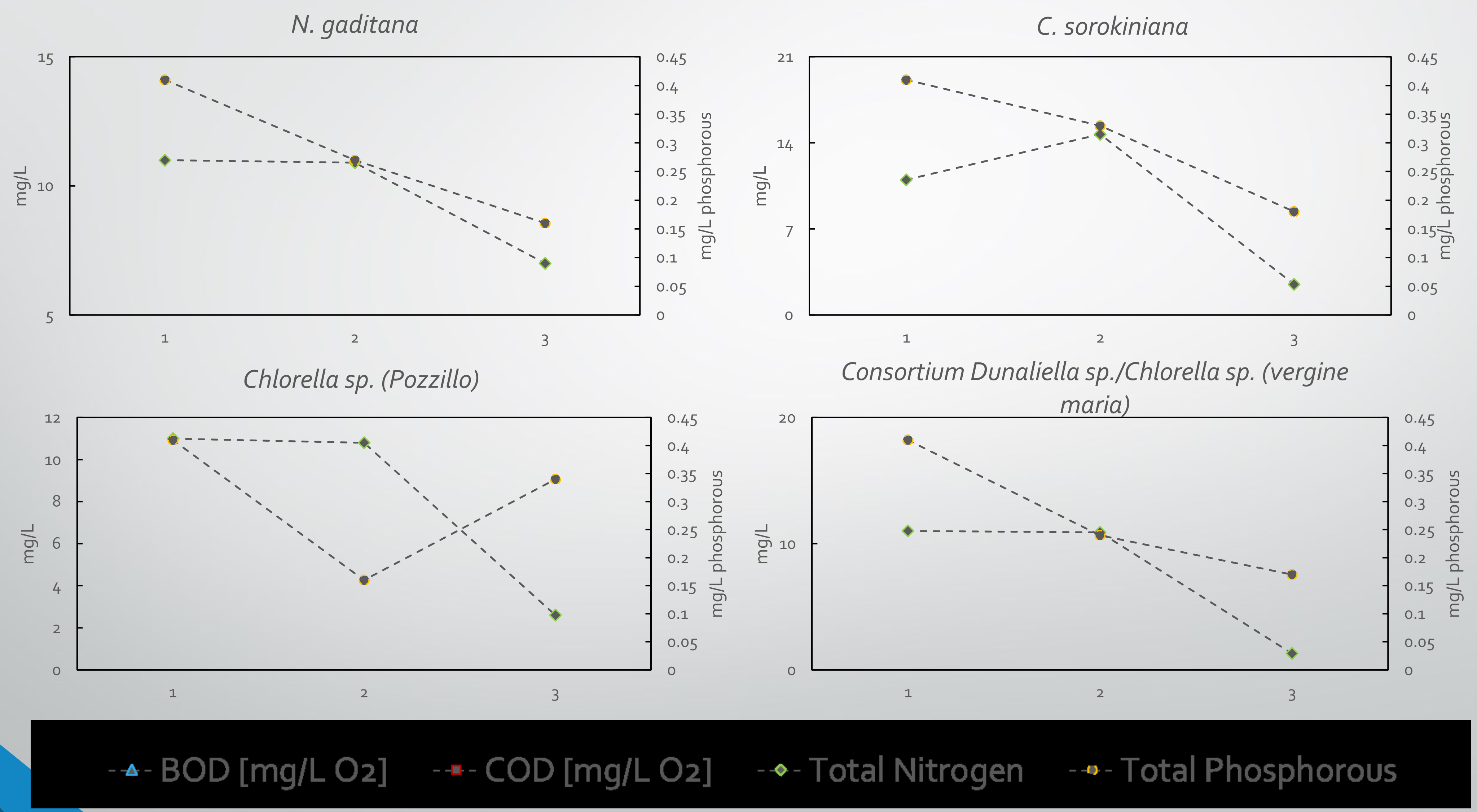
First experiment: microalgal growth curves



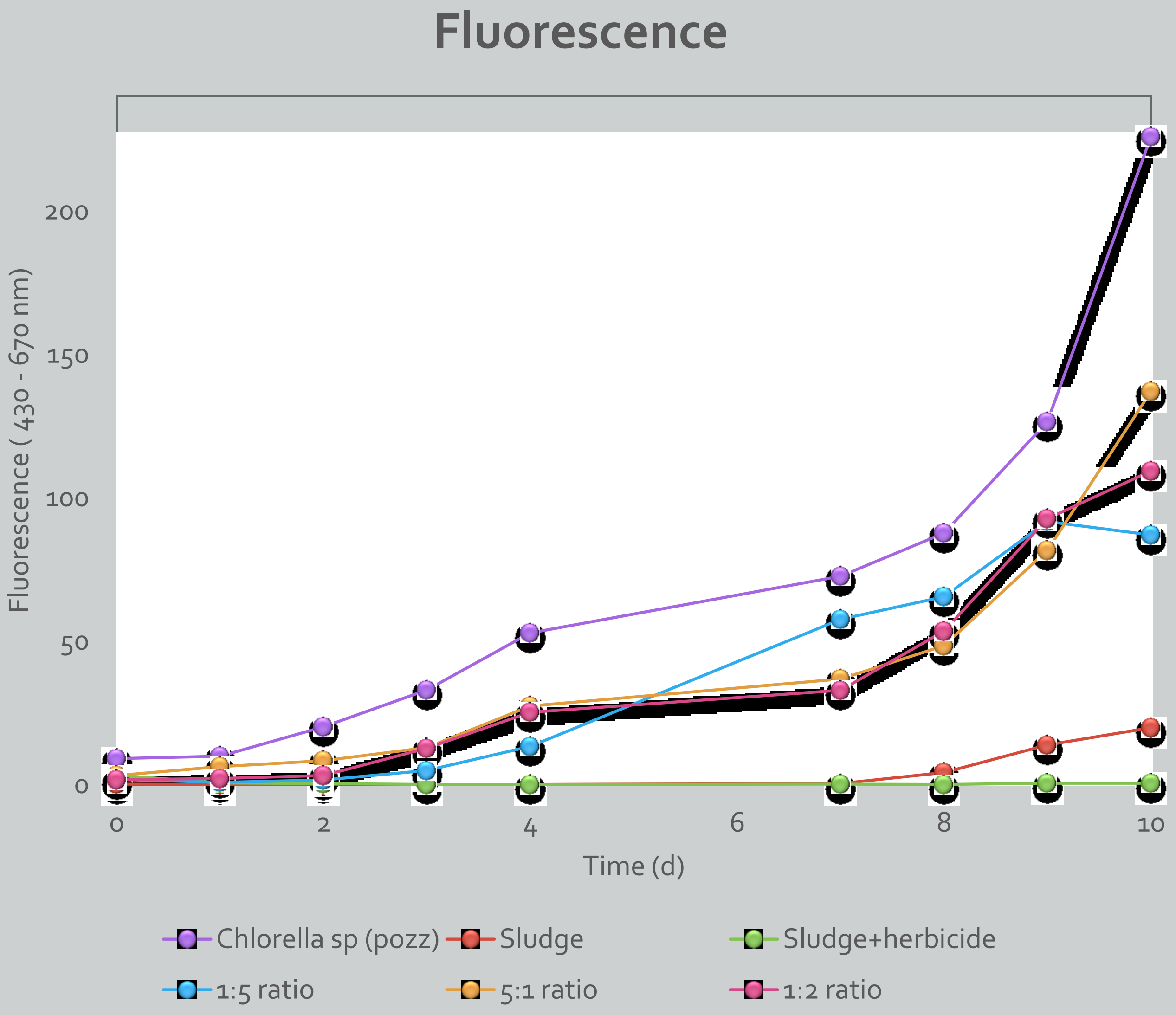
First experiment: BOD and COD

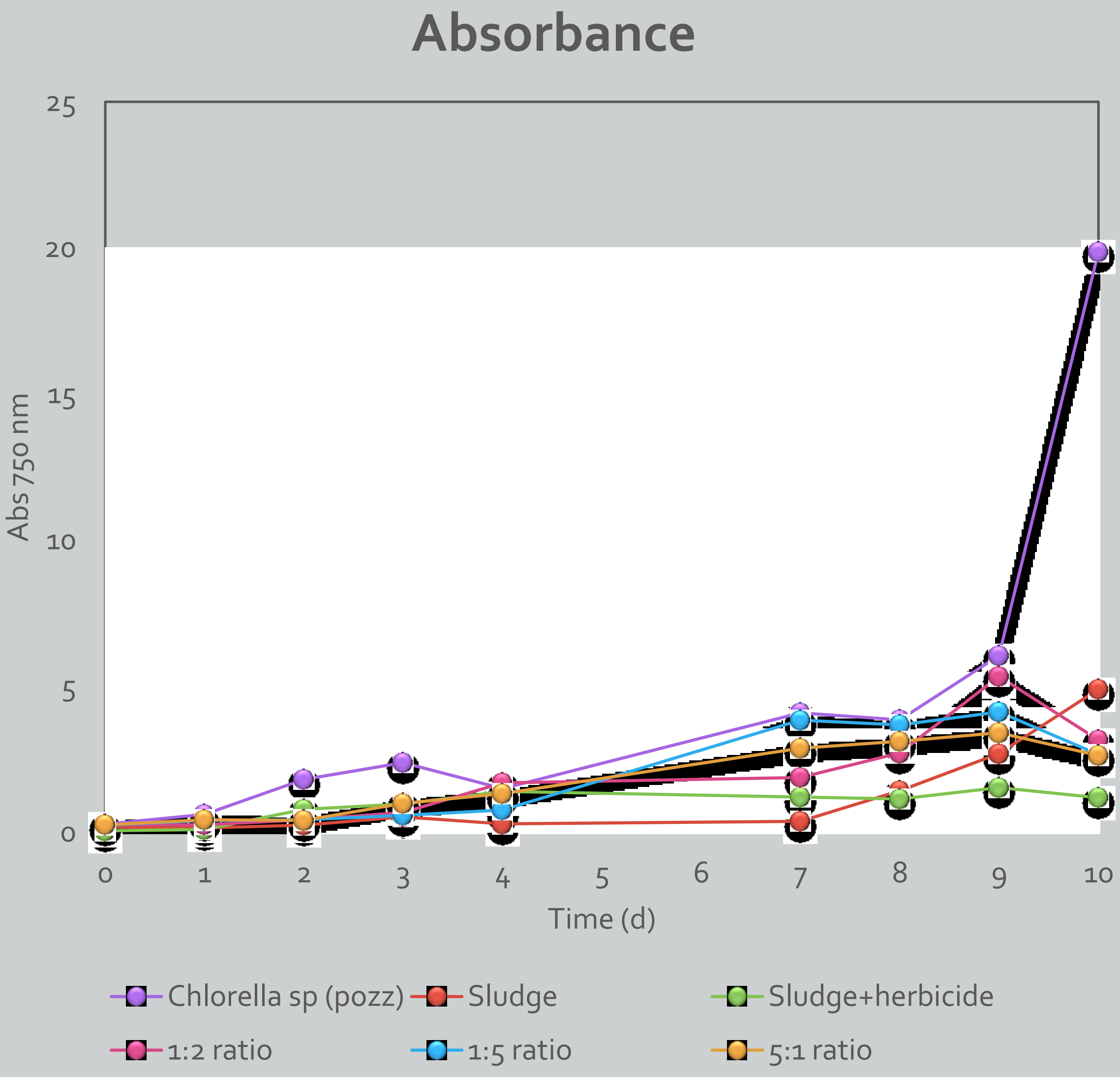


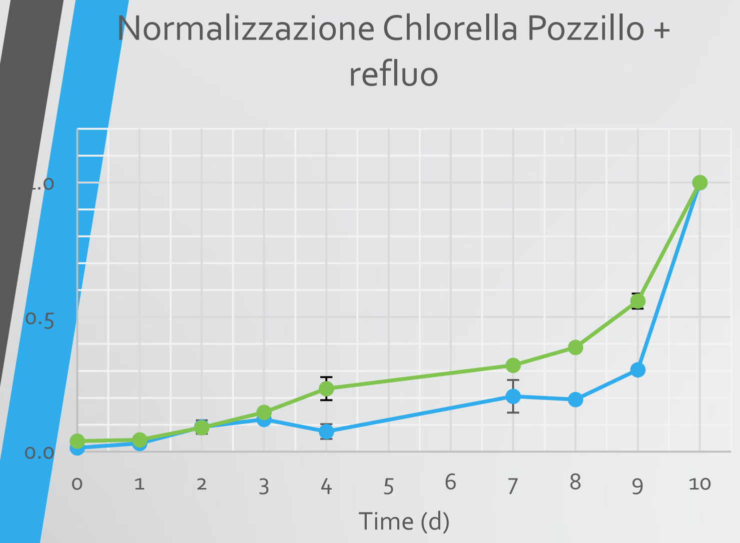
First experiment: nitrogen and phosphorous

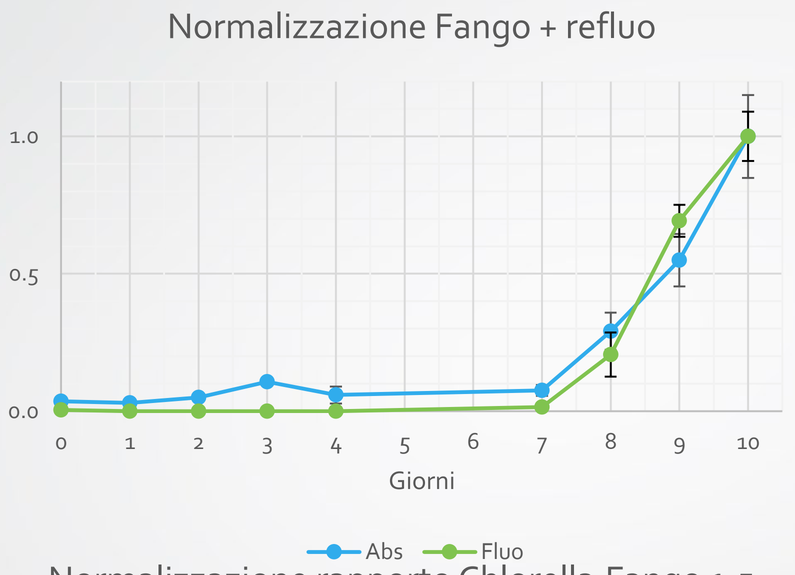


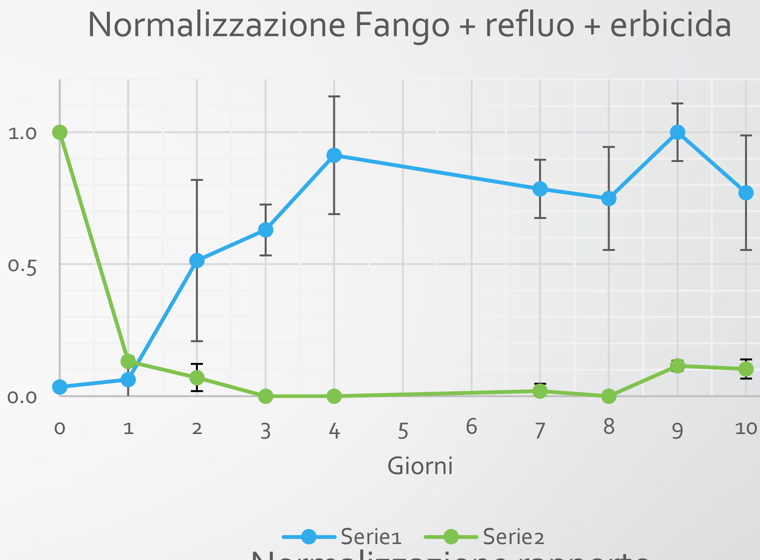
Second experiment: microalgal growth curves

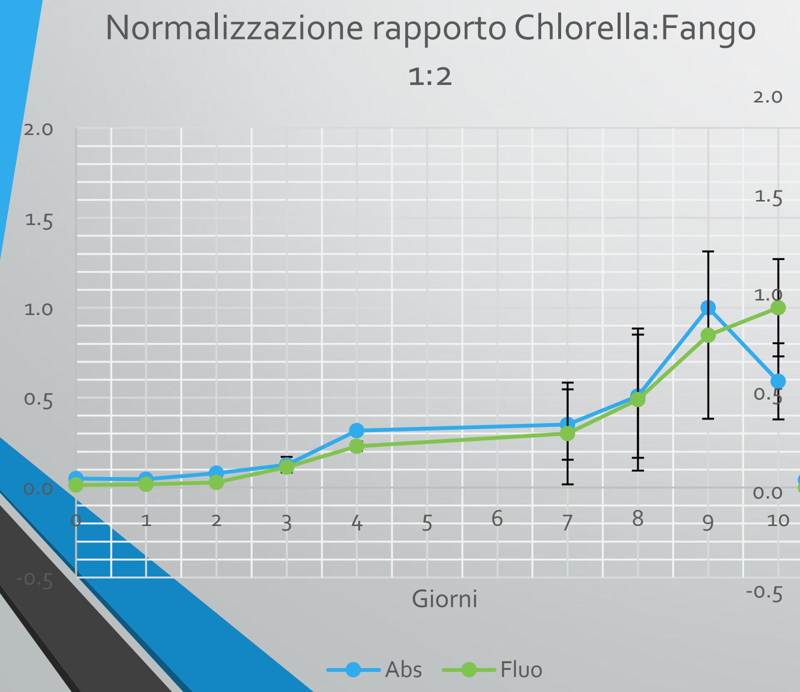


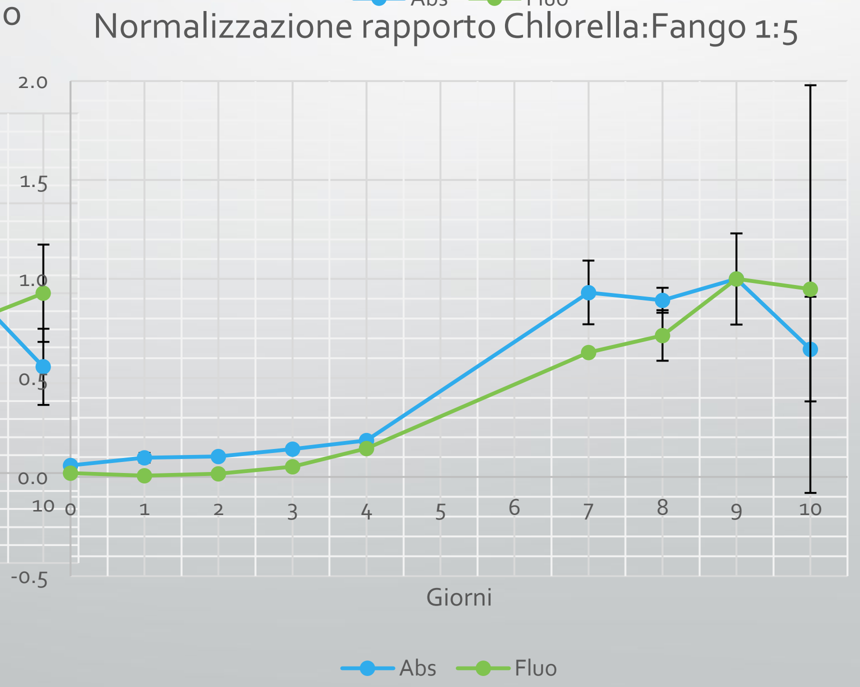


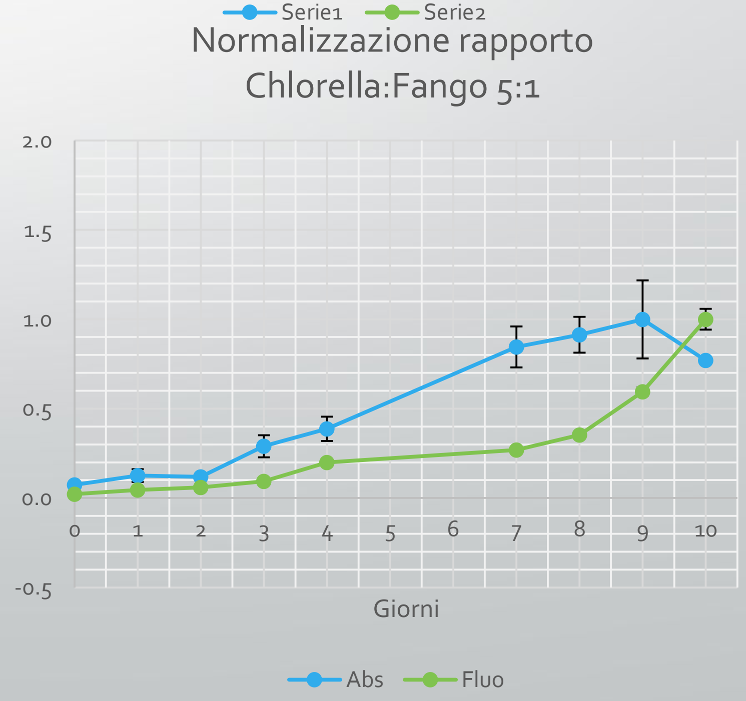

Normalizzazione Chlorella Pozzillo + refluo
0.0
0.5
0 1 2 3 4 5 6 7 8 9 10
Time (d)


Normalizzazione Fango + refluo
1.0
0.5
0.0
0 1 2 3 4 5 6 7 8 9 10
Giorni
Abs
Fluo


Normalizzazione Fango + refluo + erbicida
1.0
0.5
0.0
0 1 2 3 4 5 6 7 8 9 10
Giorni
Serie1
Serie2

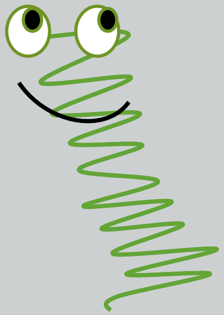

Normalizzazione rapporto Chlorella:Fango 1:2
2.0
1.5
1.0
0.5
0.0
-0.5
0 1 2 3 4 5 6 7 8 9 10
Giorni
Abs
Fluo

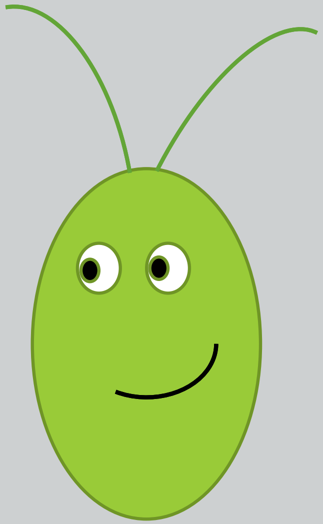

Normalizzazione rapporto Chlorella:Fango 1:5
2.0
1.5
1.0
0.5
0.0
-0.5
0 1 2 3 4 5 6 7 8 9 10
Giorni
Abs
Fluo

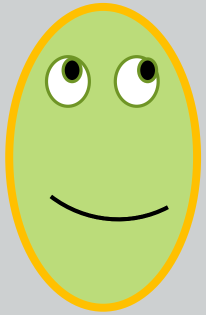

Normalizzazione rapporto Chlorella:Fango 5:1
2.0
1.5
1.0
0.5
0.0
-0.5
0 1 2 3 4 5 6 7 8 9 10
Giorni
Abs
Fluo

Conclusions

- All employed microalgae were able to grow in the sewage
- Growing on the sewage has an effect on the quantity of carbohydrates and lipids in the biomass
- No relevant effects were observed on FA composition
- All the analysed strains act in a similar way
- BOD values did not significantly decrease
- COD values increase, probably because of compounds produced by algae, such as cellulose or emicellulose, that cause its increase
- Total phosphorous and Total nitrogen were effectively removed by microalgae treatment
- The treatment is useful for removal of nutrients (tertiary treatment) but not for COD and BOD reduction. Microalgal treatment could be coupled with another process that involves consortia of yeasts and heterotrophic bacteria.







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Thank you for your kind attention!!