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## In-situ UV-Vis Probe to Monitor Algal Photobioreactors Treating Municipal Wastewater

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# In-situ UV-Vis Probe to Monitor Algal Photobioreactors Treating Municipal Wastewater

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## 1. INTRODUCTION

End use of green microalgae [1]:

- Biofuels
- Organic fertilizers
- High value added products (e.g. pigments)

Unsustainable if not coupled with used water treatment

Monitoring systems for photobioreactors [2]:

- Usually focus on biomass or pH
- Mostly validated with synthetic media

## 3. OBJECTIVE

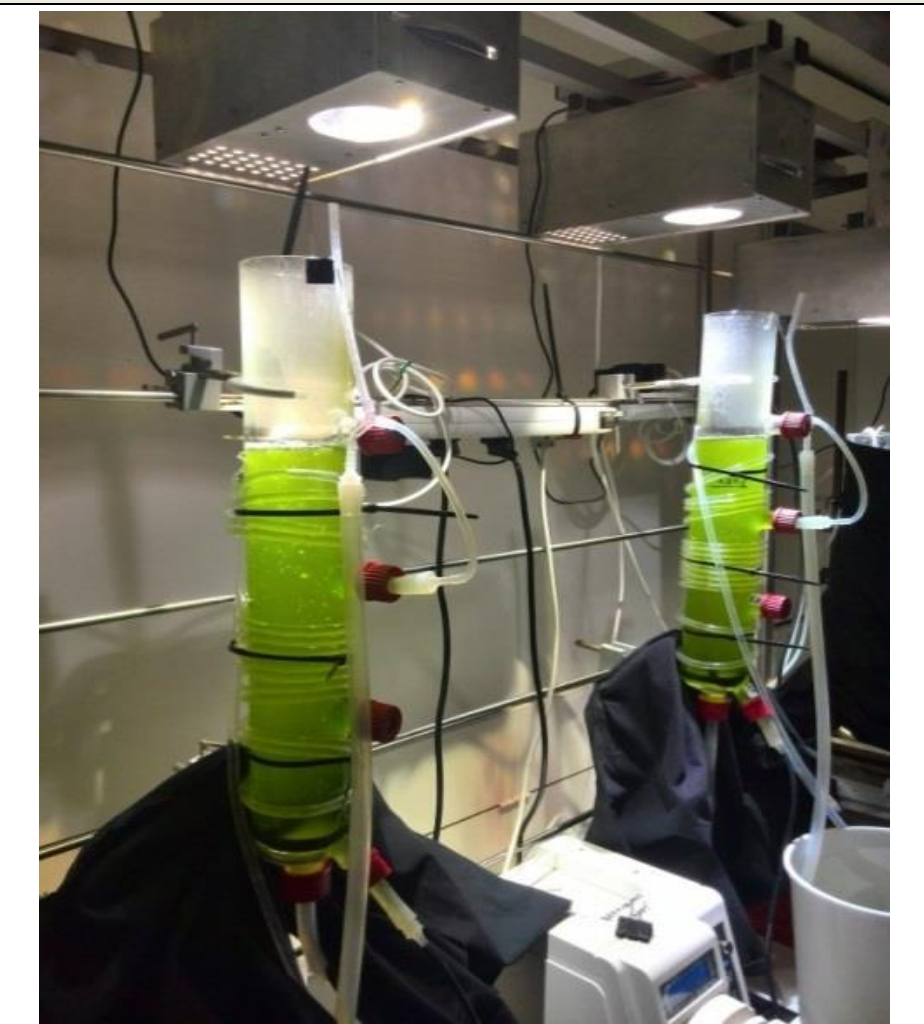
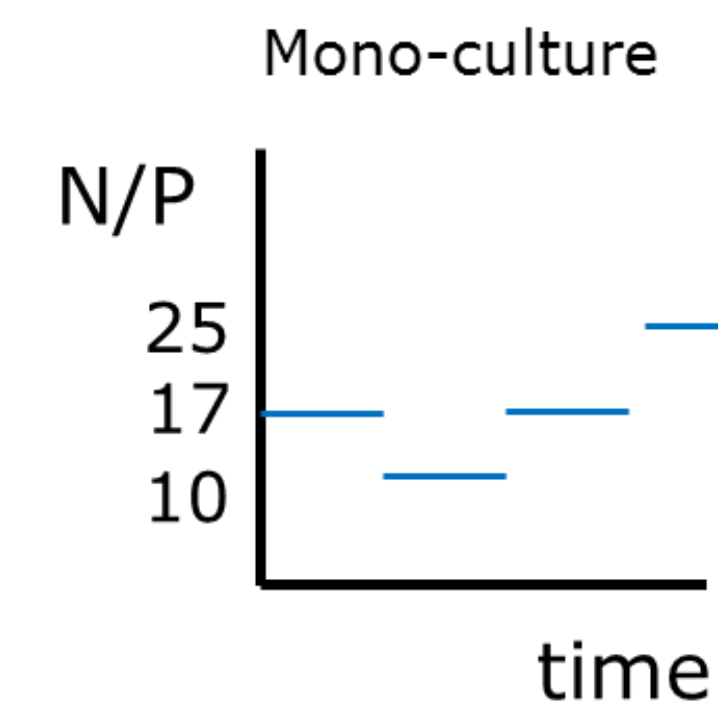
Validate a **UV-Vis sensor** as a suitable monitoring tool for **algal photobioreactors** treating **municipal used water** for resource recovery

## 2. MATERIALS AND METHODS

### EXPERIMENTAL DESIGN

Two lab-scale photobioreactors [3]:

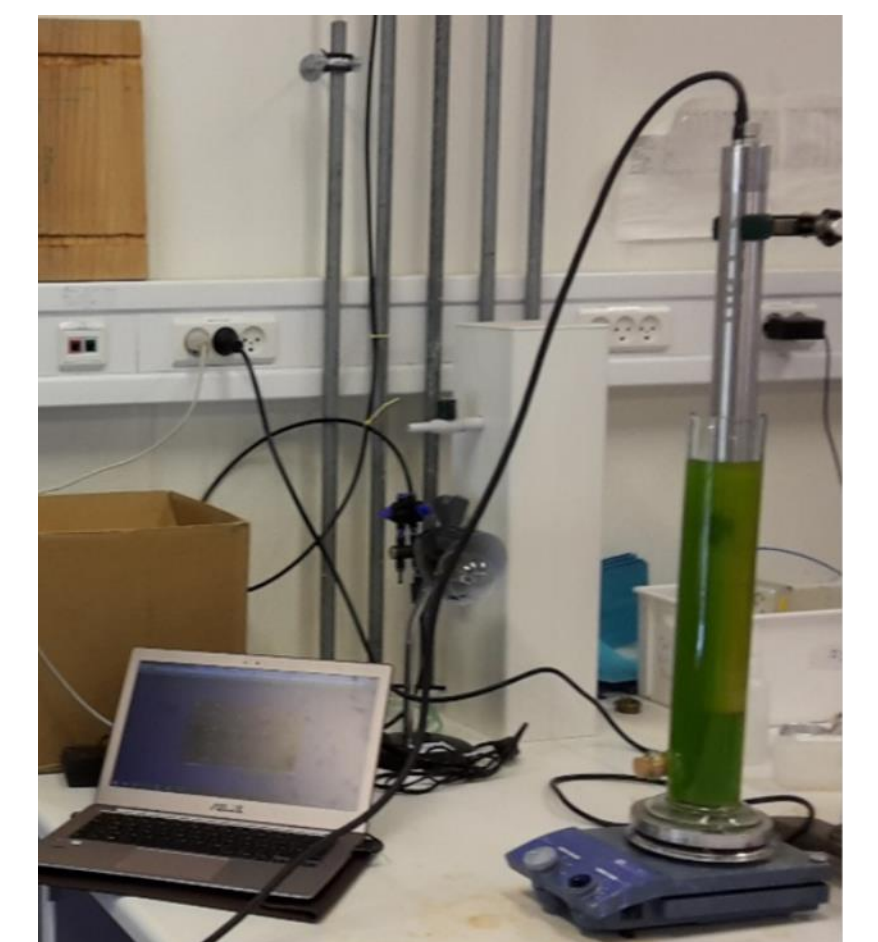
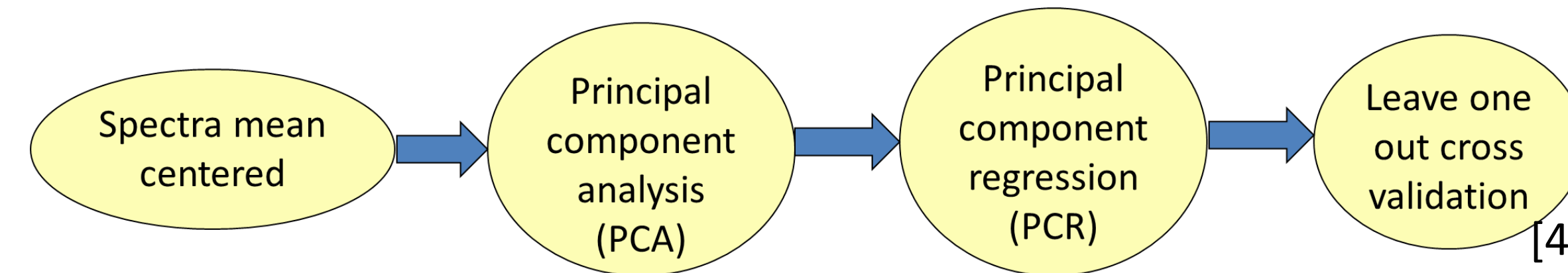
- 1.4 L reactor
- Hydraulic retention time of 3.5 days
- Fed with treated municipal used water
  - Variability in nutrient load



### ANALYTICAL METHODS

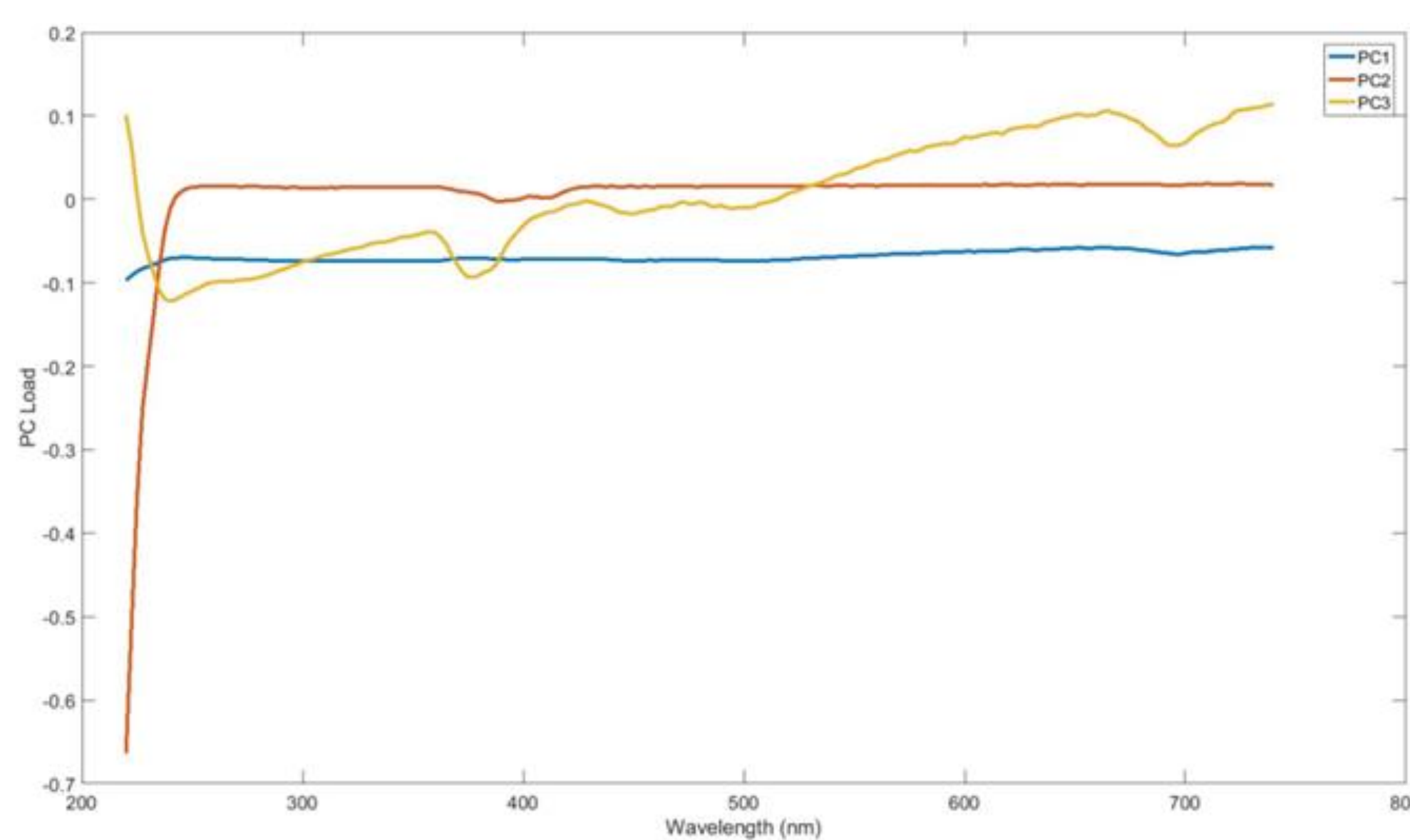
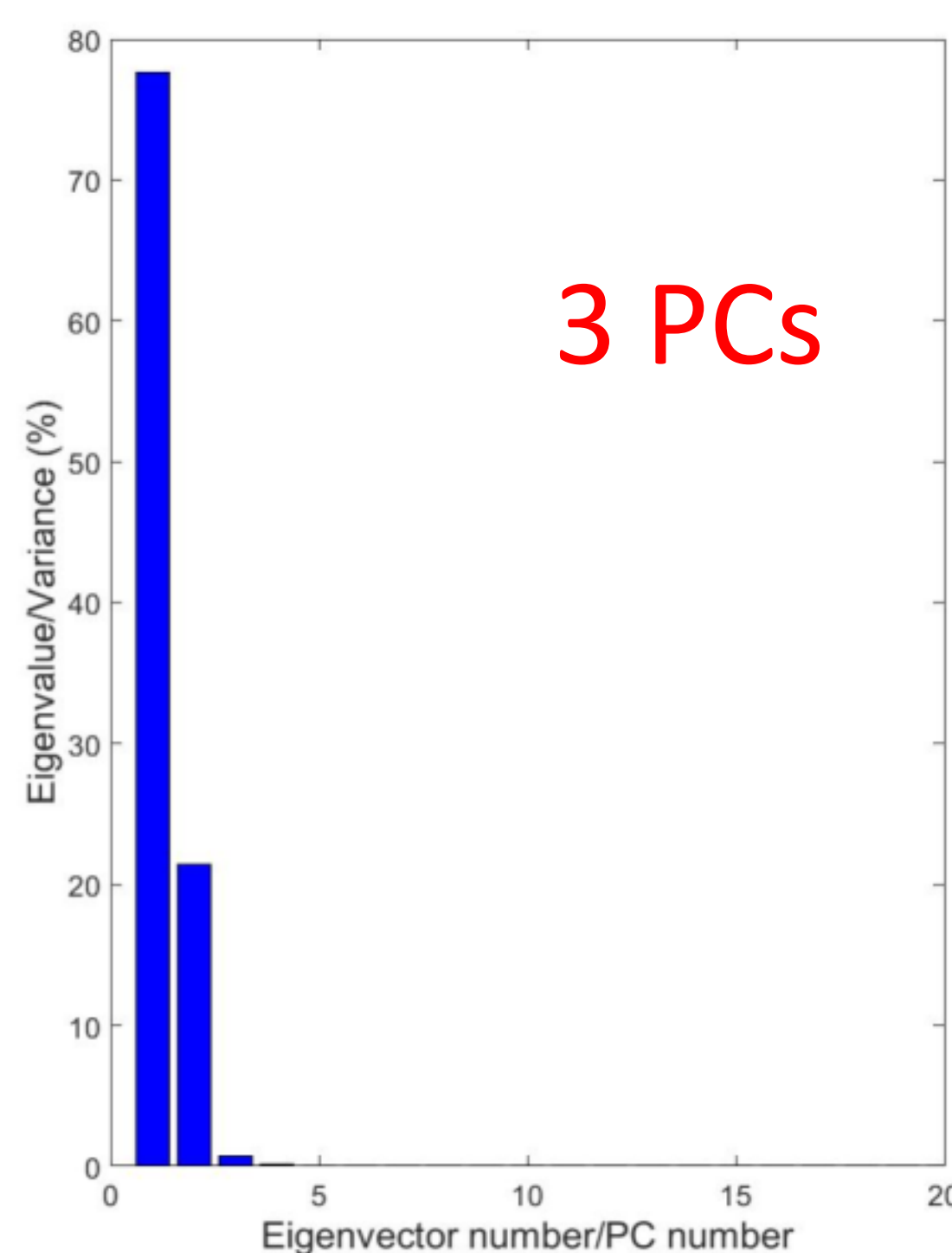
Variables monitored:

- Nitrate
- Total suspended solids
- Total chlorophyll



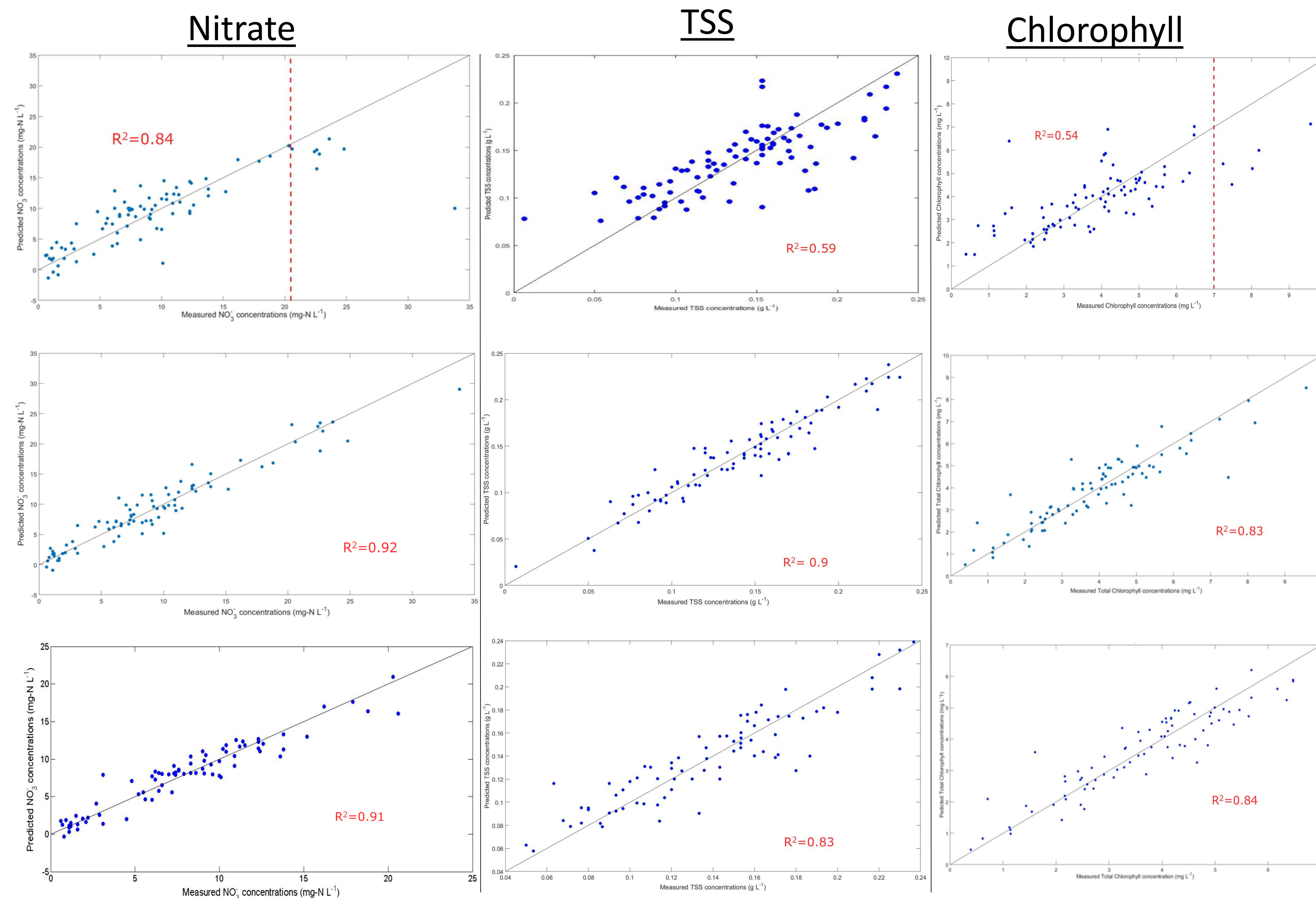
## 4. RESULTS AND DISCUSSION

### Principal component analysis



- **PC1** relates mainly to variability on **TSS** and **chlorophyll**
- **PC2** relates mainly to variability on **nitrate**

### Principal component regression



- **First row:** models based on 3 first PCs
  - Only accurate for nitrate
- **Second row:** models based on the optimal model suggested by the leave one out cross validation method
  - Accurate, but over parametrized for TSS (40 PCs) and chlorophyll (27 PCs)
- **Third row:** models based on data after outlier removal (TSS) or saturation data removal (nitrate and chlorophyll)
  - **Nitrate:** only 10 PCs give comparable results as optimal after saturation removal
  - **TSS:** only 10 PCs give comparable results as optimal after outlier removal
  - **Chlorophyll:** only 24 PCs give comparable results after saturation removal

## ACKNOWLEDGEMENTS



### References:

- [1] Cai and Park. *Renewable Sustainable Energy Reviews* 19 (2013): 360-369.
- [2] Havlik et al. *Trends in Biotechnology* 31 (2013): 406-414.
- [3] Wágner. *Used water resource recovery using green microalgae*. PhD thesis DTU Environment
- [4] Masic et al. *Water Research* 85 (2015): 244-254.

