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## IMPACT OF ORGANIC COMPOUND STRUCTURE AND CONCENTRATION IN THE INFLUENT ON ALGAL BIOMASS PRODUCTION

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### Introduction

Microalgae and bacteria engage in various forms of interaction, often symbiotic in nature. These symbiotic relationships involve nutrient exchange, cell-to-cell communication, and the stimulation of chemical compounds. Microalgae are capable of detecting bacterial-produced quorum-sensing signal molecules, vitamins, and siderophores, leading to enhanced bioactivity, nutrient removal, and stress tolerance in symbiotic associations. The formation of symbiotic relationships between microalgae and bacteria has been shown to significantly improve the efficiency of wastewater treatment. Consequently, granular activated microalgae systems present a promising option for wastewater treatment and bioenergy production.

However, microalgae and bacteria can also produce inhibitory compounds that negatively affect each other's growth. It is important to note that the majority of studies on microalgae-bacteria interactions have been conducted under well-controlled laboratory conditions to minimize cross-contamination.

In this study, we aim to investigate the effect of modifying the concentration and structure of the organic compound used as the sole source of organic carbon in the influent supplied to the bioreactors. Specifically, the structural modification involves replacing the methyl group in sodium acetate with the phenyl group in sodium benzoate, to evaluate how this alteration impacts algal biomass development.

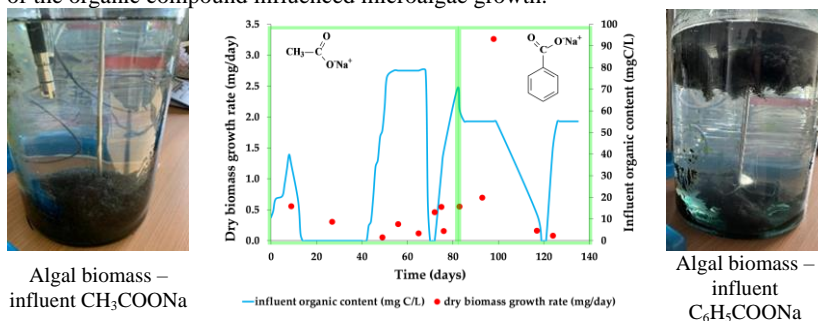
### Materials and methods

A 14 L water tank was used to cultivate the microalgae granules.

Mature activated algae granules were initially grown in a 1.5 L sequencing batch photobioreactor (BIOSTAT® Aplus, Sartorius Lab Instruments GmbH, Goettingen, Germany). Inside the granular structures, microalgae biodiversity was mainly represented by *Chlorella sp.* and *Phormidium sp.* populations. Each treatment batch was conducted for 24 hours including the following consecutive cycles: (1) biomass

settling (1 min), (2) 1 L effluent withdrawn (5 min), (3) biomass feeding (5 min), and (4) wastewater treatment with a hydraulic retention time of 23 h 49 min by setting up a photoperiodicity to 12 h light – 12 h dark, with continuous stirring (speed 200 rpm).

The influent had the following chemical composition:  $\text{NH}_4\text{Cl}$  89 mg/L;  $\text{K}_2\text{HPO}_4$  28 mg/L;  $\text{CaCl}_2$  40 mg/L;  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  75 mg/L;  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  5 mg/L;  $\text{H}_3\text{BO}_3$  50  $\mu\text{g/L}$ ;  $\text{ZnCl}_2$  50  $\mu\text{g/L}$ ;  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  30  $\mu\text{g/L}$ ;  $\text{MnSO}_4 \cdot \text{H}_2\text{O}$  50  $\mu\text{g/L}$ ,  $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}$  50  $\mu\text{g/L}$ ;  $\text{AlCl}_3$  50  $\mu\text{g/L}$ ;  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  50  $\mu\text{g/L}$ ;  $\text{NiCl}_2$  50  $\mu\text{g/L}$ . Sodium acetate or sodium benzoate were used as the organic carbon source. The experiment ran for 80 days before changing the carbon source. After 80 days, sodium acetate was replaced with sodium benzoate to investigate how the structure of the organic compound influenced microalgae growth.



**Figure 1.** Algal biomass growth rate *versus* influent organic carbon loading

The concentration and type of organic carbon source had a strong influence on microalgae growth as presented in Figure 1. It is also observed that the density of the algal biomass also changes when the sodium acetate is replaced by sodium benzoate indicating the influence of organic compound on the metabolic products. The growth of the algal biomass and the development of filamentous or globular ones was evaluated by analyzing the chlorophyll content (Chl) and total organic content (TOC) in the dry biomass.

### Results and conclusions

The analysis of the chlorophyll concentrations variation extracted in ethanol 90% for the two working stages (feed with variable content of sodium acetate and feed with variable content of sodium benzoate) shows that the amount of chlorophyll a, b and c decreases over time. The TOC/Chl ratio had a maximum after approximately 11 weeks of feeding with sodium acetate, indicating an increase of filamentous species weight at the expense of globular ones in the collected algal biomass.

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