CRC for Water Sensitive Cities

Emily Yi Yuan Lee
Supervised by Anas Ghadouani and Damien Batstone
C 2.1
Resources recovery

Effects of carbon source in nutrient assimilation of purple phototrophic bacteria

Introduction

The concept of “sustainability” is receiving increasing attention from the public, water utilities, and suppliers. Many wastewater treatment processes in practice today are not feasible from both economic and environmental viewpoints, because the efficiency of nutrient recovery is usually low and highly energy intense. Purple phototrophic bacteria (PPB) have proven to be capable of reducing chemical oxygen demand (COD), and removing ammonia (NH_3-N), and orthophosphate (PO_4-P) from domestic wastewater (Hulsen et al. 2014). However, this can only be achieved by the addition of an external carbon source, which would obviously increase cost.

Objectives

PPB are anaerobes and can grow via a range of metabolism modes by utilising different substrates in the growth medium. In this studies, PPB were grown under photoheterotrophic mode by using different carbon sources to study how growth and nutrient assimilation (NH_3-N and PO_4-P) of mixed PPB culture were affected when different types of carbon source were used. The three carbon sources were chosen due to the differences in the carbon oxidation state.

The Concept

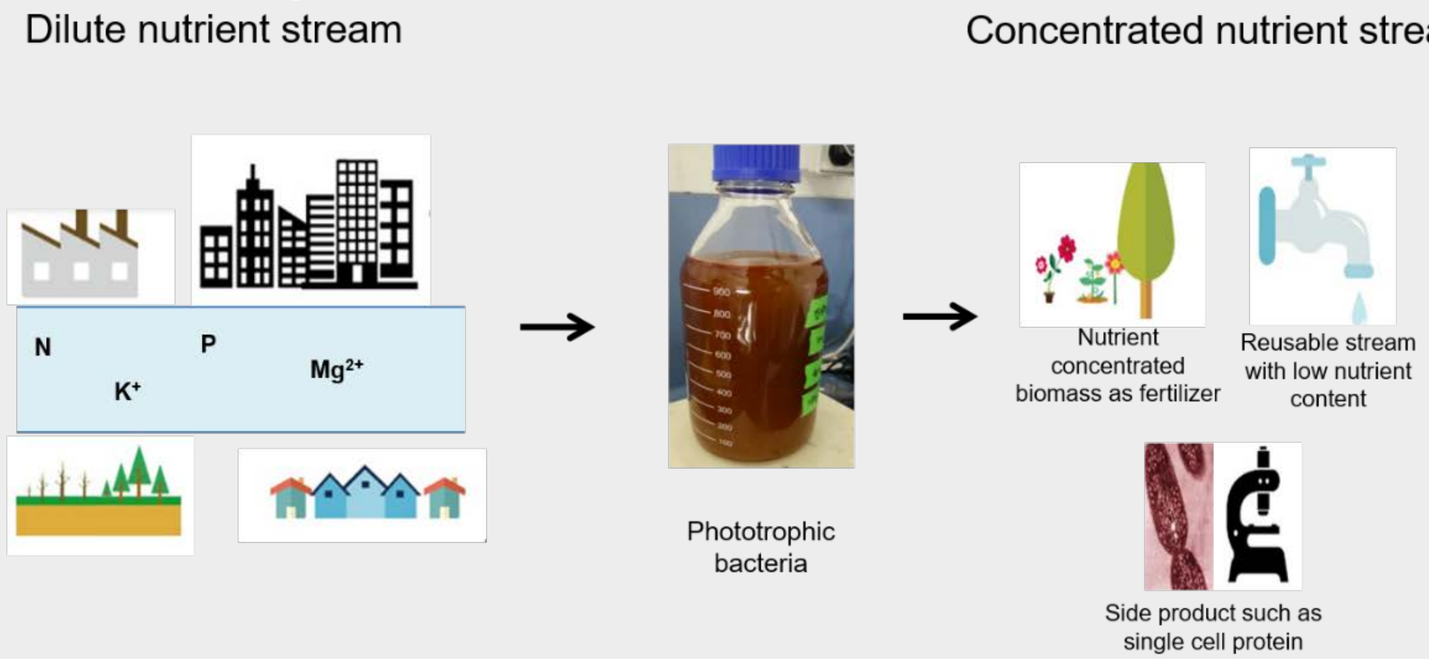

Figure 1: Pre-nutrient assimilation (diluted stream)

Figure 2: Post-nutrient assimilation (concentrated stream)

Summary and Conclusions

- PPB grown in succinic acid achieved the best performance among the three carbon substrates with the highest ammonia removal (Figure 3a), and highest orthophosphate removal (Figure 3b), while consuming less SCOD than sodium acetate.
- Succinic acid may be used as a carbon source to aid PPB-mediated removal of N and P in wastewater treatment processes, however it is not as cost effective an option as sodium acetate.

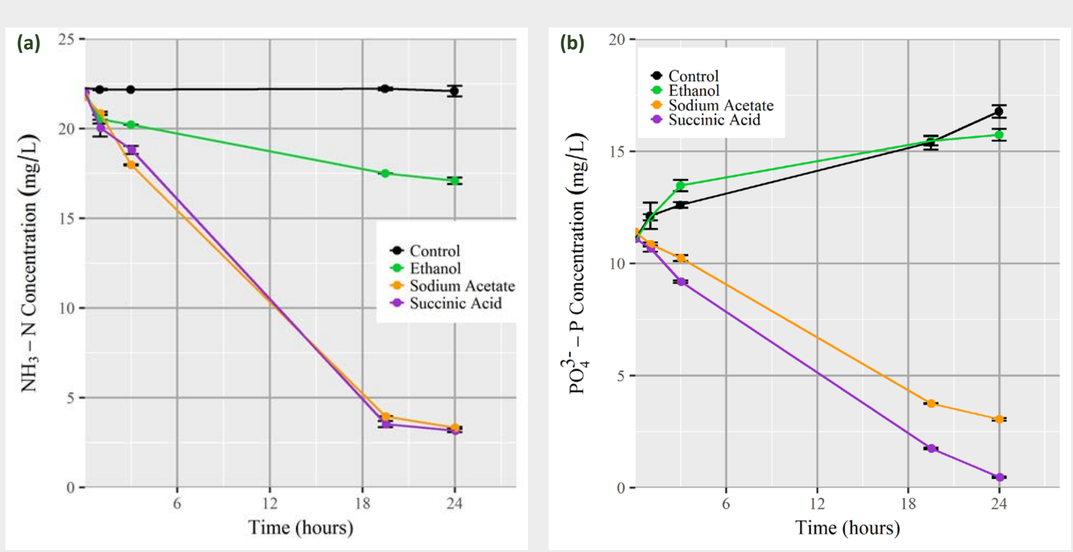

Figure 3: The effects of different carbon source on the (a) nitrogen and (b) phosphorus remaining in the PPB growth medium

THE UNIVERSITY OF WESTERN AUSTRALIA
SEEK WISDOM

Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Programme