Background
The conventional wastewater treatment plants are more frequently used in large cities for treating municipal wastewater. However, due to its high energy consumption and high operational cost, this type of infrastructure is not suitable for the local and global sustainability. *Chlorella sorokiniana* is one algal strain which is proven to be capable in wastewater treatment. However, the optimum conditions for algal treatment still need to be determined, in order to reach the maximum performance.

Aims
Algae starvation was proven to have the ability to increase nutrient removal in the literature. Also, the configurations for scale-up algae growth need to be specified. This project is therefore divided into two parts. In the first part, the algae will be grown in a small scale, with both starved and unstarved conditions. The second aspect of this project will be the comparison between photobioreactors with different configuration in the scale-up test. This involves the algae growing in two types of reactor: bubble column and airlift reactor.

**Starvation Tests**

**Processes:**
- Generation 1: algae provided with full nutrients
- Generation 2: 2 groups of algal culture. Group 1 (starved) had 10% of nutrients provided to group 2 (unstarved)
- Generation 3: both cultures in generation 2 provided with full nutrients

Assessment on the algal growth and nutrient uptake

Generation 2: Unstarved (bottom) and starved (top) algal cultures

**Scale-up Tests**

**Processes:**
- Growing of algae in bubble column (BC) and airlift reactor (ALR)
- Algae growing in the above reactors, but with configuration changes
- Assessment on the algal growth and nutrient uptake

**Conclusion:**
- Starvation did not improve the algal growth and nutrient uptake
- Unstarved culture is 17% and 44.7% higher in terms of biomass and nutrient uptake

**Figure:** Biomass and nitrate ratio in the third generation

**Conclusion:**
- Connecting more thin bubble columns in series has the highest performance, then single bubble column, then ALR
- Reduction in column diameter can increase the nutrient removal rate