Performance and fouling behavior of membrane photobioreactor-based microalage-activated sludge culture treating domestic wastewater: Effect of biomass retetion time

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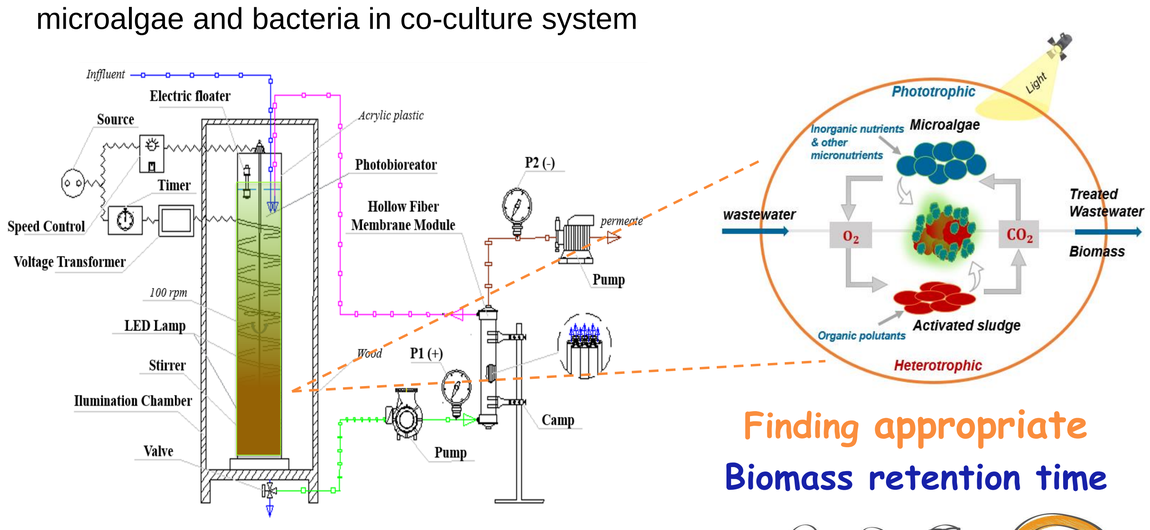
INTRODUCTION

Co-culture of microalgae - activated sludge photobioreactor (PBR) technique for wastewater treatment attracts a lot of attention recently due to the treatment performance (organic matter and nutrients removal) without aeration. Membrane photobioreactor (MPBR) is used that they can serve as an effective way of combining wastewater treatment with biomass production (Sun et al., 2018). Biomass retention time (BRT) can be better controlled microbial growth rate, thus, that very important to improve the algae growth rate and explored as symbiotic mechanism between microalgae and bacteria in co-culture system



Finding appropriate Biomass retention time

MATERIALS AND METHODS

Microorganism and wastewater

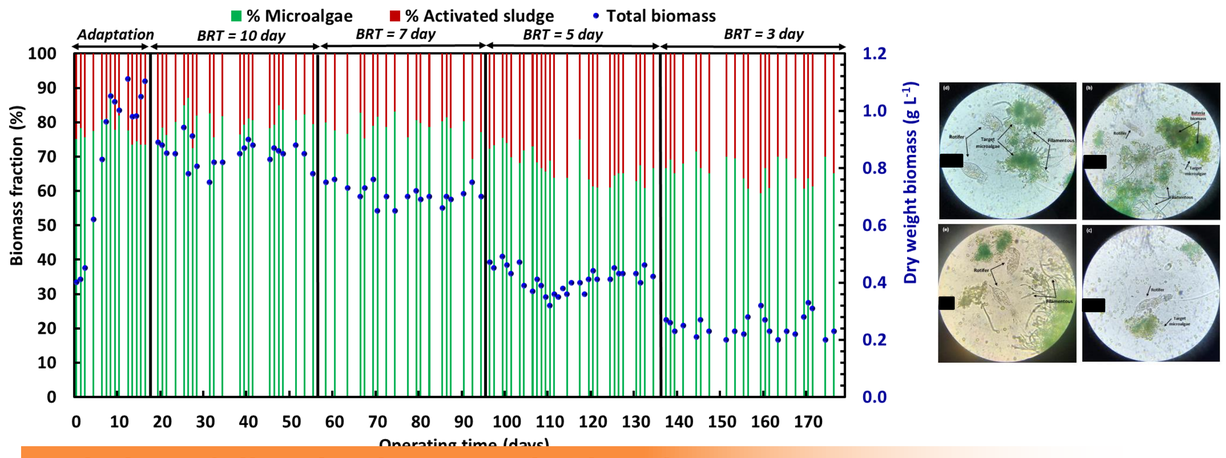
- Microalgae strain (*Chlorella* sp.) was taken from Aquaculture Research Institute 2-Ministry of Agriculture and Rural Development, Vietnam.
- Activated sludge was collected from CASP wastewater treatment system.
- Characteristics of domestic wastewater: COD 185±45 mg L^{-1}, TKN 38±8 mg L^{-1}, NH_4^+-N 20±5 mg L^{-1}, TP 4.9±2.3 mg L^{-1}, NO_3^--N 0.15±0.03 mg L^{-1}, NO_2^--N 0.1±0.05 mg L^{-1} and pH 7.6±0.4. Low relatively COD/N ratio 5±2 and N/P 8±2.

Experimental design

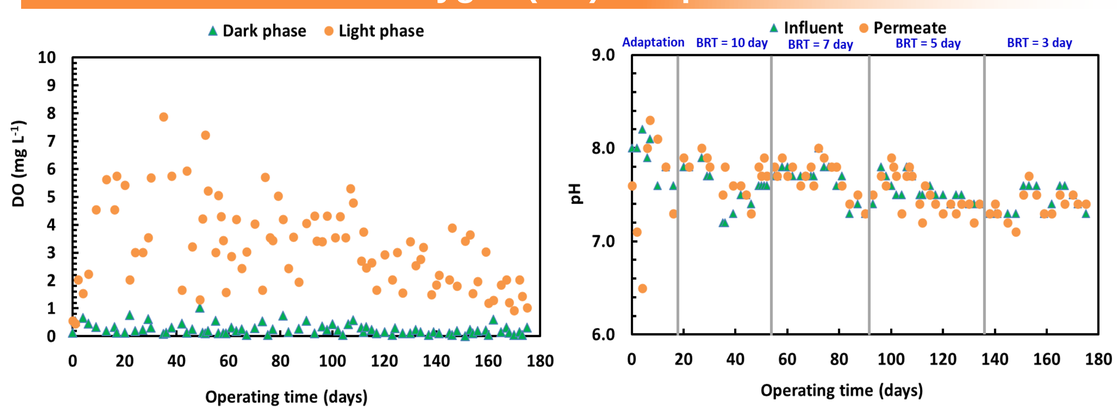
Operating parameters	Biomass retention time (d)			
	3	5	7	10
Inoculum ratio of algae/sludge (wt/wt)	3:1			
HRT (day)	1			
Volume of withdrawal biomass (L)	4.7	2.8	2	1.4
Agitation speed (rpm)	100			
Light intensity (µmol/m^2s)	100			
Light/dark cycle (h/h)	12:12			
Flux (L/m^2h)	16.5			
Cross flow velocity (m/s)	1			

RESULTS AND DISCUSSION

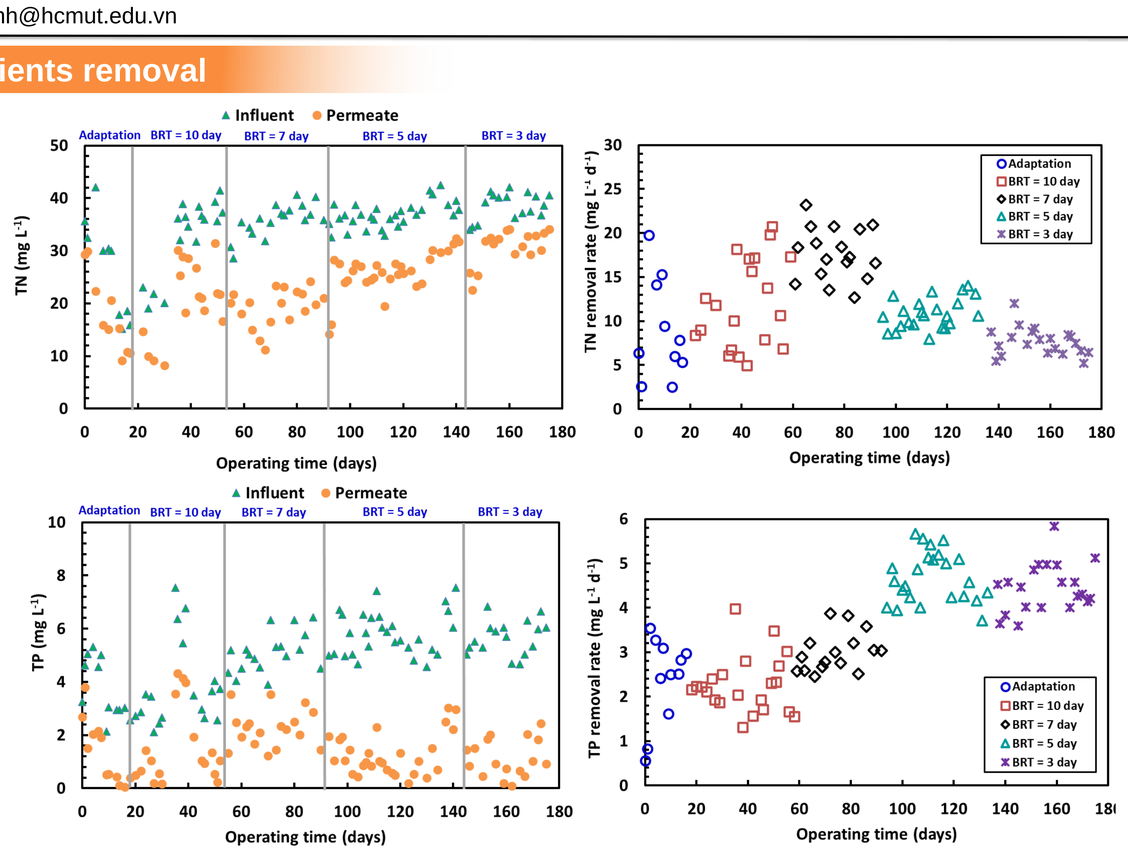
Biomass growth



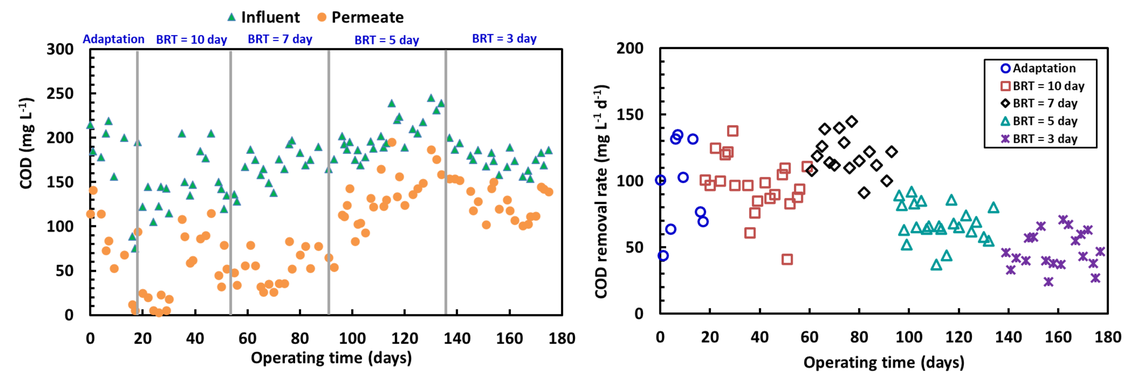
Variation of dissolved oxygen (DO) and pH



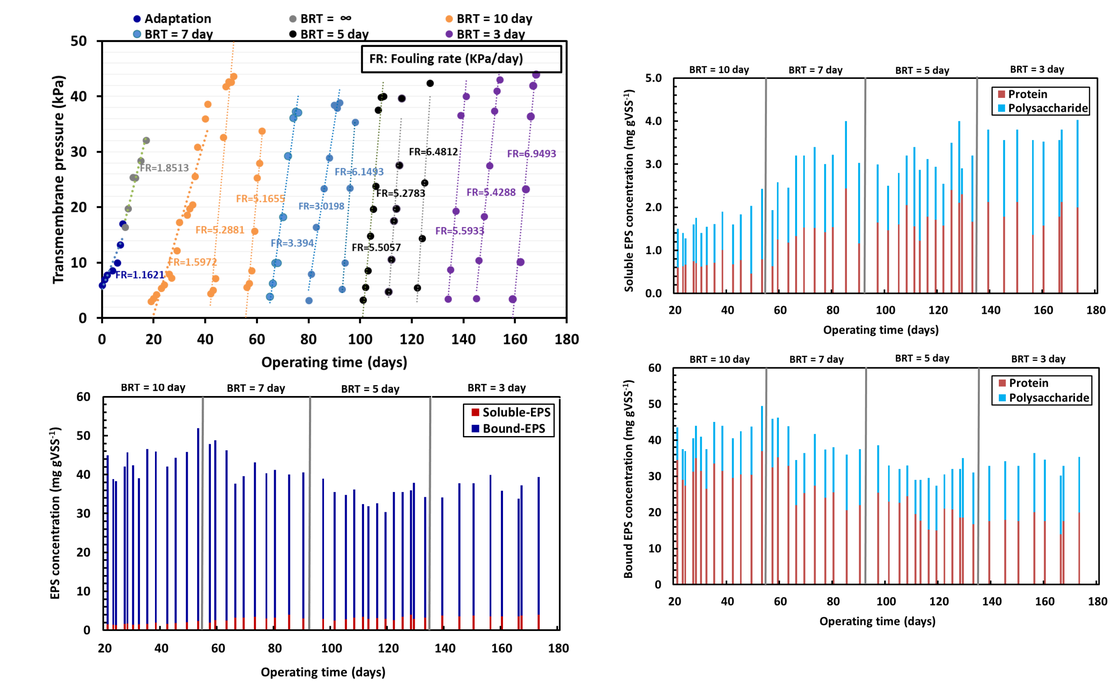
Nutrients removal



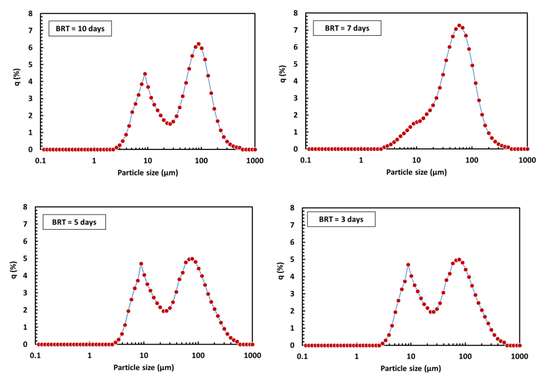
Organic matter removal



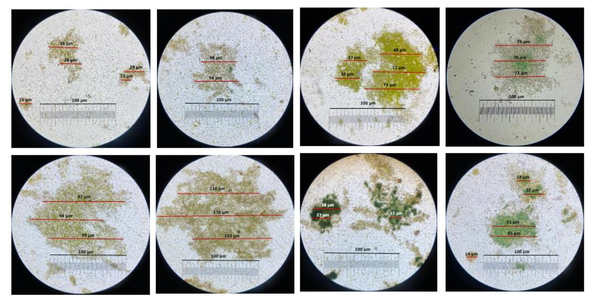
Membrane fouling



Particle size distribution



BRT	10	7	5	3
Floc size_mean (µm)	63.16 ± 8.6	61.19 ± 7.9	57.94 ± 7.4	57.92 ± 6.3



CONCLUSIONS

Biomass retention time has a significant influence on co-culture MPBR of algae-activated sludge symbiotic and membrane fouling. Appropriate BRT causes an increasing population dynamics in co-culture system, which results in nutrient and organic matter removal. The study indicates that the addition of algae into activated sludge has the good potential to directly treat domestic wastewater in MPBR if operated at BRT of 7 days.

Acknowledgement

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