

OPTIMIZING THE MIXING REGIMES OF PROCESS WATERS FOR MICROALGAE PRODUCTION

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BACKGROUND

Both phosphorus and nitrogen are essential elements for algal growth, metabolism, and reproduction. In order to determine the possibility of two Process Waters to provide N- (PW1) or P-source (PW2) for algal cultivation, the growth characteristics of 4 microalgae (2 fresh-water algae, *Chloromonas typhlos* and *Picochlorum eukaryotum*; 2 marine algae, *Nannochloropsis Gaditana* and *Porphyridium purpureum*) in combined PW1 and PW2 solutions were tested.

The ratio of N and P in the growth medium may affect the biomass production and nutrient removal efficiency of microalgae (Wagner et al. 2021), thus, the mixing regime of the PWs was also optimized prior to the scale-up.

OBJECTIVE

Under lab conditions; determine the potentials of combined two process waters (PW1 rich in N, PW2 rich in P) as nutrients source for microalgae growth, optimize their mixing ratio for high biomass accumulation.

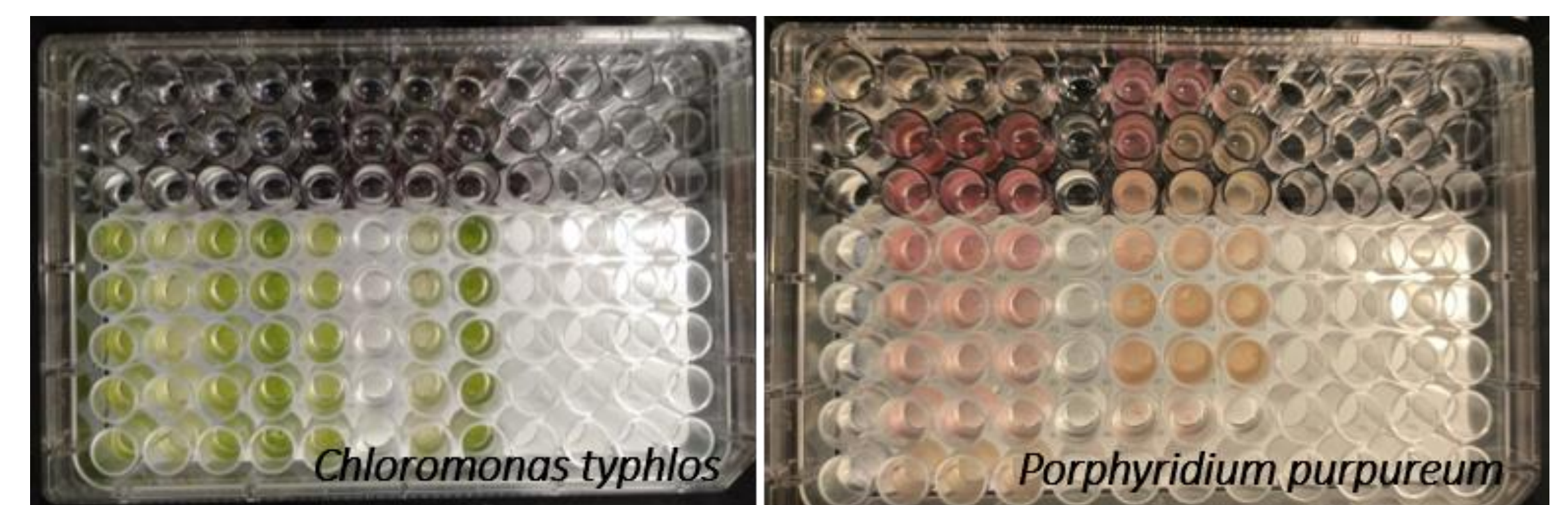
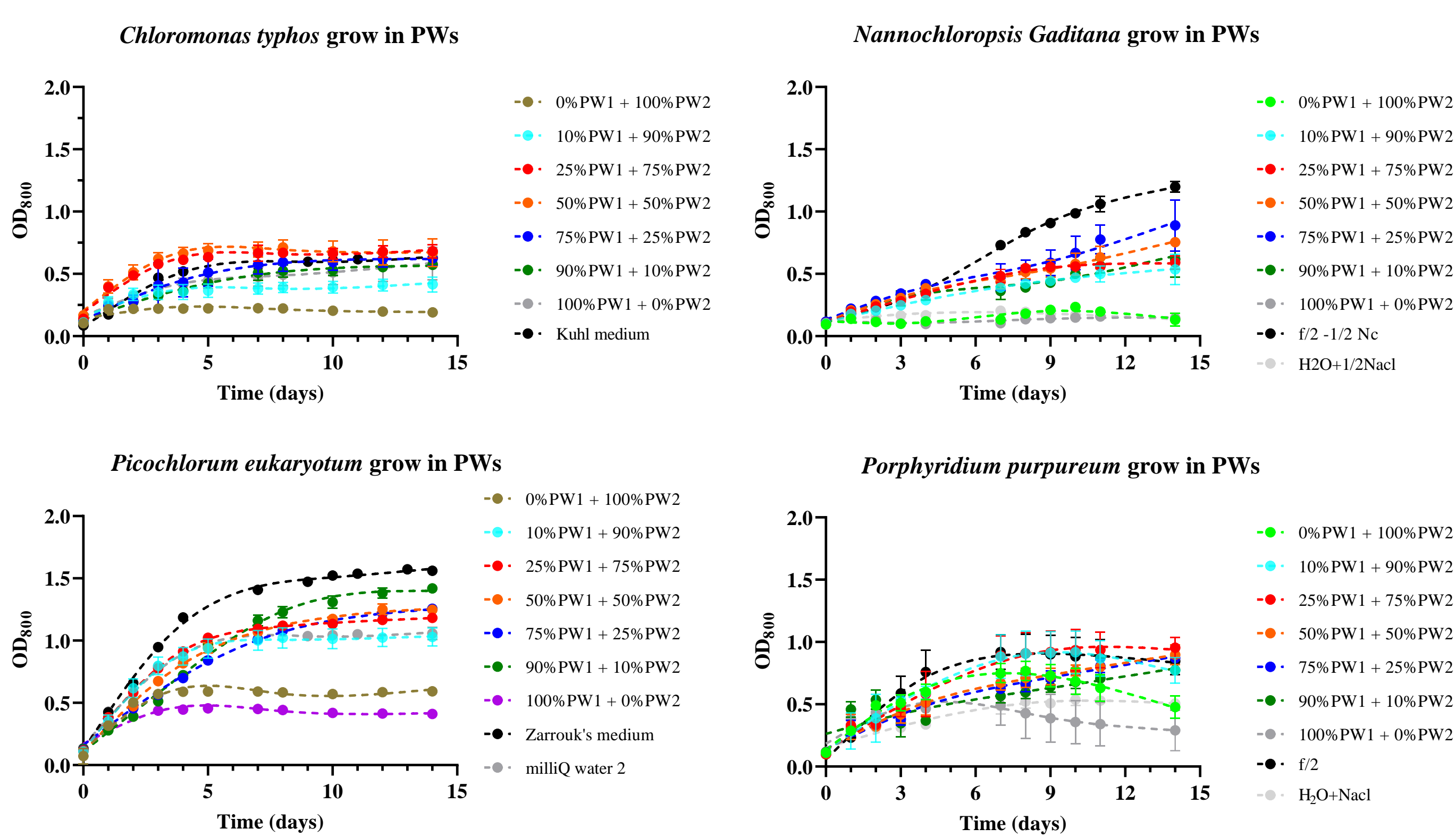
METHODOLOGY

1. Adjusting the PWs combinations (N:P ratio)
2. Characterizing the algal growth traits in microplate growth systems
3. Quantifying the nutrients removal efficiency under the optimal mixing at a larger scale

COMBINATION REGIMES

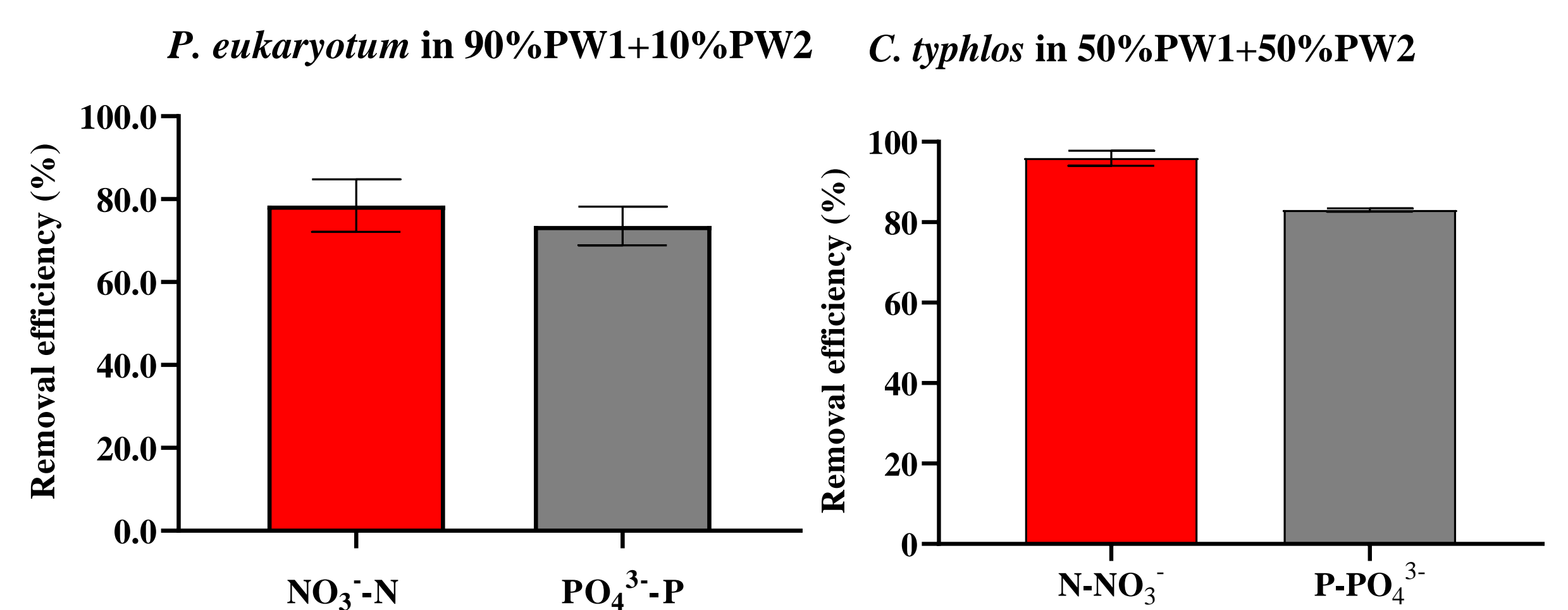
PW1(%):PW2(%)	PW1 (μL)	PW2 (μL)	N-NO ₃ ⁻ (mg L ⁻¹)	P-PO ₄ ³⁻ (mg L ⁻¹)	N:P mass ratio
0:100	0	250	0.00	7.89	-
10:90	25	225	1.95	7.10	0.27
25:75	62.5	187.5	4.87	5.92	0.82
50:50	125	125	9.74	3.95	2.47
75:25	187.5	62.5	14.61	1.97	7.41
90:10	225	25	17.53	0.79	22.22
100:0	250	0	19.48	0.00	-

PW1 = Regeneration water from demineralization plant; up to 50 mg nitrogen/L, mainly present as nitrate; EC = 11-13 mS/cm)
PW2 = P-content 1.8- up to 8 mg/L.; EC = 0,05-4,6 mS/cm.



OPTIMAL COMBINATIONS

Algal strain	Optimal combination	Maximal OD ₈₀₀	Maximal μ (d ⁻¹)
<i>C. typhlos</i>	50%PW1 + 50%PW2	0.71	0.22
<i>P. eukaryotum</i>	90%PW1 + 10%PW2	1.42	0.31
<i>N. Gaditana</i>	75%PW1 + 25%PW2	0.89	0.21
<i>P. purpureum</i>	25%PW1 + 75%PW2	0.95	0.25



CONCLUSIONS

1. The two PWs as N- (PW1)/P-sources (PW2) could be adopted for algal biomass production, and the optimal combination regimes for 4 different microalgae were identified;
2. *P. eukaryotum*, an alga derived from PW1, showed the growth rate using a combination of 90%PW1+10%PW2, indicating that this alga has a higher potential for algae-based biomass production than the other microalgae.
3. The freshwater algae *P. eukaryotum* and *C. typhlos* could be taken as effective bioreagents to remove nutrients from PWs.

