Comparative Study of the Growth Rate and Wastewater Treatment Efficiency of (Caulerpa sertularioides) and (Ulva intestinalis) in Shrimp Pond Effluent

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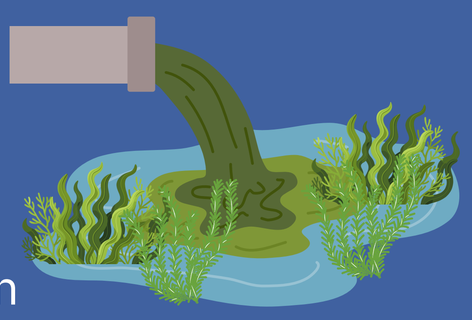


Abstract

This study aimed to compare the growth rate and wastewater treatment efficiency of Caulerpa sertularioides and Ulva intestinalis in shrimp pond wastewater. The experiment was conducted under two water conditions: seawater (control) and shrimp pond wastewater. Each condition consisted of three treatments: C. sertularioides, U. intestinalis, and a mixed culture, with three replicates per treatment over a four-week period. Algae were cultured in 40-liter basins with an initial biomass of 25 g. Water quality parameters, including dissolved oxygen (DO), pH, temperature, and salinity, were monitored, and growth rate was determined by weekly biomass measurements.The results indicated that U. intestinalis exhibited the highest wastewater treatment efficiency, with DO increasing from 6.40±0.00 mg/L to 7.25±0.37 mg/L, significantly higher than C. sertularioides and the mixed culture ($p<0.05$). The pH in the U. intestinalis treatment was 8.0±0.05, within the optimal range. In terms of growth rate, U. intestinalis showed the highest value (54.40%), followed by the mixed culture (51.60%) and C. sertularioides (42.80), with significant differences among treatments ($p<0.05$).These findings demonstrate that U. intestinalis has high potential as an effective and environmentally friendly biological treatment for shrimp pond wastewater.

Keywords: (Caulerpa sertularioides), (Ulva intestinalis), wastewater, shrimp pond

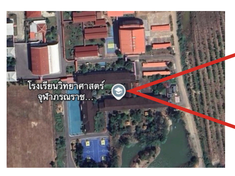
Introduction

Wastewater in shrimp pond

Caulerpa sertularioides

Ulva intestinalis

Study site



Princess Chulabhorn Science High School Trang, located in Bang Rak Subdistrict, Mueang Trang District,Trang Province

Shrimp pond ,located in Palian District, Trang Province

Research Question

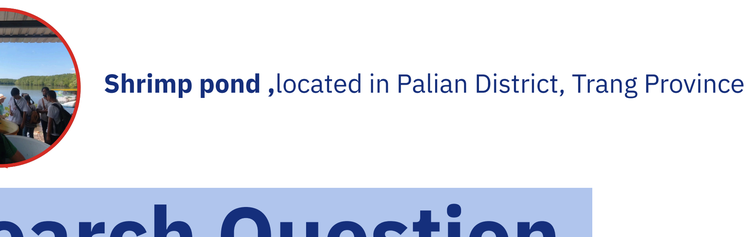
1. Which species, between Feather algae (Caulerpa sertularioides) and Gut weed (Ulva intestinalis), demonstrates higher efficiency in treating shrimp farm wastewater over a one-month period?
2. How does the pollutant reduction efficiency in shrimp farm wastewater correlate with the growth rates of Feather algae (Caulerpa sertularioides) and Gut wee (Ulva intestinalis)?

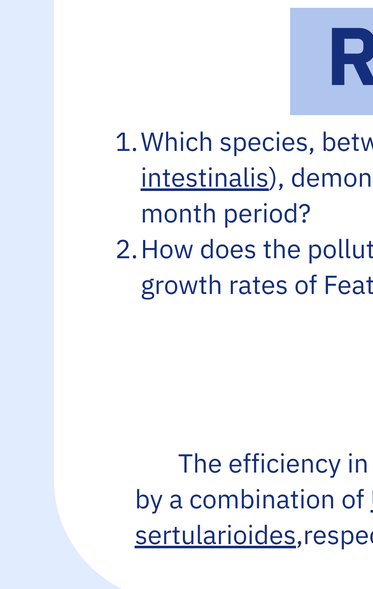
Hypothesis

The efficiency in treating shrimp pond effluent was highest for Ulva intestinalis, followed by a combination of Ulva intestinalis and Caulerpa sertularioides, and Caulerpa sertularioides,respectively.

Method

1 Prepare seawater (control) and effluent

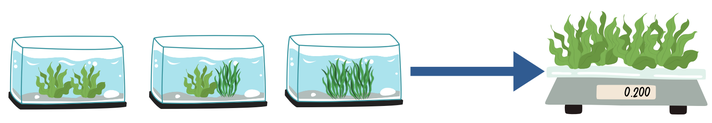




2 Water Quality monitoring

DO, pH, Turbidity,
Nitrogen/Phosphorus

3 Prepare seawater (control) and effluent



Results

Table 1: Average weight, weight gain, and percentage weight increase of *C. sertularioides* and *U. intestinalis* cultivated in control seawater over 4 weeks.

Treatment	Weight			
	Initial Weight (g)	Final Weight (g)	Weight Gain (g)	Weight Increase(%)
C. sertularioides	25±0.00	31.9±0.28	6.9±0.28	27.60
U. intestinalis	25±0.00	33.1±0.36	8.1±0.36	32.40
Polyculture (*C.s+U.i*)	25±0.00	32.5±0.31	7.5±0.31	30.00

Table 2: Average weight, weight gain, and percentage weight increase of *C. sertularioides* and *U. intestinalis* cultivated in shrimp pond effluent over 4 weeks.

Treatment	Weight			
	Initial Weight (g)	Final Weight (g)	Weight Gain (g)	Weight Increase(%)
C. sertularioides	25±0.00	35.7±0.18	10.7±0.18	42.80
U. intestinalis	25±0.00	38.6±0.21	13.6±0.21	54.40
Polyculture (*C.s+U.i*)	25±0.00	37.9±0.20	12.9±0.20	51.60

Table 3: Water quality parameters in control seawater for *C. sertularioides* and *U. intestinalis* cultivation.

Parameters	Pre-experiment	Treatment		
		C. sertularioides	*U. intestinalis*	Polyculture
pH	8.1	7.9±0.07	7.8±0.08	7.7±0.06
Salinity (ppt)	30	31.2±0.30	31.40±0.35	31.30±0.25
DO (mg/L)	6.50	7.1±0.20	7.40±0.25	7.60±0.30
Surface Temp (°C)	30	30.2±0.50	30.3±0.50	30.2±0.45
Sub-surface Temp (°C)	29	29.2±0.40	29.3±0.40	29.2±0.35

Table 4: Water quality parameters in shrimp pond effluent for *C. sertularioides* and *U. intestinalis* cultivation.

Parameters	Pre-experiment	Treatment		
		C. sertularioides	*U. intestinalis*	Polyculture
pH	8	7.9±0.06	8.0±0.05	7.8±0.07
Salinity (ppt)	20	20.1±0.18	20.2±0.16	20.0±0.20
DO (mg/L)	6.40	6.92±0.34	7.25±0.37	7.01±0.35
Surface Temp (°C)	26.4	26.3±0.65	26.4±0.67	26.3±0.66
Sub-surface Temp (°C)	25.7	25.5±0.61	25.6±0.63	25.5±0.62

Discussion and conclusion

This study aimed to compare the growth rate and wastewater treatment efficiency of Caulerpa sertularioides and Ulva intestinalis in shrimp pond wastewater. The experiment was conducted under two water conditions: seawater (control) and shrimp pond wastewater. Each condition consisted of three treatments: C. sertularioides, U. intestinalis, and a mixed culture, with three replicates per treatment over a four-week period. Algae were cultured in 40-liter basins with an initial biomass of 25 g. Water quality parameters, including dissolved oxygen (DO), pH, temperature, and salinity, were monitored, and growth rate was determined by weekly biomass measurements. The results indicated that U. intestinalis exhibited the highest wastewater treatment efficiency, with DO increasing from 6.40±0.00 mg/L to 7.25±0.37 mg/L, significantly higher than C. sertularioides and the mixed culture ($p<0.05$). The pH in the U. intestinalis treatment was 8.0±0.05, within the optimal range. In terms of growth rate, U. intestinalis showed the highest value (54.40%), followed by the mixed culture (51.60%) and C. sertularioides (42.80), with significant differences among treatments ($p<0.05$).From the tartar results, it can be concluded that the properties of U. intestinalis are effective in controlling wastewater from shrimp ponds. The rate of U. intestinalis cultivation, combined with a mixed cultivation method, results in better water-soluble quantities and pH balance. The spirulina algae's adaptability and nutritional capabilities in shrimp pond discharge are effectively demonstrated, and its effectiveness can be verified by following official environmental wastewater management recommendations, leading to further development of formal aquaculture practices.

Citations

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