Effects of salinity, light and nutrients on photosynthesis of sterile *Ulva pertusa*

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Abstract: The effects of salinity, irradiance and nutrients on photosynthetic oxygen production rate of *Ulva pertusa* (sterile type) were studied. The results showed that the photosynthetic rate was influenced by salinity, the oxygen production rate was higher at salinity 20%₀ under irradiance 2710 lx. The maximum oxygen production rate (*Pmax*) , light saturation constant (*Iₛ*) and compensation light intensity (*Iₐ*) were 79.62 O₂/μg/cm²•h, 191.08 μE/m²•s, 10.12 μE/m²•s, respectively. The nutrients (NH₄⁺-N, NO₂⁻-N, PO₄³⁻-P) uptake of *U. pertusa* could be described by Michaelis-Menten model. Ammonia is toxic to *U. pertusa* at concentration above 0.07 mmol/L under lower irradiance (106 lx).

Key words: *Ulva pertusa*; photosynthesis; salinity; irradiance; nutrients
1. Introduction

1.1 Experimental Materials

- PES
- 150 ml incubation vessels
- 10 cm culture vessels
- 18 h incubation at 20 ± 1°C
- Room temperature: 2700 lx, pH 8.0 ~ 8.2

1.2 Experimental Method

- 150 ml incubation vessels
- 0.45 µm filtration
- 27.5°C, pH 8.37

1.3 Control Group

- 250 ml incubation vessels
- 0.5 h incubation

1.4 Experimental Group

- 250 ml incubation vessels
- 150 ml incubation vessels
- 200 ml incubation vessels
- NH₄Cl, NaNO₃
- PES

2. Results and Discussion

2.1 The Effect of Salinity on Photosynthesis Rate

- Photosynthesis rate increases with salinity.
- Maximum photosynthesis rate occurs at 36% salinity.

2.2 The Relationship Between Light Intensity and Photosynthesis Rate

- Photosynthesis rate increases with light intensity.
- Compensation light intensity: 191.08 µE/m²•s

\[
P(I) = \frac{P_m I/I_s}{(1 + I/I_s)}
\]

where:

- \( P_m \) is the maximum photosynthesis rate
- \( I_s \) is the saturation light intensity
- \( a' = P_m/I_s \)

- \( P \) is the photosynthesis rate
- \( h, J_3 \) are constants
- \( c, r \) are correlation coefficients
- \( I_c \) is the light intensity
- \( \alpha' \) is the light absorption coefficient
- \( \beta' \) is the light scattering coefficient
- \( \gamma' \) is the light refraction coefficient
- \( \delta' \) is the light reflection coefficient

Fig. 1. Plot of oxygen production rate vs. salinity of sterile U. pertusa.
不育性孔石莼光合作用的曲线！

它表示光限制条件下的光合作用效率。代表了植物对光的竞争能力，最大光利用系数！

受非酶的光化学反应控制，并与植物的光驯化有关。越大植物对光的竞争能力越强。

荫生植物的特征。一般认为海藻属于荫生植物。为！

曾报道了的光合作用参数。在高营养水平下为。低营养水平下为。

孔石莼吸收氮的动力学曲线见图所示。可用基于酶动力关系的方程描述。

其中为植物对水中营养盐的吸收速率。为最大吸收速率。它反映营养水平和环境限制程度。越大营养水平越低。越小植物对光的竞争能力越强。

为水中营养盐浓度。为半饱和常数。为吸收速率达到最大吸收速率一半时的水中营养物质浓度。它是在一定条件下藻类对某种营养环境适应的结果。越小种群越能在低营养物质浓度下生长。适应能力越强。

在光照温度下。浓度小于时。孔石莼变种吸收的动力学参数为。但是当浓度大于时。吸收率下降。

其原因可能是在较低的光密度下孔石莼对的利用速率较低而表现出的中毒的抑制现象。研究表明。当氨氮浓度超过时对机体是有毒的。光反应终止。但是可能受到光强度的影响。光强越弱越易受氨氮影响。孔石莼变种的值高于。也高于。

对的浓度超过时对机体是有毒的。光反应终止。但是可能受到光强度的影响。光强越弱越易受氨氮影响。孔石莼变种的值高于。也高于。在光密度温度下。孔石莼吸收的动力学参数为。但是当浓度大于时。吸收率下降。这可能是孔石莼对光水平适应的结果。在较低的光照强度下。孔石莼对营养环境的适应能力增强。越能在低营养物质浓度下生长。适应能力越强。

研究结果表明光水平可以改变最大光合作用与生长的氮需要量。光照强度在光合作用中起调节氮的限制作用的作用。植物生长的临界氮浓度与光强度和温度有关。本项研究结果从另一期。刘长发等。万方数据
2.4 Angles prove this.

"Phosphorus absorption kinetics"

Figure 4 shows the phosphorus absorption kinetics of Ulva pertusa under different light intensities and temperatures.

In light intensity EFGH and temperature EH, the phosphorus absorption kinetics of Ulva pertusa parameter M for (20 ± 0.5°C) and N for (2710 lx) are shown.

For light intensity YFH and temperature EH, the phosphorus absorption kinetics of Ulva pertusa parameter P for (370 lx) and Q for (2.102 × 10⁻⁸ mmol/L) are shown.

In light intensity EFGHIJ and temperature K, the phosphorus absorption kinetics of Ulva pertusa parameter R for (3.46 × 10⁻⁴ L/cm²/h) and S for (0.1078 mmol/L) are shown.

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(1) 20% of the... 

(2) Pₚ = 79.62 O₂ pg/cm²/h, Iₛ = 191.08 µE/m²/s, Iₛ = 10.12 µE/m²/s, Iₛ = 1.35 µE/m²/s.

(3) (I = 106 lx) and (I = 11025 lx) Kₚ = 0.0551 mmol/L, Kₚ = 0.1078 mmol/L.

(4) Kₚ = 370 lx 2.102 × 10⁻³ mmol/L, Kₚ = 2710 lx 1.896 × 10⁻³ mmol/L.

References


