碳酸氫鈉濃度對擬球藻生長之影響

陶氏玄絨、余世宗

摘要

本實驗所使用之擬球藻是一株海洋微藻，具有累積油脂的特性。研究目的在找出最適合擬球藻生長的碳酸氫鈉的濃度，以利於大量藻體生質的生產。實驗中的主要變數為培養基中之碳酸氫鈉濃度，其濃度範圍由1~30 g L⁻¹。實驗培養基為經修改之Walne培養基，含有2.5%之NaCl及50 mg L⁻¹之N0₃-N。批次培養的其他條件：初始pH=8, 連續照光強度12000 Lux。實驗結果顯示在碳酸氫鈉濃度為14 g L⁻¹時，擬球藻經8小時批次培養其生質濃度可達0.8 g-dry-wt L⁻¹, 生質生產速率達0.56 g-dry-wt L⁻¹ d⁻¹, 而二氧化碳的固定率為85%，隨培養時間增加，擬球藻生長速率開始下降，主要原因：(1)培養基的pH上升，並超過9.5, (2)培養基離子強度增加。由批次培養的結果，初始碳酸氫鈉濃度與比生長速率的關係，可以Haldane模式表示之。依據此模式可計算出擬球藻最佳碳酸氫鈉生長濃度為15 g L⁻¹。

關鍵詞：擬球藻、碳酸氫鈉、Haldane模式

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參考文獻

accumulation by the marine microalga *Nannochloropsis gaditana*, submitted to two different thermal treatments.


Mitsuhashi, Food for Aquaculture, Food and Agriculture Organization of the United Nations, Rome, Italy. 298p.


Efficiency of phenol biodegradation by planktonic *Pseudomonas pseudoalcaligenes* (a constructed wetland isolate) vs. root and gravel biofilm, *J.*


Kurzbaum E., Kirzhner F., Sela Sh., Zimmels Y., Armon R., (2010),

466.

Koleli, F., Balun, D., (2004), Reduction of CO2 under high pressure and high temperature on Pb-granule electrodes in a fixed-bed reator


Dynamics/Aquaculture, Collaborative Research Support Program, Oregon State University, Corvallis, Oregon, 97331-1641, 125p.

Kojima, T.,


2657.


Hori, Y., Ito, H., Okano, K., Nagasu, K., Sao, S., (2003),

45 – 507.


M.J., Harrison, S. t.L, (2009), Lipid productivity as a key characteristic for choosing algal species for biodiesel production, *J. Appl. Phycol.*, 21, 493 –

27.


Griffiths,


media with different concentrations of sodium bicarbonate and carbon dioxide gas, African J. Biotech., 10(61), 13128-13138.

Feron, P.H.M.,

25.

Feron, P.H.M., M.C., Talukdar, J., Bora, R., Sharma, P., (2011), Studies on the growth behavior of *Chlorella*, *Haematococcus* and *Scenedesmus sp.* in culture


De Pauw, N., & Van Vaerenbergh, E., (1983), Microalgal wastewater treatment

21.


19.

Dauta, A., Devaux, J., Piquemal, F., (1990), Growth rate of four freshwater algae in relation to light and temperature. *Hydrobiologia*, 207,

18.

Colman, B.,

17.

Chu, G.H., Park, J.B., Cheong, M., (2000), Synthesis

16.


15.

Brown, L.M., (1996), Uptake of Carbon Dioxide from Flue Gas by Microalgae, *J. Energy Conversion Management*, 37,

14.

Brown, A.M., (2001),

13.


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