THE POTENTIAL USE OF *PORPHYRIDIUM* BIOMASS FOR VALUABLE NATURAL PRODUCTS

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Goleuke and Oswald (Appl. Microbio. 1962) suggested there was a potential use for *Porphyridium* as a source of valuable chemicals. The work was not followed up until recently, when Gudin et al. (Energy from Biomass, 1980) pointed at the possible use of *Porphyridium* as a source of polysaccharides. Nicols et al. (Phytochem, 1969) pointed out the relatively high quantities of essential fatty acids in *Porphyridium*, and Aren et al. (Biotech. and Bioeng. 1983) reported on the synthesis of prostaglandins from arachidonic acid. Clearly, the economic feasibility for producing *Porphyridium* would have a wider basis if *Porphyridium* would be grown outdoors in monoalgal cultures, yielding a high output.

We report here on preliminary studies designed to evaluate the growth potential of *Porphyridium*. The optimum temperature for *Porphyridium* was found to be ca. 25 °C, at which temperature, cells divide every ten hours. Any deviation from the optimal temperature was associated with a relatively sharp decline in growth rate (Fig. 1).

To evaluate whether this decline indicated that *Porphyridium* was particularly sensitive to fluctuations in temperature, cultures were grown at 25 °C and then incubated for 1 hr at various temperatures above and below this point. Oxygen evolution as an indication for a possible cellular damage was then recorded, and as shown in Fig. 2, no harmful effects could be detected in temperatures as high as 35 °C, a temperature that may be readily reached during the day in many arid zones.

Oxygen evolution was measured as described in Fig. 3, except that the temperature in the measuring cell was changed as stated. The potential yield obtainable under outdoor conditions, depends to a large measure on the light saturation characteristics

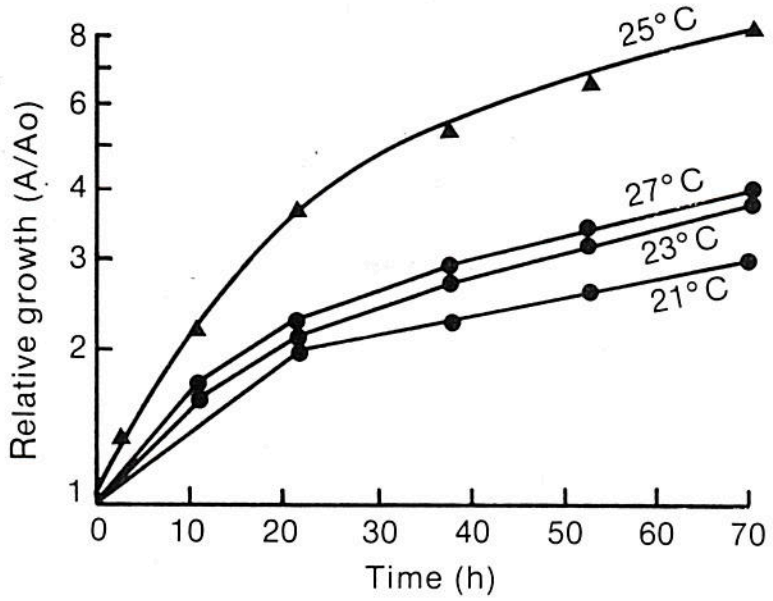

Fig. 1. The effect of temperature on the growth of *Porphyridium* under continuous light (8000Lux) and 1% CO_2.

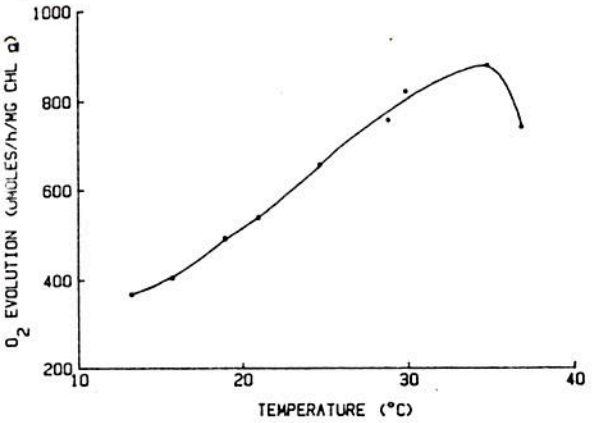

Fig. 2. The effect of the incubation temperature (30 min) on the oxygen evolution of *Porphyridium*.

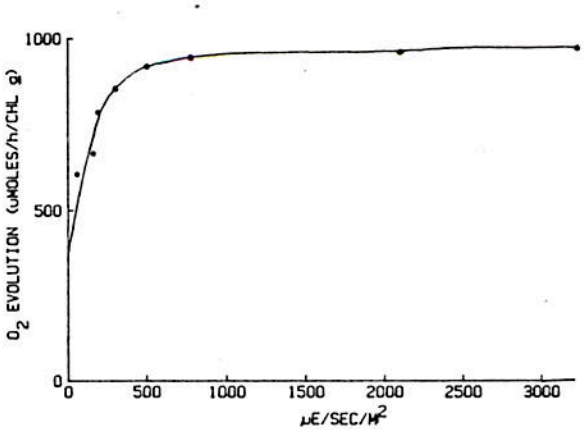

Fig. 3. The effect of light intensities on oxygen evolution in *Porphyridium*.

and the ability of the algal cell to maintain a high photosynthetic activity without being photoinhibited by high radiation intensities. Fig. 3 shows that 0_2 evolution is saturated only at a relatively high value i.e. - ca. 1/3 of the maximal light intensity outdoors.

Oxygen evolution was measured using Klark type oxygen electrode, placed in a thermoregulated cell (25 °C). Light intensities were modified with neutral density filter 0.1 to 3.0 NP. Significantly, in light intensities higher than those presented in full daylight, photosynthetic activity was not inhibited at all. Yet, another parameter which determines the output rate in algal mass cultures is the population density, since the output rate is a function of the population density (x) and the specific growth rate (μ). If cell concentration can be increased with only a small decrease in the specific growth rate, a net increase in the over all productivity will result.

Figure 4 demonstrates the response of photosynthetic activity to an increase in cell density, indicating this activity leveled off only when the culture reaches fairly high densities. This characteristic is further illustrated when plotting the specific activity of oxygen evolution as a function of cell concentration (Fig. 5).

Clearly, an increase of 3 fold cell density is followed by a decrease of only 50% of the total photosynthetic activity, demonstrating the potential of *Porphyridium* for mass culture.

Finally the performance of *Porphyridium* was

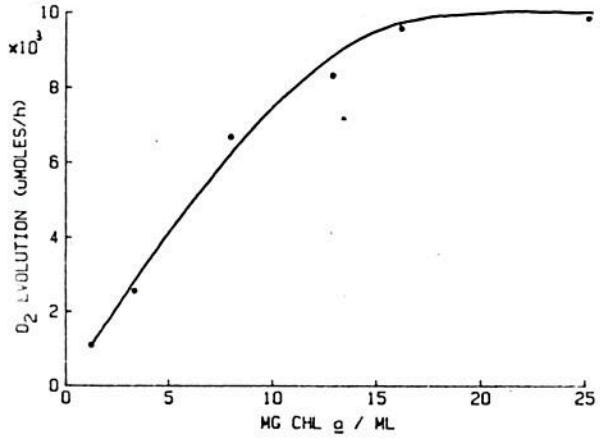

Fig. 4. The effect of the chlorophyll concentration on oxygen evolution (experimental as in Fig. 3).

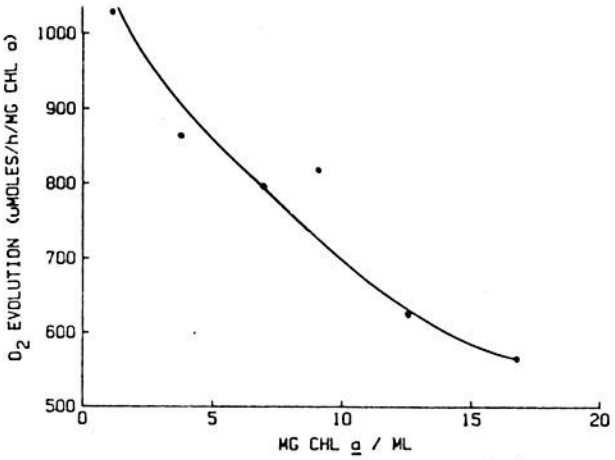

Fig. 5. The specific activity of oxygen evolution as a function of chlorophyll concentration (experimental as in Fig. 3).

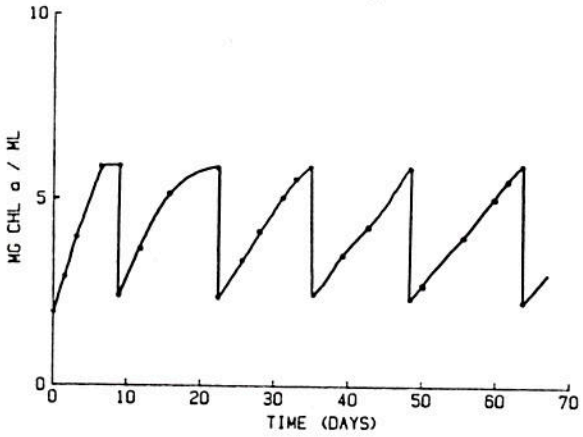

Fig. 6. The growth of *Porphyridium* under outdoor conditions: 150 lit. cultures were grown in a 1m pond, during early Spring. The average maximum daily temperature was 17 °C. pH was maintained at 7.5 ± 0.3 and the average daily output was 10 gr. dry wt·m^{-2} d^{-1}.

tested under outdoor conditions. This species can be successfully grown under outdoor conditions, as a monoalgal culture, being continuously harvested (Fig. 6).