Respiratory metabolism in macroalgae: Using the respiratory electron transport system (ETS) to detect stress and different physiological states.

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Introduction

Metabolism study of green algae (Ulva) communities, inhabiting intertidal pools of Gran Canaria. As an index of metabolic status and stress we used the electron transport system (ETS) to differentiate between different growing conditions in the natural environment. This technique has been successfully used to study many different marine planktonic organisms including bacteria, phytoplankton and zooplankton, but it has not been used to study marine macroalgae.

In this first phase of our research we have developed the methodology for homogenizing Ulva and have used a standard spectrophotometric-based kinetic enzyme assay to describe the impact of nutrient limitation on the metabolic capacity in samples collected in the wild and maintained in controlled culture.

Material and methods

Two homogenization methods

Figure 2: Tissue grinder method. Algal disks were cut with a cork borer and a homogenate was prepared with a teflon-glass tissue grinder using a disintegrated glass microfiber filter (GF/C Circle, 25mm) as the abrasive. We followed the Kenner and Ahmed (1975) ETS methods and modifications of Gómez et al., 1996.

Choice of the homogenization method: The difference in the Specific ETS from the two methods was significant, in addition to its, we decided to use the tissue-grinding method because it was less expensive and easier.

Results

1. Correlation between different biomass proxies. There is a good correlation between Dry Mass, ETS activity and chlorophyll (Fig. 5, 6 & 7)

2. Relative importance of NADH, NADPH and Succinate in determine ETS activity.

3. Time-course of metabolism in aquaria with filter sea water over a week.

4. Variability of the ETS activity, Dry Mass, nutrients and Chlorophyll in three different locations around Gran Canaria.

Conclusions

1. Comparison between ETS means in both homogenization methods demonstrated a significant difference. We used the tissue-grinding method because it was less expensive and easier.

2. There is a good correlation between Dry Mass, ETS activity and Chlorophyll using the optical density at 670 nm as a reference to measure biomass.

3. The contribution of the Succinate, NADH, and NADPH in the ETS activity is 7.8%, 30.7% and 61.5% respectively.

4. The differences in the 8-day ETS time courses for the two areas were statistically different.

5. Bocabarranco has the highest ETS activity and agree with the high levels of nutrients and Taliarte has the smalls level of nutrients coinciding with the smallest ETS activity.

6. Taliarte has the highest Dry Mass, probably due its a different Ulva sp., than the other two places.

References