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Contribution of organic bases to alkalinity in marine microalgae cultures

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We established the carbon fractionation in a closed photobioreactor system for different microalgae species. Between a 6.1 and 10.7% of total carbon outputs in the system was the contribution of dissolved inorganic carbon, depending on the strain and culture conditions.

The cultivation system consisted in a PBR (BIOSTAT®PBR 2S). CO₂ injection was modulated by a pH controller, maintaining a constant pH. Samples were taken daily in fed-batch cultures for measurement of biomass, dissolved organic carbon (DOC), and simultaneous determination of dissolved inorganic carbon (DIC) and total alkalinity (A_T). Organic bases (OB) are defined as the difference between measured A_T and A_T calculated from pH and the total DIC content. Cultures were performed for Nannochloris atomus, Synechococcus sp. and Pleurochrysis pseudoroscoffensis.

A continuous increase of DIC, DOC and A_T for Nannochloris atomus and Synechococcus sp. was found over culture time. However, for Pleurochrysis, a decrease in these concentrations was observed. In all cases, inorganic carbon species were directly related to cellular density in cultures. Furthermore, exits a strong correlation between A_T and DOC.

OB in these high-density cultures have a contribution in the range of 247-634μmol kg⁻¹ to A_T, depending on the cultured species. The maximum of OB was reached at the end of the exponential growth phase, except for Pleurochrysis pseudoroscoffensis. These OB not only have an influence to the quantification of DIC, but influence the intensity of inflection points and shape of peaks in derivative titration curves. For Nannochloris atomus and Synechococcus sp., the intensity of inflection points decreases when DOC and cellular densities increases. However, intensity of inflection points in culture of Pleurochrysis pseudoroscoffensis shows an increase with DOC.

The evaluation of such organic bases in A_T, provides a best quantification of inorganic carbon outputs applied to carbon balances in photobioreactors.

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