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Portable Measurement System for *in situ* Estimation of Oxygen and Carbon Fluxes of Submerged Plants

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Abstract:

The metabolism of submerged plants is commonly characterized by oxygen development. The turnover rates of carbon dioxide and other inorganic carbon species, however, are assessed only at distinct points in time after incubation or calculated through shifts in pH and total alkalinity. A novel three parameter measurement system was developed in order to improve this issue and to gain a better understanding of the metabolism of aquatic plants. It allows the simultaneous and continuous assessment of oxygen concentration, partial pressure of carbon dioxide and pH with optical sensors without the need of taking water samples. Plants or plant parts can be enclosed in a chamber, while the surrounding water is either flushed through or circulated within the system. The method was evaluated in regards to measurement time and possible stress reactions during measurement. Its applicability *in situ* was confirmed with *Elodea nuttallii* and *Ceratophyllum demersum*. The measurement system will enable deeper insights into the metabolism and response of aquatic plants to changing environmental conditions, especially related to carbon fixation.

Keywords: carbon metabolism, *in situ* measurement, photosynthesis, optical sensors, aquatic plants, multiparameter monitoring