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Development of new high-throughput and small-size method for measuring sediment oxygen demand in lakes

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Abstract:

Purpose Sediment oxygen demand (SOD) measurement currently requires a long preparation time and bulky experimental equipment, which represent major obstacles to conducting SOD measurements. We developed a new SOD measurement method that can be easily conducted in a shorter time than the existing laboratory method.

Materials and methods The undisturbed sediment core was transferred into the custom-made small glass vial (inner diameter 12.8 mm, length 125 mm). The SOD sample was incubated in the dark with or without stirring the overlying water inside the vial. The change in DO concentration was measured using a non-contact fluorescent oxygen sensor, and then the SOD was calculated. For comparison and verification of the new method, SOD was also measured using a large undisturbed sediment core (inner diameter 11 cm, length 50 cm).

Results and discussion The SOD measurements using the new method were positively correlated with the SOD measurements using the large undisturbed sediment core, suggesting that the new method is a feasible alternative to the conventional method. In the new method many SOD measurements can be taken from a single sediment core sample. This makes it possible to reduce the uncertainty associated with the highly heterogeneous structure of the sediments, and thus the new method has great advantages in obtaining reliable SOD data.

Conclusions A novel high-throughput method for SOD was developed that shortens sample preparation time and improves convenience of measurement. The new method is expected to contribute substantially to the accumulation of SOD monitoring data and to make great progress in elucidating the dynamics of dissolved oxygen in lakes.

Keywords: sediment oxygen demand, Lake Biwa, dissolved oxygen, sediment, incubation experiment