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A Study of the Diurnal Variation of Dissolved Oxygen (O2) and Its Stable Isotopes Composition (dO-18) in Lake Shihwa, Korea

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The concentration and δ^{18}O of O_2 in seawater is controlled by photosynthesis, respiration, and air-sea gas exchange near the surface. Respiration reduces O_2 concentration and enriches ^{18}O, while photosynthesis brings the opposite result. For this reason, δ^{18}O of O_2 is used a tracer for biological and chemical processes in the lake. To understand the diurnal variation of dissolved oxygen and its stable isotopes, they were measured in Lake Shihwa every 3 hours on July 23-24, 2007. Lake Shihwa, located in the western coast of the Korean peninsula, is an artificial seawater lake, made by the construction of the Shihwa dyke in 1994. Since Lake Shihwa is constrained in physical conditions such as small size of waves and few tides and currents, it can be seen clearly that the biological effect on dissolved oxygen and its isotope variation. The dissolved oxygen concentration varied between 70 $\sim$ 300 μmol/kg, which was between 30 $\sim$ 130 % saturation. It was highest in day time and lowest in night time, showing clear diurnal variation, which shows photosynthesis and respiration pattern. The δ^{18}O value varied between 13.5 $\sim$ 30.5 ‰ (vs. SMOW), and had the opposite diurnal pattern to dissolved oxygen, which implies the diurnal variation of photosynthesis and respiration rates. The concentration of chlorophyll a was 3 $\sim$ 14 μg/l, and had a similar variation pattern to dissolved oxygen. The ratio of photosynthesis (P), respiration (R), and gas exchange (G) is calculated from dissolved oxygen and its isotope, and so on. PoRGy model developed by Venkiteswaran et al. (2007) was applied to quantify the relative ratio of these parameters. The result is P:R:G = 3.8 : 4.6 : 1. The estimated primary production is 5003 mg C/m^2/day.