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# Nutrient and Oxygen Fluxes Across Water-Sediment Interface in the Downstream of the Nakdong River

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## 1. Introduction

The eutrophic state of the inland waters would be determined by the nutrient availability. Nutrient concentration may be primarily maintained by wastewater loadings from the surroundings in the drainage basin. Large amount of organics are trapped within sediment system and a variety of nutrients including ammonia and phosphate are concurrently released into the overlying water. This may be a major source for algal production and sufficient to maintain the eutrophic state after external source was eliminated benthic and pelagic processes are generally very tightly coupled in shallow freshwaters. Sediments play an important role in phosphorus and nitrogen cycles or ecosystem metabolism of freshwaters, acting both as a sink and a source of nutrients.

Nutrient and oxygen fluxes from Sediment-water interface were measured in the laboratory incubation system using materials collected in the downstream of the Nakdong River. Concurrently, Water-column, pore water parameters were determined to clarify the flux patterns. This research have eventually aims to evaluate the contribution to the eutrophication of sediment and to serve to the water quality management in this local area.

## 2. Results

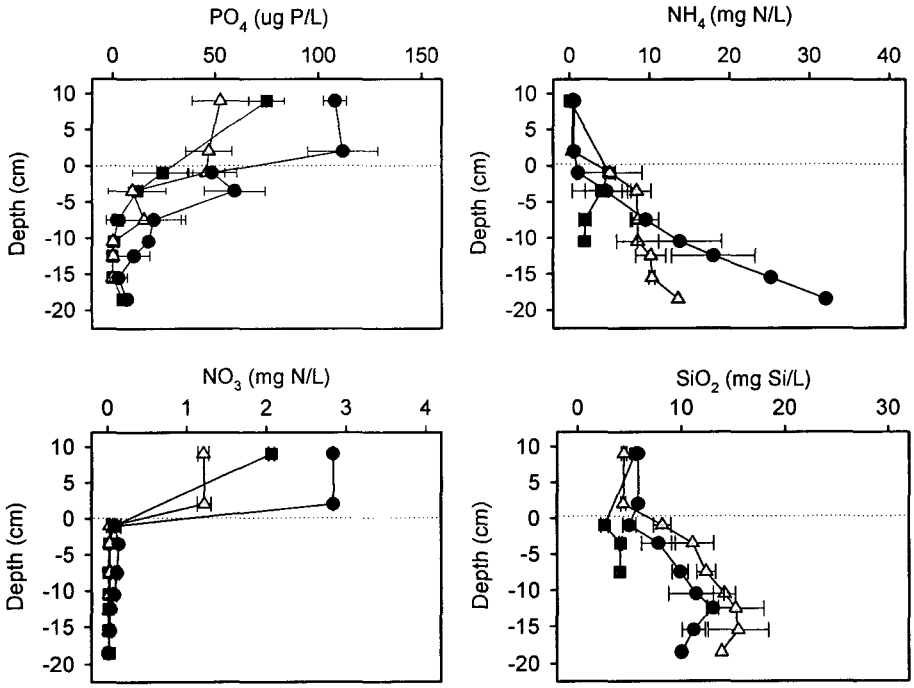
Dissolved oxygen concentration and temperature of the overlying bottom water and surface water in the field were monitored to determine or simulate the nutrient fluxes of sediment in the Nakdong River. Oxygen concentration of the bottom water near sediment have dropped in summer from July to August except the heavy rain season. NH4 and PO4 concurrently increased in this periods. Coupling NH4 and oxygenation of bottom water was strong and PO4 relatively weak.

Spatial and temporal pore water profiles were presented to clarify the variations and compared the nutrient concentration of the overlying water with those in pore water. NH4 and SiO2 concentration of pore water decreased with depth in contrast with PO4 and NO3 concentration. Spatial difference of nutrient concentration were

minimal among three stations. However, NH4 concentration in pore water were variable corresponding the depth and sampling stations.

Unactive phaeopigment comprised of above 80% of total pigment in sediment. Algal pigment concentration were rich in sediment and maintained with significant quantity below 20 cm depth. It is suggested that algal deposition materials were reluctant to decomposition or decay for a long times. Active chlorophyll-a decreased with depth in comparison with unactive phaepigment.

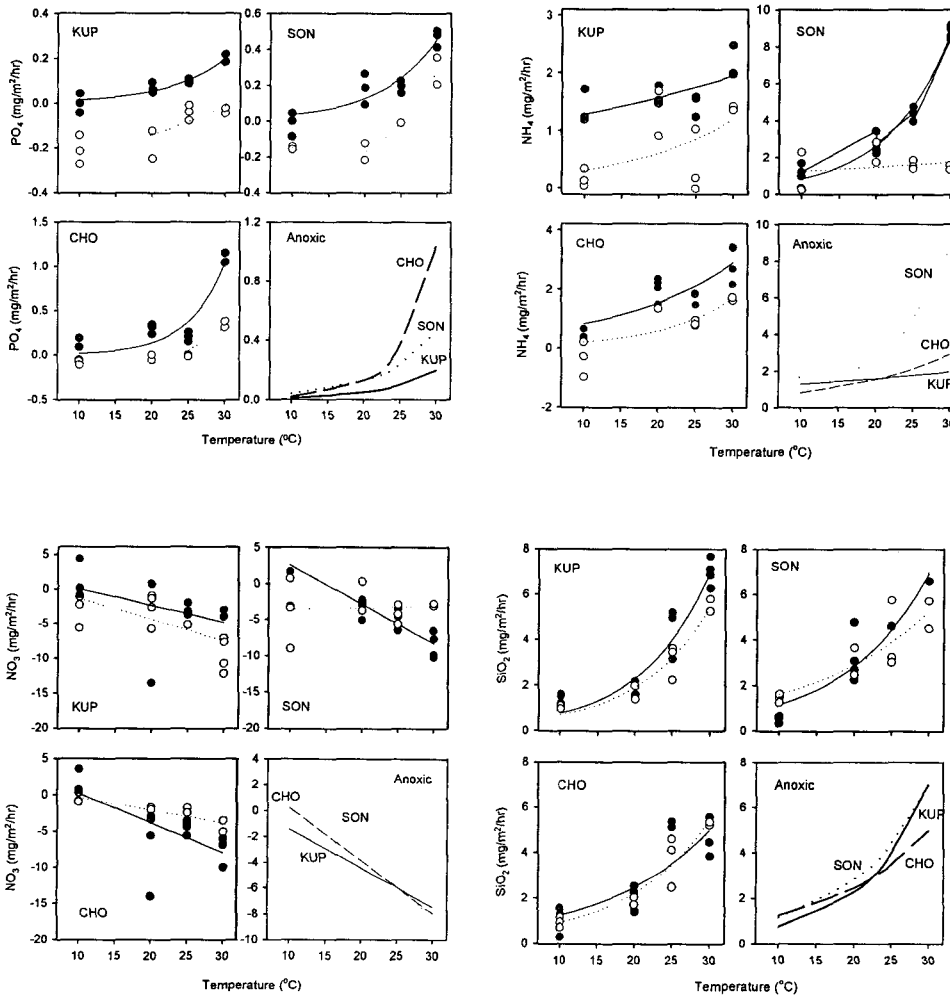
SOD is very important factor to determine the oxygenation of the overlying waters. SOD rates of the Nakdong River increased linearly with temperature in the range of 5-30℃ with almost constant below 10℃ temperature. SOD values at station SON were very variable with temperature gradients.




(Fig. 1) Porewater profiles of ammonium, nitrate, phosphate and silicate concentration in the lower parts of the Nakdong River.

Phosphate and ammonia fluxes showed a logarithmic increase with temperature and were elevated above 20℃. Large fluxes were observed when they were coupled with a hypoxic and high-temperature condition. In the well oxygenated condition, phosphate fluxes were negative or negligible but ammonia fluxes were sustained with

some degree amounts. Nitrate was contrary to phosphate and ammonia flux patterns with reverse absorption into the sediment. Silica showed invariable results about oxygenation level (oxic and hypoxic) and sediment texture. $PO_4$ fluxes at station CHO were more active than other station and $NH_4$ fluxes active at station SON.




(Fig. 2) Nutrient fluxes from 10℃ to 30℃ temperature gradients and two oxygenation conditions (oxic : open circle, Anoxic : close circle) at three sampling stations.

3. Discussion

Large nutrient fluxes were observed when they were coupled with a hypoxic and

high-temperature condition. Sediment pore chemistry of top layer were important for the nutrient mobilization and algae depositions were primary components of the organic material of sediments.

The fluxes were closely correlated with pore water chemistry of sediments and activated by the top sediment layer comprised of labile organic matters or algal detritus. From the in situ survey for bottom water chemistry and laboratory flux experiments, a strong co-variation was found between *Microcystis* outbreak and internal nutrient loading from sediments. It is suggested that the released nutrient from sediment would support the *Microcystis* algal bloom in the downstream of the Naktong River, especially the algal scum occurrence. The ecological implications of the nutrient fluxes were discussed in terms of sources and sinks of nutrients with couplings of algal productions in the Naktong River.

In the near future, we would analyze the interaction between the algal growth and internal loading.

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