

Analysis of river organic pollution in a low precipitation region based on water isotopes and phytoplankton species

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The river organic pollution was studied in the Shin River in Kagawa Prefecture, Japan. In Kagawa Prefecture, where water resources are scarce, the use of water is efficient and a large proportion of water is retained within the river basin. The retention time of water within the river basin becomes longer and algae increase in water areas represented by irrigation ponds. The dynamics of particulate organic matter (POM) in the Shin River was significantly influenced by the natural and artificial hydrological environment in the river basin. The degree of organic pollution in the Shin River was high and most of the organic matter was algae.

$\delta^{18}\text{O}$ of water of the middle and lower reaches of the Shin River was high, and it was found that water subjected to evaporation for a long time in the basin flows in the river. The concentration of organic matter in the Shin River increased along with the rise of $\delta^{18}\text{O}$, and it was found that algae increased in the stay waters in the basin of the middle/lower reaches and flows in the Shin River. It was thought that the irrigation ponds in the basin were the main sources of water and organic matter for the river. This tendency was notable during the non-irrigation season in that the volume of water in the basin decreased. On the other hand, the proportion of algae in the organic matter in the river decreased when there was much precipitation.

During the non-irrigation season, the number of algal cells increased to 2.3×10^4 - 7.8×10^4 cells mL^{-1} in accordance with the increase in the concentration in irrigation ponds, and species composition changed to *Pseudanabaena* sp. as well as irrigation pond. Although *Microcystis* sp. was also dominant in the middle/lower reaches as well as the irrigation ponds during the irrigation season, cell numbers were lower than in October. In addition, the number of algal cells in the river correlated well with $\delta^{18}\text{O}$ in the river water; irrigation pond phytoplankton is supplied to rivers when water flows from irrigation ponds to the river. The influence of irrigation ponds on rivers was found to increase during non-irrigation seasons when irrigation water is scarce and precipitation is low, and so the quantity of river water decreases.

This study found that water supplied from such areas accounted for a large proportion of river water, causing organic pollution of the river by algae. It also found that this trend became stronger during the non-irrigation season when the amount of water in the river basin declined, while the trend became less obvious when precipitation was high. Therefore, to improve the state of organic pollution in the river, the inflow from irrigation ponds must be controlled. It is important to develop a method to reduce the concentration of organic matter in the river by establishing a well-planned water utilization system at a river-basin level with climate conditions and the amount of river water as underlying factors.

Keywords: Water isotopes, Phytoplankton, Organic pollution, River, Kagawa Prefecture