Detection of methylphosphonate and phosphite contained in suspended particles in spring water

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Introduction

Methylphosphonate and phosphite are included in the process of constituting a biological cycle of phosphorus. Bacteria in the ocean is supposed to produce methylphosphonate and phosphite in the cell (Van Mooy et al., 2015). In freshwater system, it is strongly suggested that *Synechococcus* metabolizes methylphosphonate in subsurface layer of Lake Saiko (Yamanashi, Japan) under strong phosphorus limitation. However, methylphosphonate and phosphite in natural are considered to be dissolved in extremely low concentrations. Therefore, no reports existed that have detected these phosphorus compounds in natural waters. New analytical method for the determination of methylphosphonate and phosphite in natural was developed based on ion chromatography, and it was applied to detect them in waters of Lake Biwa (Shiga Japan) and spring nearby shore of Lake Biwa.

Methods

Ion chromatography was used to detect trace methylphosphonate and phosphite. Eluent condition was modified to separate these compounds from other major anions (chloride, nitrate, and sulfate) based on the condition for trace phosphate determination in waters of Lake Biwa (Maruo et al., 2016: Tsuji et al., in press). Water samples were obtained from Lake Biwa (Nov. 4th, 2018) and springs nearshore of Lake Biwa named “Kanabo”, in Maibara city, Shiga Prefectute (Nov. 6th, 2018). To detect methylphosphonate and phosphite in suspended matter, water samples (each 1.5 L) were filtered with a polycarbonate membrane filter (Nuclepore: Whatman, pore size of 0.2 μm). Then, the filter and MQW 25 mL were put in a glass bottle. The glass bottle was allowed to stand for 1 hour in a water bath (60˚C). After that, the extract solution contained was filtered with a disctype membrane filter (IC ACRODISC, Pall: pore size of 0.2 μm) and an all plastic syringe. The filtrate was injected in ion chromatograph system for the determination of methylphosphonate and phosphite included in suspended particles.
Immediately after collecting the sample water, the sample water was also filtered with a capsule filter (SUPOR Acropak 200 Capsule Filter, Pall: pore size 0.8 / 0.2 μm). Filtrate was used to determine methylphosphonate and phosphite dissolved in water.

Results and Discussion

Methylphosphonate (4.8 nM) and phosphite (3.6 nM) were detected in the solution extracted from suspended particles sampled in spring. Additionally, phosphite (23 nM) was detected in the solution extracted from suspended particles sampled in Lake Biwa. In dissolved fraction, both methylphosphate and phosphite were not detected at both sites. These compounds in dissolved fraction might exist in very low concentration and/or immediately utilized by biota. By ion chromatography, detection of methylphosphonate and phosphite contained in organisms sampled from other water systems is expected.

References

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