

## 微生物による OCS 分解時の同位体分別係数の決定 Sulfur isotopic fractionation in carbonyl sulfide during microbial degradation

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Carbonyl sulfide (OCS) is the most abundant gas containing sulfur in the atmosphere, with an average mixing ratio of 500 p.p.t.v. in the troposphere. OCS is suggested as a sulfur source of the stratospheric sulfate aerosols (SSA) which plays an important role for Earth of radiation budget and for ozone depletion. Therefore, OCS should be validated for prediction of climate change, but the global OCS budget is imbalance. It is known that some microorganisms in soil can degrade OCS, but the mechanism and the contribution to the OCS in the air are still uncertain. Isotopic composition and isotopic enrichment factor are used to trace the sources and transformations of atmospheric trace gases. Recently, we developed new method measuring sulfur isotopic composition of OCS using fragmentation ions  $S^+$ , and this method can be used to investigate its sources and sinks in the troposphere. In order to determine sulfur isotopic enrichment factor of OCS during degradation via microorganisms, we performed laboratory incubation experiments using OCS-degrading microorganism.

Bacterium strains, which have OCS degradation activity, were cultured on the slant in a glass tube. After forming the colonies, headspace were replaced with  $N_2/O_2$  (80:20 mixture) and 0.03% of  $CO_2$ , and then OCS were added to the batch. The concentrations of OCS were measured using gas chromatograph equipped with a flame photometric detector, and headspace gases were collected in the helium purged vials for isotope analysis at the same time of concentration measurements. For isotope analysis, we injected the OCS samples to the gas chromatography-isotope ratios mass spectrometry system using  $^{32}S$ ,  $^{33}S$ , and  $^{34}S$  fragment ions. Isotopic enrichment factor is determined by correspond to the Rayleigh isotope fractionation model.

In this experiment, The isotopic compositions ( $^{33}S$  and  $^{34}S$ ) of OCS were increased during degradation of OCS, indicated that reaction for  $OC^{32}S$  was faster than that for  $OC^{33}S$  and  $OC^{34}S$ . On the basis of the concentration of OCS and its isotopic compositions, Rayleigh isotope fractionation model were applied to determine isotopic enrichment factors ( $^{33,34}\epsilon = (^{33,34}S-^{33,34}S_{initial}) / \ln f$ ). It is worth noting that  $^{33}\epsilon$  and  $^{34}\epsilon$  values determined by the experiments which showed no significant deviations from mass-dependent relationship, indicating that OCS degradation via microorganisms is not mass-independent fractionation (MIF) process. This result suggests this reaction is not contributed to the MIF signatures observed in sulfur for sulfate aerosol samples and/or Archaean rock records.

At the presentation, the comparison of  $^{33}\epsilon$  and  $^{34}\epsilon$  values using some strains and the atmospheric implications for the OCS degradation in the present atmosphere are discussed.

キーワード: 硫化カルボニル, 同位体分別係数, 微生物

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