Evaluation of OH reactivity of VOC emitted from the plant

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1. Introduction Volatile organic compounds (VOC) reacts with OH radicals in the atmosphere. Substances generated from their reaction such as O_3 is affecting the various organisms on Earth. VOC emitted from plants (BVOC) has high OH reactivity among the various VOCs. For this reason, it is important to examine the reactivity between BVOC and OH radical. However, many types of BVOCs present in the atmosphere, it is difficult to investigate all of them. In BVOCs, if small amounts of unidentified VOC with a high OH reactivity were present, it has larger impact in the atmosphere than low OH reactivity VOC in same concentration. In a previous study, observed VOC emitted from plants, numbers of VOC that are not identified were detected[1].

In our laboratory, we have developed a method and device (OH radical exposure device) that can determine the reaction rate constant of unidentified VOC by using Gas Chromatograph (GC-FID, FAST GC) system[2]. In this study utilizes the OH radical exposure device and GC system, intended to measure the OH reactive of unidentified VOC that emitted from the plant (cryptomeria japonica).

2. Experiment The device exposed OH radicals that generated by photolysis of H_2O to the sample[2]. Using peak areas without exposed OH and the peak area with exposed OH on the chromatogram to calculate the reaction rate constant of unidentified VOC.

A sample gas was taken from a single plant chamber using the enclosure method. In this case, in order to avoid the change in concentration of VOC, sample was taken by canister. To avoid loss of BVOCs when sampling, direct measurement experiment of the sample gas was also performed.

The samples were analyzed by using a concentrator (UNITY2: Markes international Ltd.) and a GC system (GC-FID, FAST GC). The concentration of unidentified VOC is based on the retention time on the chromatogram. OH reactivity of unidentified VOC was estimated by the concentration with OH reaction rate constant that from the experiment.

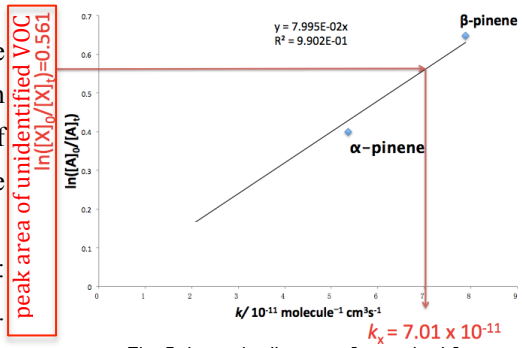

Fig. Schematic diagram of a method for determining the reaction rate constant unidentified VOC from the results of the known

3. Results and discussion Before measuring the plants, used a standard sample which contains 58 kinds of VOCs to examine the validity of the device. The results of comparing the rate constant obtained with reported values showed good agreement. From this result, the method of measuring the reaction rate constant of unidentified VOC of this device is validity.

In the plant experiment(cryptomeria japonica), the same experiment as the examination experiment was performed by using GC-FID and FAST GC. Peak areas of unidentified VOCs were changed when exposed OH radical. Determined the reaction rate constant of the unidentified VOCs by the method shown in Fig., and evaluated the OH reactivity of unidentified VOCs. Reaction rate constant of unidentified VOC was determined that showed in Fig to be 7.01×10^{-11}molecule^{-1}cm^{3}s^{-1},OH reactivity is 0.329 s^{-1}(Contribution ratio 1.52%).Direct measurement experiment wasn`t realized because of the high concentrations of sesquiterpenes. More unidentified VOC has been detected in the measurement of GC-FID than FAST GC.

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