

Development of combined GC system to measure 3 major greenhouse gases automatically.

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It is necessary to reduce emission amount of methane from rice paddy or nitrous oxide from upland field, which is anthropogenic GHG sources, according to Kyoto Protocol.

Gas flux monitoring with high frequency is necessary to evaluate its reduction result with each cultivation manner. Emission inventory of greenhouse gases is made of the obtained flux datum. It was hitherto necessary to measure concentrations of these gases with different analytical systems.

We developed a combined analytical system to be able to measure three greenhouse gases, automatically and simultaneously, with glass vial gas samples.

Measurement method of concentrations of CO₂, CH₄ and N₂O with 1ml of gas sample injection was established with the system. CO₂ was detected with Thermal Conductivity Detector (TCD), CH₄ with Flame Ionization Detector (FID) and N₂O with Electron Capture Detector (ECD), respectively, after gas samples having been separated sufficiently to each gas component through three stages of packed separation columns.

Major features of the system was as follows.

1. We used 2 isothermal ovens, 2 switching valves and 6 separation columns to build the system.
2. Sufficient separation of CO₂ and N₂O was established, even N₂O concentration having been higher than 100ppm in some case.
3. We cut running cost of the system up to half of former system, using helium as common carrier gas.
4. Analytical time for each injection of gas samples took 10 minutes with injection volume of 1mlSTP.
5. The design of the system is capable to apply several GC manufactures' products even though the prototype was made with Shimadzu GC-2014.

It is applicable to use not only in agricultural sciences but also in several kinds of fields at which GHGs flux monitoring is required. It is hoped to assemble flux monitoring datum dramatically thereby reducing analytical time with automated system.

This result was applied with the Japanese Patent Office for a patent.