

Establishing Accuracy of Position-Specific Carbon Isotope Analysis of Propane by GC-Pyrolysis-GC-IRMS

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Abstract

Rationale: Position-Specific (PS) $\delta^{13}\text{C}$ values of propane has proven its ability to provide valuable information on evolution history of natural gases. Two major approaches to measure PS $\delta^{13}\text{C}$ values of propane are quantitative NMR (qNMR) and GC-Py(rolysis)-GC-IRMS. The qNMR has verified measurement accuracy, however, required large sample size and long experimental time limit its applications. The GC-Py-GC-IRMS is more versatile method with small sample size, but its accuracy has not been demonstrated. **Methods:** We measured PS $\delta^{13}\text{C}$ values of propane from nine natural gases, using the both methods and evaluated the accuracy of GC-Py-GC-IRMS method. **Results:** The results show that large carbon isotope fractionations occurred for the both terminal and central carbons within propane during pyrolysis. The isotope fractionations during the pyrolysis are reproducible at optimum conditions, but vary between the two GC-Py-GC-IRMS systems tested, affected by experimental conditions (e.g., pyrolysis temperature, flow rate, and reactor conditions). **Conclusions:** Therefore, it is necessary to evaluate and calibrate each GC-Py-GC-IRMS system using propane gases whose PS $\delta^{13}\text{C}$ values are accurately determined. This study also highlights a need of PS isotope standards for propane and other molecules.

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