Use of compound specific isotope analysis (CSIA) on investigation of soil and groundwater contamination

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In order to consider the effectiveness of CSIA on investigation of soil and groundwater contamination, stable carbon isotope ratio (d<sup>13</sup>C) of each CVOC product that becomes potential source contaminant was measured and the effectiveness of CSIA on investigation of soil and groundwater contamination was examined by investigating the d<sup>13</sup>C value distribution about each CVOC on a soil and groundwater contaminated site.

In this analysis, experimental reagents and the industrial reagents of CVOCs produced in Japan about CVOCs products that become potential source contaminants were collected and the d<sup>13</sup>C values of these products were measured using Elemental Analyzer/Isotope Ratio Mass Spectrometer (EA/IRMS).

As the result of measuring the d<sup>13</sup>C values about four tetrachloroethene (PCE) products and four trichloroethene (TCE) product, d<sup>13</sup>C values of PCE were -37.29 to -29.77 permil and that values of TCE were -33.49 to -27.18 permil. The range of the d<sup>13</sup>C values on PCE products was greater than that on TCE products.

The d<sup>13</sup>C values of CVOC increase by the isotopic fractionation according to the degradation process by the microorganism and hardly change in a physical process such as the dilutions and volatilizing. Therefore, there is a possibility to be able to specify the contaminant source based on the result of CSIA of the contaminant.

On the groundwater investigation in a soil and groundwater contaminated site by PCE as a primary source, The d<sup>13</sup>C values of each CVOC in groundwater were measured by CSIA using Gas Chromatograph/Combustion/Isotope Ratio Mass Spectrometer (GC/CRMS), and two dimension distributions of the d<sup>13</sup>C values in aquifer were estimated about each CVOC. It is reported that the uncertainty of the d<sup>13</sup>C value is within the plus or minus 0.5 permil under the ideal condition, though the problem remains in the reliability of low concentration samples. The groundwater investigations were done in August and December, 2007.

In August, the d<sup>13</sup>C values of PCE in the monitoring well of RW-C which installed into the source area was -27.03 permil and the value in the monitoring well of A-3.0 which is located 40.4 m downstream side of RW-C was -23.10 permil.

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Keywords: soil and groundwater contamination, stable carbon isotope, compound specific isotope analysis, chlorinated volatile organic compound