

Comparison of carbon extraction methods for radiocarbon analysis of DIC in water samples

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The sample preparation is critical for precise ¹⁴C measurements. To establish the reliable method, international comparisons of ¹⁴C analysis for organic and carbonate matters have been conducted several times in the past. Recently, we have initiated a comparison for ¹⁴C measurements of water samples with a wide range of DIC concentrations, including sea water and groundwater, as a part of the Radiocarbon Intercomparison on Chemical Experiments, Water series (RICE-W) program. This program also aimed to investigate sample storage methods such as type of sample bottles and disinfection using a toxic substance (e.g. HgCl₂ solution).

We firstly assessed the carbon extraction methods using eight water standards (seawater, groundwater, hot-spring water, and NaHCO₃ solution). The preparation methods are categorized mainly two types: carbonate precipitation (SrCO₃ or BaCO₃) and CO₂ gas extraction with acid addition (water bubbling or purging of vial-headspace gas). We confirmed that sample preparation method does not effect to ¹⁴C of DIC. It was also noted that the low extraction yield of the precipitation method for sea water was not problematic for ¹⁴C measurements.

We moved forward with evaluating sample storage bottles; polyacrylonitrile (PAN), glass, polypropylene (PP) bottles. ¹⁴C concentration of NaHCO₃ solutions increased from ~0.5pMC to ~1.5 pMC for PAN and glass bottles and to ~10 pMC for PP bottle, respectively, for ~500 days. We conclude that PAN and glass bottles are appropriate for storage. Our program will be continued to assess the influence of a toxic substance to suppress biological activity of part of natural waters during the sample storage. However, it requires special procedures for transport, disposal and experiment. Thus, we prepared six water standards using solution of chemical reagents without a toxic substance. Chemical compositions were arranged to be similar with natural waters having a wide range of ¹⁴C concentration. The next step of the RICE-W program is now getting started using them. We welcome laboratories participating this program. Please contact us to "rice-ml@aist.go.jp".

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