

Amino acids on witness coupons collected from the ISAS/JAXA curation facility for the assessment and quality control of the Hayabusa2 sampling procedure

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The Hayabusa2 spacecraft is visiting a near-Earth carbonaceous type (C-type) asteroid, 162173 Ryugu, and planning to return the pristine samples to the Earth. C-type asteroids are considered to be related with carbonaceous chondrites that are enriched in organic and volatile materials. The one of the scientific goals of Hayabusa2 mission is to understand the origin and evolution of organic materials through interactions with water and minerals in the early solar system [e.g., 1]. Thus, the characterization of organic materials in the returned sample has great importance for this purpose. However, the analysis of small quantities of extraterrestrial organic materials in the returned samples requires a great care to avoid the introduction of terrestrial contaminants and any artifact materials to the pristine samples. Thus, the assessment of the degrees of the terrestrial contaminants to the samples as well as the comprehensive and specific managements to minimize the terrestrial contamination throughout the mission is essential.

The purpose of the study is to investigate the potential terrestrial organic contamination in a clean chamber for the Hayabusa2 returned samples in an Institute of Space and Astronautical Science/Japan Aerospace Exploration Agency (ISAS/JAXA) curation room [2-4]. As the indicator of the terrestrial organic contaminants, we selected amino acids that ubiquitously exist in the terrestrial environments and are also the target molecules in the Hayabusa2 mission. In the study, we used witness coupons made of aluminum foil to collect the contaminants in the clean chamber. The witness coupons were collected at different exposure times, ranging from 1 day to 1 month to examine the accumulation rate of the contaminants. After the collection, amino acids on the witness coupons were extracted in hot water, hydrolysed with HCl, and then converted to *N*-pivaloyl isopropyl (Pv/iPr) ester derivatives for gas chromatographic (GC) analysis [5].

On the witness coupons, eight terrestrially common amino acids (glycine, alanine, valine, leucine, isoleucine, proline, aspartic acid and glutamic acid) were detected and seven of them, except valine due to the under quantification limit, were quantified. Among them, glycine was the most abundant species with the highest concentration of 10 pmol/cm². A time-dependent profile of the four major amino acids (glycine, alanine, aspartic acid and glutamic acid) showed the increasing trend between 1 to 7 days. The average accumulation rates are 1.2 pmol/cm²/day for glycine, 0.6 pmol/cm²/day for alanine, 0.1 pmol/cm²/day for aspartic acid and 0.2 pmol/cm²/day for glutamic acid. The species and the concentrations of amino acids on our witness coupons are similar to those reported by the National Aeronautics and Space Administration/Johnson Space Center (NASA/JSC) OSIRIS-REx team [6]. Thus, the quality control against terrestrial contaminants in ISAS/JAXA curation facility is at the same quantitative level as in their facility. This inter-laboratory evaluation [7] about the terrestrial organic contamination will provide important information for the curation procedure of the Hayabusa2-returned samples.

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Keywords: Amino acid, Hayabusa2, Curation, Witness coupons, Quality control