

BAO001-P04

Room:Convention Hall

Time:May 23 14:00-16:30

Stability of Bioorganic Compounds in the Exposed Facility of the International Space Station

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A wide variety of organic compounds including amino acid precursors have been detected in such extraterrestrial bodies as carbonaceous chondrites and comets. It was suggested that these organics were formed in quite cold environments. We irradiated frozen mixtures of possible constituents of ice mantles of interstellar dust particles including water, methanol and ammonia with high-energy heavy ions from HIMAC, National Institute of Radiological Science, Japan. Amino acid precursors with complex structures were detected whose molecular weights are up to a few thousands. Such complex amino acid precursors are much stronger than free amino acids against radiation. Such organics could have been incorporated in solar system small bodies after the formation of the solar system and delivered to the primitive Earth.

Possible carriers of such organics are meteorites, comets and interplanetary dust particles (IDPs) that were formed from comets and meteorites. It is suggested that IDPs brought much more organics than meteorites and comets. However, nature of organics in IDPs is little known, since they have been collected only in terrestrial biosphere.

We are planning a space experiments named Tanpopo, where IDPs would be collected in aerogel equipped on the Exposure Facility of the International Space Station. In addition, amino acids and their relating compounds would be exposed to space environments to see their possible alteration processes in the interplanetary space. We will report some preliminary results for the preparation of the mission including the capture of amino acid-containing particles at high velocity with ultra-low density aerogel. In addition, we irradiated amino acids (isovaline, etc.), simple precursor of amino acids (5, 5-ethylmethylhydantoin, etc.), and complex precursor of amino acids (CAW: proton irradiation product from a mixture of carbon monoxide, ammonia and water) with high energy heavy ions from HIMAC and with ultraviolet light from a deuterium lamp in order to test the stability of extraterrestrial organic compounds in space.

Keywords: Tanpopo Mission, amino acids, space dusts, cosmic rays, ultraviolet light