# Stability of Organic Compounds in Lunar and Planetary environment

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It is reported that water ice was present on the Moon. It has not been confirmed, but the Moon should have been bombarded by many comets as well as meteorites. Comets and meteorites bring a wide variety of extraterrestrial organic compounds. Thus cometary organics may be stored on the Moon if they have not been destroyed by such energy sources as solar UV and cosmic rays. Here we investigated the stability of amino acids and related compounds in the lunar environments against cosmic radiation.

Samples investigated here were (i) free amino acids, (ii) proteins (bound amino acids), and (iii) simulated interstellar organics containing complex amino acid precursors. Aqueous solutions of these samples were sealed in Pyrex tubes. In some tubes, basalt powder, simulating lunar regolith, were added to the solution. They were irradiated with gamma-rays from a Co-60 source in Research Centre for Nuclear Science and Technology, University of Tokyo. The simulated interstellar compounds were synthesized as follows: A Pyrex glass tube was filled with the following components: 350 Torr of carbon monoxide, 350 Torr of ammonia and 5mL water. The gas mixture was irradiated with protons (3.0 MeV, 2 mC) generated with a van de Graaff accelerator (Tokyo Institute of Technology). After irradiation, the resulting product was recovered as aqueous solution.

An aliquot of each gamma-irradiation product was acid-hydrolyzed with 6 M HCl at 383K for 24 hours. Amino acids in both the hydrolyzed and the unhydrolyzed products were determined with an amino acid analyzer (Shimadzu LC-10A).

When the aqueous solutions were irradiated, the bound amino acids (proteins and complex amino acid precursors) were more stable than free amino acids. The stability increased when regolith was added to the aqueous samples. In the case that water was removed from the samples by freeze-drying, apparent decomposition were not observed up to 30 kGy dosage. It is suggested that amino acids decreased only 5% during 40-100 thousand years if they were kept dry when the annual radiation rate on the moon is 0.3-0.7 cSv. It suggested that organic compounds brought by comets could be stably preserved in the lunar environments if water was sublimated. Thus, cometary organics on the Moon are possible targets for future lunar missions.

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