Amino acids in soils in the vicinity of Syowa Station

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Detection of the frontiers of biosphere is among major themes of astrobiology. Amino acids, constituents of proteins are essential bioorganic compunds, and thus they are good target to detect life in extreme environments. It was shown that amino acids and their D/L ratios had good correlation with microbial activity in core samples. It can be said that Antarctica is under the extremely cold and dry environment on the Earth. Here amino acids in soil samples near the Syowa Base were derermined.

In most studies, amino acids were determined after extraction from the soil samples or meteorites with hot water. However, some of amino acids in mineral matrix may not extracted by such extraction method. We used HF-digestion before amino acid analysis, and compared the results with ordinal extraction method.

Antarctica soil samples were collected near Syowa Base. Reference soils are sampled from YNU campus. Each soil sample was powdered by using a mortar and a pestle. In the extraction method, the sample of ca. 0.1 g was taken in the test tube, 1 mL of Milli-Q water was added, and was sealed, and the mixture was heated at 100 degrees-C for 24 h in a heating block. After heating, the water extract and a wash were filtered through membrane filter, and dried under vacuum. The dried water extracts were hydrolyzed in 6 M HCl at 110 degrees-C for 24 h . Liquid HCl were removed under vacuum. Hydrolyzed samples were desalted by using cation exchange resin (AG50W-X8). Amino acid was measured by cation- exchange HPLC (Shimadzu LC-10A).

In the HF digestion method, each sample of ca. 0.1 g was taken, it put into the Teflon container with 5 MHF-0.1 M HCl. The mixture was heated at 110 degrees-C for 24 h in a heating block. The digested sample was dried by heating on the block heater. The residue was hydrolyzed in 6 M HCl at 110 degrees-C for 24 h, and then desalted by using cation exchange resin (AG50W-X8). Amino acid was measured by the cation-exchange HPLC.

Total amino acids found in Antarctica samples ranged from 60 - 140 nmol/g (HF digestion method). They were about 1/500 of those found in the campus soil samples, but still they are good indicator of bioactivity in Antarctica. The HF digestion method gave about 8 times higher amino acids than the extraction method. It was strongly suggested that the HF digestion method should be used to investigate the frontier of biosphere where amino acid level is quite low.