

## OS4-5

## 宇宙環境曝露に耐性を具備する藍藻について

## Tolerances of cyanobacteria to environments in space

横谷香織

Kaori Tomita-Yokotani

筑波大学, University of Tsukuba

### 1. Introduction

Cyanobacteria are photosynthetic organisms and they reportedly contributed to atmospheric oxidation in ancient Earth. The concept of cyanobacteria as useful organisms in an extraterrestrial environment is interesting for all of researchers in cyanobacteria and space research fields. There are some reports on the use of cyanobacteria in experiments on the International Space Station (ISS). Here, I describe a few useful points about the use of cyanobacteria in experiments in space and some reports of exposure experiments on cyanobacteria in space.

### 2. Why cyanobacteria are suitable for use in extraterrestrial environments.

Some cyanobacteria have high tolerances to the element in terrestrial and extraterrestrial environments<sup>(1)</sup>. The reason why they have such tolerances would be related to their occurrence in ancient Earth. At the time when they first appeared on Earth, atmospheric oxygen rate would be under  $\sim 1000\times$  that of the present atmospheric level (PAL). There were also many extremes in temperature and high ultra violet rays (UV) in the past period. The cyanobacteria are still living under the condition. At least under the Van Allen belt, some cyanobacteria would have functions for living in harsh environments; therefore, the various use of cyanobacteria in extraterrestrial environments such those beyond the Van Allen belt, such as Moon or Mars, needs to be discussed<sup>(1)</sup>.

### 3. Space exposure experiments in cyanobacteria.

A terrestrial cyanobacterium, *Nostoc* sp. HK-01, has a high tolerance to various elements of space environments; temperature, vacuum, heavy metal -ion beam radiation, VUV and UV radiation, and gamma rays<sup>(1)</sup>. This strain was selected an experimental subject for Tanpopo Mission which conducted in the exposure facility(EF) of the ISS module "Kibo", over a three year<sup>(2)</sup>. A species of cyanobacterium, *Chroococidiopsis* sp. has also a high tolerance to space environment<sup>(3)</sup>. Both the cyanobacteria can live in the extraterrestrial environments. I will discuss their tolerances to extraterrestrial environments and how functional substances possibly relate to their tolerances.

### References

- 1) Tomita-Yokotani, K., Kimura, S., Ong, M., Ajioka, R., Igarashi, Y., Fujishiro, H., Katoh, H., Hashimoto, H., Mita, H., Yokobori, S., Ohmori, M. *Eco-Engineering*, **20** (2020) 47-53.
- 2) Kawaguchi, Y., Shibuya, M., Kinoshita, I., Yatabe, J., Narumi, I., Shibata, H., Hayashi, R., Fujiwara, D., Murano, Y., Hashimoto, H., Imai, E., Kodaira, S., Uchihori, Y., Nakawagawa, K., Mita, H., Yokobori, S., Yamagishi, A., (2020) DNA Damage and survival time course of *Deinococcus* cell pellets during 3years of exposure to outer space. *Frontiers in Microbiology*, **11**, 1-11. doi: 10.3389/fmicb.2020.02050
- 3) Billi, D., Verseux, C., Faglierone, C., Napoli, A., Baqué, M., de Vera, J. P., (2019) A desert cyanobacterium under simulated Mars-Like conditions in low Earth orbit: Implications of the habitability of Mars. *Astrobiology*, **19**, 158-159



© 2020 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

