

# INTERPLANETARY MIGRATION OF EUCARYOTIC CELL, SPORE OF *Schizosaccharomyces pombe*. . P2-195

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**Introduction:** The TANPOPO mission to examine possible interplanetary migration of microbes, and organic compounds at the Exposure Facility of Japan Experimental Module (JEM) of the International Space Station (ISS) is progressing [1]. Some microbes are considered as the exposed samples, and spore of *Schizosaccharomyces pombe* (*S.pombe*) is put on the list of the exposed eukaryotic cell because the spore is supposed to be one of the most tolerant organic form toward extreme environments. *S.pombe* (Fig.1) is a kind of yeast isolated originally from beer made in East Africa in 1890s. In this paper, results of preliminary experiments for the exposure are shown.

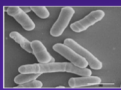


Fig.1 Microscopy of *S.pombe*

## Materials and Methods

**Spores** of *S.pombe* strain JY1 were prepared by the conventional and usual method.

Tolerance toward **heat and vacuum** of *S.pombe* was examined on the assumption of severe temperature change in earth orbit. Under a pressure of 1.0 pascal, the temperature was heated to 80 degrees, and cooled to -80 degrees in 90 minutes.

Tolerance toward **heavy particle irradiation** was examined by argon beam.

Examination of **γ ray irradiation** was performed at JAEA, Japan.

**UV tolerances** were examined using ultraviolet light of wavelength 172 nm (1.01 mW/cm<sup>2</sup>) and 254 nm (1.19 mW/cm<sup>2</sup>).

## Results

Spores of *S.pombe* showed **tolerance for the thermal cycle under the vacuum**. Colony formation rate of the spore in exposure duration of 14 days (224 heat cycles)(95.8 %) was almost same as that of 1 cycle (97.8 %), and estimated at fewer decreasing in long term of one year (Fig. 2).

Even in case of the **heavy particle irradiation** supposed to be extremely severer than that simulated for condition in earth orbit, the spores showed the strong resistance. After the irradiation of 538 Gy, 98.0 % of the spore survived (Fig.3).

As for the **γ ray irradiation** supposed to be extremely severer than the condition in earth orbit (20 Gy), the survival rate (87.8 %) was also high enough to survive after the exposure in space. Nevertheless, stronger irradiation of γ ray (500 Gy) reduced the survival rate (51.5 %) (Fig.4).

On the other hand, **UV** affected the survival rate severely. Although the spore showed tolerance toward UV irradiation of wavelength 172 nm (36.4 kJ/m<sup>2</sup>) to some extent, UV irradiation of wavelength 254 nm (42.8 kJ/m<sup>2</sup>) dramatically reduced the survival rate (1.0 %). This result showed that the spores can't survive after one year under the UV condition in space (Fig.5).

Fig. 2

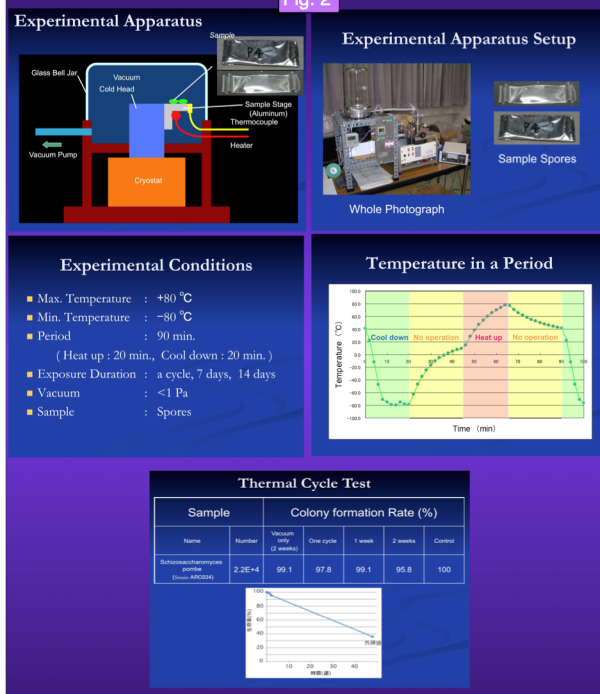


Fig. 3 Heavy Particle Irradiation Test

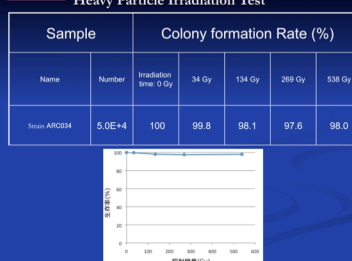


Fig. 4 γ ray irradiation

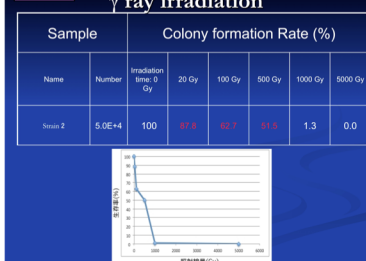
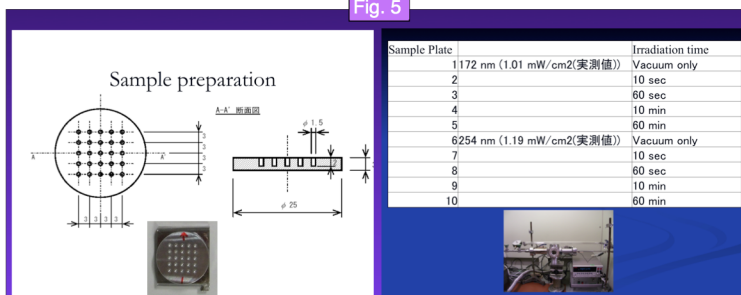
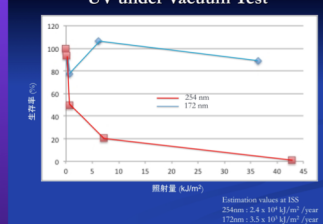


Fig. 5



UV under Vacuum Test



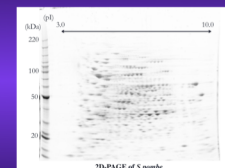
## Discussions

Besides UV irradiations, Spores of *S.pombe* showed tolerances for the survival after the exposure in space for one year. Biologically considering, spores have their roles to bear sufferings and survive. And, these results for spores of *S.pombe* this time showed the possible survival in space and the possibility of interplanetary migration.

Recently, it was found that spores of *S.pombe* are coated by Isp3, one of the unique gene products of *S.pombe*, and peculiar resistance of the spores toward extreme environments is assumed [2]. Results this time support the assumption, and the limit of protection ability of Isp3 is of great interest from the perspective of interplanetary migration.

## Future Plans

After the stress, besides the survival analyses, metabolic test (yield based on sugar and productivity of ethanol), gene expression analyses and proteomics are planned.



## References:

- [1] A. Yamagishi, H. Yano, K. Kobayashi, S. Yokobori, M. Tabata, H. Kawai, M. Yamashita, H. Hashimoto, H. Naraoka and H. Mita, *International Symposium on Space Technology and Science (ISTS) Web Paper Archives*. 2008-k-05 (2008),
- [2] K. Fukunishi K., et al. (2013) *Yeast Genetics Society of Japan*, Abstract #P14.