The culturing of sea grape *Caulerpa lentillifera* by using waste water of kelp grouper and estimating the ability of absorbing elements contained in waste water.

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Recirculating aquaculture system has a problem in the dealing waste water. Recently, it is aimed to combine the treatment of waste water with cultivation of marine algae to prevent environmental pollutions. In this study, kelp grouper and sea grape were used for experimental fish and alga and sea grape were cultivated for 28 days by using kelp grouper's waste water or synthetic medium (PES) in the tanks that had 50 L water volumes. Water temperature and pH were maintained at 28℃ and up to 8.0, respectively. In addition, salinities were set at 32 psu and 36 psu to confirm the tolerance of salinity, and photoperiod was controlled at 12 h light: 12 h dark in the all treatments. Sea grape cultured in 32 psu with waste water showed the highest specific growth rate (SGR) that is 7.16, similar to it of sea grape cultured with synthetic medium in 32 psu. While, the sea grape cultured in 36 psu with PES showed the lowest SGR that is 5.27. In addition, elements contained waste water, solid waste, foam waste and sea grapes were analyzed by using inductively coupled plasma atomic emission spectroscopy and total nitrogen analyzer. These results showed that the elements contained in the kelp grouper waste (i.e., waste water, solid waste and foam waste) are enough to grow up sea grape except manganese, copper and boron. Thus, these elements are needed to add to culturing water and their quantities are 189.8 µg, 99.4 µg and 157.5 µg respectively on 1 L basis.

Keywords: Kelp grouper, Sea grape, Recirculating fish culture system, Utilization of waste water, Culturing waste, Water quality

Growth of a terrestrial cyanobacterium, *Nostoc* sp. HK-01, in the poor nutrient mediums similar to the environment on Mars

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A terrestrial cyanobacterium, *Nostoc* sp. HK-01, has several abilities; photosynthesis, nitrogen fixation, usefulness as food, and space environmental tolerances. HK-01 may be utilized for bio-chemical circulation in closed bio-ecosystems, including Mars. When we introduce HK-01 to the environment on Mars, we need to define the growth of HK-01 in an environment which lacks nutrition. In this study, we tested whether akinetes (dormant cells) of HK-01 grow using components of their dead cells or/and Martian regolith simulant. We will discuss the possibility that colonies of HK-01 can be grown in an environment such as Mars.

Keywords: closed bio-ecosystems, Martian regolith simulant, terrestrial cyanobacterium

Searching for water stress proteins in terrestrial cyanobacteria, *Nostoc* sp. HK-01

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Nostoc sp. HK-01 is one of terrestrial cyanobacterium having a tolerance to desiccation stress and it has several ability, photosynthesis, nitrogen fixation and usefulness as a food, it is thought that it can be used for bio-chemical circulation in a closed ecosystem, including space.
In this study, we searched for the genes that would play an important role in the desiccation stress response. Initially, to investigate expression changes of the proteins in Nostoc sp. HK-01 cells, proteins of the desiccated cells were analyzed by SDS-polyacrylamide gel electrophoresis. The cells were dried in a desiccator. In the course of desiccation of the cells, the expression level of some proteins was increased.

Keywords: cyanobacteria, desiccation tolerance, stress protein

Evaluation of food functions of a terrestrial cyanobacterium, *Nostoc* sp. HK-01 in closed bio-ecosystems

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We study life-support in closed bio-ecosystems to provide food and oxygen for habitation in severe environments. We propose several species of organisms as candidate species. A terrestrial cyanobacterium, *Nostoc* sp. HK-01 has several unique abilities, such as photosynthesis, nitrogen fixation and tolerance to an extraterrestrial environment. Here, we propose to utilize *Nostoc* sp. HK-01 as a food resource in extraterrestrial environments such as Mars. We indicate that *Nostoc* sp. HK-01 has food functions as primary(nutritional), secondary(sensory), tertiary(physiological). We will discuss the utilization as a food resource of *Nostoc* sp. HK-01 in closed bio-ecosystems. Our results may contribute to the supply of food resources under severe conditions for life-support in closed bio-ecosystems.

Keywords: closed bio-ecosystems, cyanobacteria, food resource, Nostoc sp.HK-01, food functions

