Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

HCG34-P01 Room:Convention Hall Time:May 19 18:15-19:30

Developing the Simulator of Material Circulation Control System, SICLE

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More than 50 years have passed since the first human space flight had realized. Since then, a variety of Environmental Control and Life Support Systems (ECLSS) have been developed to sustain human life in space. Material circulation is the primary objective to create ECLSS and it can be achieved by utilizing plants and chemical/physical devices recycling waste materials. In the International Space Station, now, oxygen and water are recycled and the recycling system makes us possible to stay in space for a long period of time. In the future, research and development of more advanced ECLSS will be needed for construction of lunar base and manned space exploration to Mars.

As ECLSS becomes larger and more complicated, it is more important to control material circulation of the entire system. In order to support such researches, we are developing an ECLSS simulator called SImulator for Closed Life and Ecology (SICLE), aiming to take the current research streams into account, as well as to make a useful tool satisfying a wide range of research themes including optimum control of material circulation. We concern that the simulator is desired to have following two features.

- User-friendly interface with intuitive operation
- High versatility to apply new control models and functionalities

Users can visually design and follow their own systems with simple block diagrams, which contribute to easier usability. In addition, by implementing XML file template, the simulator allows users to create new types of equipment. Moreover, it is able to cover various devices' behaviors.

For future improvement, we will make it possible to incorporate new theories of control optimization method, and examine the performance of this simulator comparing real data of existing ECLSS environment.

Keywords: ECLSS,, CELSS, Material Circulation Control, Life Support System, Simulator

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A method using a biosensor for measurement of bacterial growth in a closed-ecosystem

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In recent years, piezoelectric quartz systems have been used in analytical chemistry because their oscillating frequencies are sensitive and have wide range. A quartz crystal microbalance (QCM), which is a nanogram mass sensing device, has been applied to determine gases, ions, and some biomolecule. These studies are based on the fact that the resonant frequency change of the quartz crystal corresponds to mass change on the crystal surface.

We have developed a method for simple and precise cell count using QCM. In this study, we measured bacterial growth by the QCM combined an flow cell in real time. This method will also be variable to analyze the behavior of cells in the closed-ecosystem.

Keywords: Biosensor, Microbalance, Microorganism

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The function of high tempreture tolerance in cyanobacteria, Nostoc sp. HK-01

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The function of dried colony of a cyanobacteria, Nostoc sp.HK-01, with high temperature tolerance was investigated.

Cyanobacteria, phototropic bacteria, have several high contribution on the closed bio-eco-engineering. The cells in the colony was viable under the environment of 100 oC during 10 hours. It was suggested that the function of high temperature tolerance was related to sugar polymer containing many components.

Keywords: cyanobacteria, high tempreture tolerance, Nostoc sp.

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Utilization of functional woody plant line, Japanese cherry tree, in closed bio-ecosystem on the biological activity.

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Trees have high contribution under the severe closed bio-ecosystems. Trees produce excess oxygen, woody materials for the living cabin, and provide a biomass by cultivating crops and other species of organisms. Our dwelling would be built using these materials in the closed-bio-ecosystems. It is possible that we use them as some herbal medicine or foods from the products of tree. In the study for life-support related to closed-ecosystem, it is one of important matter that the detail data in the given environment is examined. Here, we show the results of one of our studies using Japanese cherry tree as material tree. We will discuss the changes of the function in the materials from the tree.