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Small-package Life Support Ecological System for Long-lasting Space Experiment: Feasibility Studies on the Application to Fish Experiments

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Abstract

In 2003, the experiment was operated aboard the space shuttle Columbia, STS-107 for the study on the development and swimming behavior of Medaka fry under microgravity in space¹⁾. In this experiment a closed ecological system was prepared based on the ABS, Autonomous Biological System²⁻³⁾ and used to maintain the life of Medaka eggs and hatched fry during flight mission (16 days). It provided mechanically quiet environment and was very useful to study the behavior of animals under microgravity. In order to expand the utility of the closed ecological system for space experiment, we conducted studies aiming at designing a closed ecological system to maintain a long-term life support for the least killifish *Heterandria formosa*. We report the preliminary results of the study, focusing on the effect of biological as well as chemical factors involved in the ecological system. According to the evaluation of the life-support performance in terms of the survival, growth, and activity of the fish over 30-day periods, we concluded that the basic design verified in this study would be useful for long-term life support systems for fish. Microgravity environment in space has been recently utilized as the field to investigate the gravitational biology. Small-packaged life support systems would be applicable to biological transport through space.