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SPACE LIFE SCIENCES SYMPOSIUM (A1)
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ALGAL RESEARCH IN SPACE

Abstract

With the continued expansion of human presence into space, typical mission durations will routinely exceed six months and extend to distances beyond the moon. As such, sending periodic resupply vehicles, as currently provided to the International Space Station, will no longer be feasible. Instead, self-sustaining life support systems that recycle their waste products will become increasingly necessary, especially for planetary bases. The idea of bioregenerative life support systems using algal photobioreactors has been discussed since the beginning of the space age. In order to evaluate how such a system could be implemented, a variety of space flight studies aimed at characterizing the potential for using algae in air revitalization, water recycling, food production, and radiation shielding applications have been conducted over the years. Also, given the recent growing interest in algal research for regenerative fuel production, food supplements, and cosmetics, several algal strains are already well documented from related terrestrial experiments. This paper reviews past algal experiments flown in space from 1960 to today. Experimental methods and results from 46 investigations utilizing either green algae or cyanobacteria are analyzed and categorized through parameters, including size, species and duration. The collected data is used to build a matrix that allows an easy comparison between those experiments, which is important for future life support system requirement definition and design. Similarities between experiment results are emphasized. Common problems and shortcomings are summarized and analyzed in terms of potential solutions. Finally, key research gaps, which must be closed before developing a functional life support system, are identified.