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Photobioreactor: A better life support system for astronauts

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Humans have been exploring space for a long time now. The term space is fascinating in itself but not many know the challenges that it brings with it. Surviving in an environment different from earth poses many threats too. Some of the challenges that astronauts experience are lack of oxygen, water, food, and health-related problems. But to advance space exploration, space biotechnology is applying many tools of modern biology that help in overcoming the challenges faced by astronauts. The photobioreactor (PBR), an algae-powered bioreactor is one of the recent inventions that offer better life support systems for space travel. The potential of algae in air revitalisation, water recycling, food production, and radiation shielding applications has been studied by researchers to design algal photobioreactor as bioregenerative life support system. This system utilises the carbon dioxide exhaled by the astronauts to produce oxygen and edible biomass, which is facilitated by algae. PBR works in conjugation with another air recycling system called the advanced closed-loop system (ACLS), which extracts methane and water from carbon dioxide. Water extracted in this way could be used for any other purpose or left for recycling. The remaining carbon dioxide in spacecraft is used by PBR to produce oxygen and edible nutritional biomass that can act as a food supplement. PBR also utilises a light source to grow phototropic microorganisms, which generate edible biomass. Studies have revealed that microalgae species, Chlorella vulgaris used in PBR consumes CO2 and produces O2 and edible protein-rich biomass by photosynthesis that can cover up to 30% of the human diet. Therefore, this system has the ability to sustain astronauts without cargo resupply missions from earth particularly for future long-duration space missions.

Keywords: Space, Photobioreactor, Algae, Advanced closed-loop system, Space life support systems, Astronauts

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