Research Thrust-3: Additive Manufacturing for ISRU

Sub-project 2: Aquaponics with ethylene scavengers to support human life off Earth

Statement of R&D Problem

• As spaceflight missions grow longer and more complex, the challenges of storing enough food for the astronauts grows as well. Eventually the space and resources needed to store food on spacecraft will become too large, and new solutions must be investigated to supply ever growing food demand to support life off earth for extended periods. Aquaponic systems can overcome challenges of traditional food production systems in closed limited space to support life off Earth by efficiently recycling water and providing a consistent supply of protein and other food ingredients eliminating the need for food storage.

Statement of R&D Problem

- Thus, aquaponic systems can not only provide food during flight, but can also help to sustain colonies on other planets such as Mars. An inflatable greenhouse, that can be easily built on Mars or the Moon, can rely on solar photosynthetically active radiation (PAR) for the plant growth. There are major research gap lies in controlling ethylene in closed spaces specially with context to aquaponics. Recycling of fish and plant waste, ammonia conversion to nitrate for plant uptake, ethylene toxicity, effects of high CO_2 etc. in closed aquaponics systems are minimally addressed. Moreover, the types of fish that can sustain growth at low gravity have been minimally investigated in aquaponics systems.