NASA SBIR/STTR Technologies

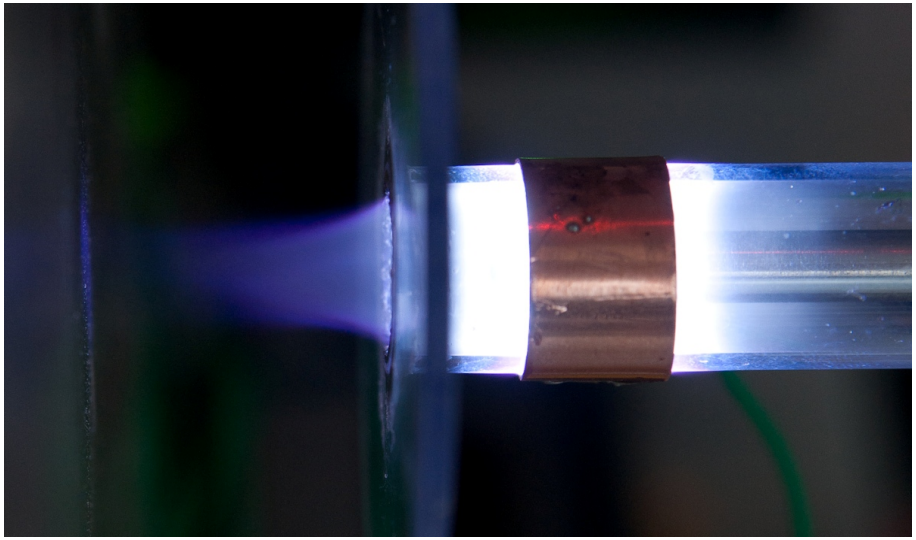
X14.02-9524 - Non-Thermal Sanitation By Atmospheric Pressure Plasma

PI: Ross Remiker

Orbital Technologies Corporation - Madison, WI

Identification and Significance of Innovation

This Non-Thermal Sanitation by Atmospheric Pressure Plasma (NTSAPP) technology uses non-thermal, atmospheric pressure plasma, which is high-energy electrical discharge at ambient temperature and pressure. Plasmas are composed of electrons, positive/negative ions, neutrons, and other neutral species. Plasma processes are highly effective in promoting oxidation, enhancing molecular dissociation, and producing free radicals, UV radiation, and shock waves to enhance chemical reactions and destroy microbial cells. NTSAPP uses non-thermal, atmospheric pressure plasma to sanitize fresh fruits and vegetables without the use of consumable chemicals and without significantly raising the temperature of the food; so food taste and quality are not affected. The technology can function in reduced gravity and pressure environments, and is efficient in terms of mass, power, volume, waste, and resource use. NTSAPP technology could also be used to sanitize working surfaces and instruments.



Estimated TRL at beginning and end of contract: (Begin: 4 End: 6)

Technical Objectives and Work Plan

The primary objective of the NTSAPP Phase 2 is to develop and evaluate a fully operational plasma reaction chamber prototype for sanitizing fresh food on long-duration space missions. This effort will build upon knowledge gained and lessons learned from the Phase 1 and other ORBITEC plasma development projects. Completion of the following tasks will result in a fully functional prototype and performance test results to be delivered at the completion of the contract.

- Design next-generation benchtop prototype power supply and controller.
- Design next-generation benchtop prototype plasma jet reactor.
- Fabricate and optimize performance of benchtop prototype power supply/controller and plasma jet reactor. This includes measuring plasma density and reactive-ion-species produced with different experimental and operational input variables.
- Design plasma reaction chamber that incorporates multiple plasma jet reactors and power supply/controllers into an integrated package that meets EXPRESS Rack single locker interface, EMI, and safety requirements.
- Fabricate and optimize performance of integrated plasma reaction chamber.
- Evaluate antimicrobial performance of plasma chamber with a number of different fruits and vegetables, and with a number of different inoculums.
- Complete food safety analysis, including development of a HACCP program for growing and preparing fresh food in space.
- Evaluate effect of plasma treatment on food quality.

NASA Applications

NTSAPP can be used to sanitize fresh foods grown in space and to sanitize raw ingredients, either produced on orbit or transported to space raw. Non-thermal plasma does not raise the temperature of the treated food significantly; so it has minimal effect on food quality. Non-thermal plasma can replace chemical disinfectants in most applications. The technology has low system mass, consumable mass, and power consumption, and is insensitive to reduced cabin pressure and reduced gravity.

Non-NASA Applications

Non-thermal plasma sanitation technology can reduce the number of cases of food-borne illness due to contaminations by sanitizing food at the point of use, such as at a restaurant or a food processing facility. This technology can be used in place of chlorinated water, which can leave a residue and is not entirely effective, and irradiation, which generally has a poor public perception.

Firm Contacts

Ross Remiker
Orbital Technologies Corporation
Space Center, 1212 Fourier Drive
Madison, WI, 53717-1961
PHONE: (608) 827-5000
FAX: (608) 827-5050