Project Introduction

The objective of this work is to quantify the reduction of biofilm formation in a water distribution system resulting from an organoselenium surface coating on stainless steel pipes and fittings. Differentiated from currently marketed antimicrobials, selenium, is permanent, catalytic and does not leach into the environment. This will reduce the problems associated with biofilm growth and fouling in the water recycling system. Thus, we could draw quantifiable conclusions about the system performance for long term missions in complex water treatment systems containing organoselenium coatings and provide the data to NASA engineers who may then make an assessment as to whether or not this is a viable technology to reduce the need for biocides, reduce ESM, and potentially impact NASA by decreasing the chemical burden for treatment which would decrease payload mass and downtime affecting astronauts’ efficiency. The project will quantify the impact of an organoselenium surface coating within stainless steel pipes and fittings on product water quality and service life of the pipes and fittings over time. Objective 1. Optimize the attachment of organoselenium to the surface of stainless steel to achieve the greatest and most reliable reduction in biofilm growth and formation. Objective 2. Assess performance of the organoselenium surface treatment of stainless steel pipes and fittings in a bench-scale system over varied periods of time (i.e. 1 week, 1 month, 3 months) against biofilm accumulation and service capacity.

Anticipated Benefits

Potential NASA Commercial Applications: If successful, the use of organoselenium coatings to prevent bacterial colonization and/or biofouling may be applied to potable and wastewater piping infrastructure and treatment systems. Additionally, these organoselenium compounds may be applied to any hard surface to achieve a permanently efficacious environment to combat the growth and proliferation of bacteria. These surface coatings may also be applied to medical instruments, devices and wound care products to combat infection. While this application focuses on a surface coating, the same organoselenium compounds may be modified to be applied as a polymer additive suitable for numerous plastic component applications which require protection against bacteria and biofilm colonization.
Primary U.S. Work Locations and Key Partners

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ Johnson Space Center (JSC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Houston, TX</td>
</tr>
<tr>
<td>Selenium, Ltd.</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td>Austin, TX</td>
</tr>
</tbody>
</table>

Organizational Responsibility

Responsible Mission Directorate: 
Space Technology Mission Directorate (STMD)

Lead Center / Facility: 
Johnson Space Center (JSC)

Responsible Program: 
SBIR/STTR

Project Management

Program Director: 
Jennifer L Gustetic

Program Manager: 
Carlos Torrez

Project Manager: 
Caitlin E Meyer

Principal Investigator: 
Robert E Hanes

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5