M.L. 2017 Minnesota Aquatic Invasive Species Research Center Subproject Abstract
For the Period Ending June 30, 2020

SUBPROJECT TITLE: MAISRC Subproject 28: Evaluating Innovative Coatings to Suppress Priority AIS
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FUNDING SOURCE: Environment and Natural Resources Trust Fund (ENRTF)
LEGAL CITATION: M.L. 2017, Chp. 96, Sec. 2, Subd. 06a

SUBPROJECT BUDGET AMOUNT: $84,940
AMOUNT SPENT: $51,234
AMOUNT REMAINING: $33,734

Sound bite of Project Outcomes and Results

Biofouling is a natural phenomenon that includes the adhesion of Zebra mussels to structures or boats and contribute to their spread in Minnesota waters. Current antifouling coatings are environmentally toxic. We demonstrate the efficacy of an eco-friendly coating technology that could help mitigate the spread of sessile invasive species, while minimizing non-target impacts.

Overall Subproject Outcome and Results

Biofouling is a natural phenomenon that sticks on structures or boats. It is a vector for the spread of numerous invasive species in Minnesota waters. A current way of fighting biofouling involves using metals that are harmful to the environment. We successfully evaluated a new generation of coatings containing a non-toxic, antifouling, biological molecule, and demonstrate that it reduces the adhesion of invasive species. These coatings could help mitigate the spread of sessile invasive species not only in coastal and inland waterways but also on recreational and industrial equipment surfaces, while minimizing non-target impacts.

Problem: Replace current toxic antifouling coatings with coatings containing a non-toxic, antifouling, biological molecule to mitigate the spread of sessile invasive species while minimizing non-target impacts.

Methodology: We took advantage of our unique technical and scientific edges to evaluate the potential of this technology to replace toxic biocides currently used to limit biofouling. Coated samples were submerged in the field in three different sites in Minnesota, including infested sites, and samples were analyzed using microscopies, organisms were quantified and measured, and surface microbial communities determined.

Results and Significance: Biofouling is a main vector for the spread of aquatic invasive species. Current antifouling solutions are both partly effective and highly toxic to the environment. In this proof-of-concept project, we demonstrate that our non-toxic enzyme technology can prevent the adhesion of AIS on submerged surfaces. We show that in three different Minnesotan field sites that enzymatic coatings can outperform coatings containing biocides, and prevent Zebra mussels adhesion to polycarbonate surface over the course of two summer months. This enzyme-based coatings could help mitigate the spread of sessile invasive species in Minnesota and beyond. These results evidence that this novel technology has the potential to replace toxic antifouling coatings and help mitigate the spread of AIS in Minnesota and beyond.

Subproject Results Use and Dissemination

We have disseminated our findings to stakeholders to increase awareness of our technology and allow us to learn about market landscape and end-users needs. In particular, we discussed with lake owner associations leaders at and representative of the Legislature at the AIS Research and Management Showcase. We also have communicated via seminars and presentation with other stakeholders, including Dupont, the MN DNR, the Bureau of Reclamation, and presented our results at the iPrime meeting, an academic-industrial meeting where key stakeholders were present, including 3M, BASF, Evonik and Ecolab. We also used communication services at the Biotechnology Institute to disseminate our results to the public in the form of a blog article and we are preparing two research articles to communicate to the scientific community.

Presentations:

- Huang, Hicks, Elias. Suppressing Microbial Communication to Mitigate the Spread of AIS. 9/18/2019. MAISRC Research and Management Showcase.
- Elias. Interference in Microbial Signaling: a powerful way to control microbes and study their languages. 12/3/2019. Presentation to the bureau of Reclamation.
- Elias. Interference in Microbial Signaling: a powerful way to control microbes and study their languages. 11/18/2019. Presentation to Dupont.
- Elias. New Advances in Controlling Microbial Behaviors by Interfering in Microbial Speech. 8/6/2020. iPrime national meeting.

Media:

- Enzyme-based coatings developed at the University of Minnesota help protect port infrastructure by disrupting the signals underwater bacteria use to communicate. Nick Minor and Kristal Leebrick, Gateway: Signal and Noise. 18 May 2020. https://gateway.bti.umn.edu/2020/05/18/signal-and-noise/

Attachments:

- Figure of results of coupons coated with paint containing control protein.