MORGAN STATE UNIVERSITY
DIVISION OF RESEARCH AND ECONOMIC DEVELOPMENT
OFFICE OF TECHNOLOGY TRANSFER

Executive Summary

Bacterial Polysaccharides as Heavy Metal Capture and Homogenous Vaccine Agents

Innovation

Microbial exopolysaccharides (EPS) can play key roles in biosorption. Bacteria, fungi and some algae are known to produce EPS. EPS can be found released into the environment or attached to the microorganism cell surface (in the case of capsular polysaccharides). Microbial EPS plays physiological roles in cell adhesion, biofilm formation and protection from host defense mechanisms. These biopolymers are equipped with ionizable functional groups that are known sites for interactions with heavy metal cations. This technology alters specificity of polysaccharide-producing enzymes, which could be beneficial to improving metal capture by modified polysaccharides. Binding of Cu^{2+} and Pb^{2+} metal cations to Neisseria meningitidis-type polysaccharides was also assessed. All concentrations of metal cations tested were able to completely bind to colominic acid. This polymer is equivalent to the capsular polysaccharide of N. meningitidis serogroup B containing a homopolymer of negatively charged sialic acid. There was slightly less binding observed with Neisseria meningitidis serogroup W which contains repeating units of the neutral sugar galactose and sialic acid. This work represents the first assessment of the metal binding-properties of these capsular polysaccharides.

Market Need

There are relatively few published studies, however, that seek to optimize the metal binding properties of an organism's capsular polysaccharide using the enzymatic machinery responsible for polysaccharide synthesis. This creates limitations in adapting polysaccharides to increase binding affinity for specific metals. This bacterium is one of six types of disease-causing serogroups of N. meningitidis. Accordingly, most studies with these polymers focus on vaccine development. Thus, the innovation has potential to fill needs in both in vaccine development, as well as remediation of heavy metal pollution in water and soils.

Intellectual Property

A non-provisional patent (U.S. Patent Application #16/842,923) was filed in April 2020.

Stage of Development

In recent studies, serogroup W polysaccharide was less efficient as some unbound Pb^{2+} was detected. This polysaccharide has less negatively charged functional groups which may account for this result. Future work will seek to optimize metal-binding with Neisseria meningitidis serogroup W polysaccharide.

Technology Transfer Opportunity

Heavy metal pollution of water is a significant environmental and public health concern. Current biological strategies of heavy metal removal from water are performed using microbial biopolymers, including polysaccharides, that are already fully formed. This creates limitations in adapting polysaccharides to increase binding affinity for specific metals, which the innovation seeks to address. In addition, the technology could aid in homogenous vaccine development. Licenses are available for specific applications or for all fields of use.

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Field(s) of Use:
- Biochemistry
- Microbiology
- Toxicology
- Immunology

Key Words:
- Heavy Metal Pollution
- Binding
- Vaccine
- Biosorption

Advantages:
- Specific metal binding
- Homogenous vaccine production

Status:
Patent pending

Links:
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