

# Beef Day 2021

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## Metal-Organic Framework-Based Sensor for Bacterial Trehalose in Beef Products

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### Objective

The objective is to detect trehalose from pathogenic bacteria using an electrochemical sensor based on alkali earth metal-organic frameworks (AE-MOFS).

### Study Description

Trehalose is a sugar produced by microbes to protect themselves from extreme cold and desiccation. Problematic bacteria for beef products such as *E. coli* and *Salmonella spp.* are well studied for their trehalose production, making the molecule a novel biomarker for meat product contamination, especially given the cold, dry meat packing plant environment. Trehalose identification could mitigate losses due to recalls. We employed trehalose's unique interactions with AE-MOFs. These materials were cast as a film onto an electrode to detect trehalose in broth by electrodepositing it onto the AE-MOF-coating (~45 seconds/sample). Sensors were able to detect a linear range of 0.25 – 75.0 mM of trehalose. On autoclaved samples, trehalose production peaked in bacteria exposed to refrigeration at 6h and gradually declined over 48 h to initial levels. We are now transitioning the technology to directly detect trehalose on meat products. The direct detection scheme is illustrated below in the graphical abstract.

### Take Home Points

First non-enzymatic trehalose sensor for detecting pathogens

Linear range of 0.25 – 75.0 mM

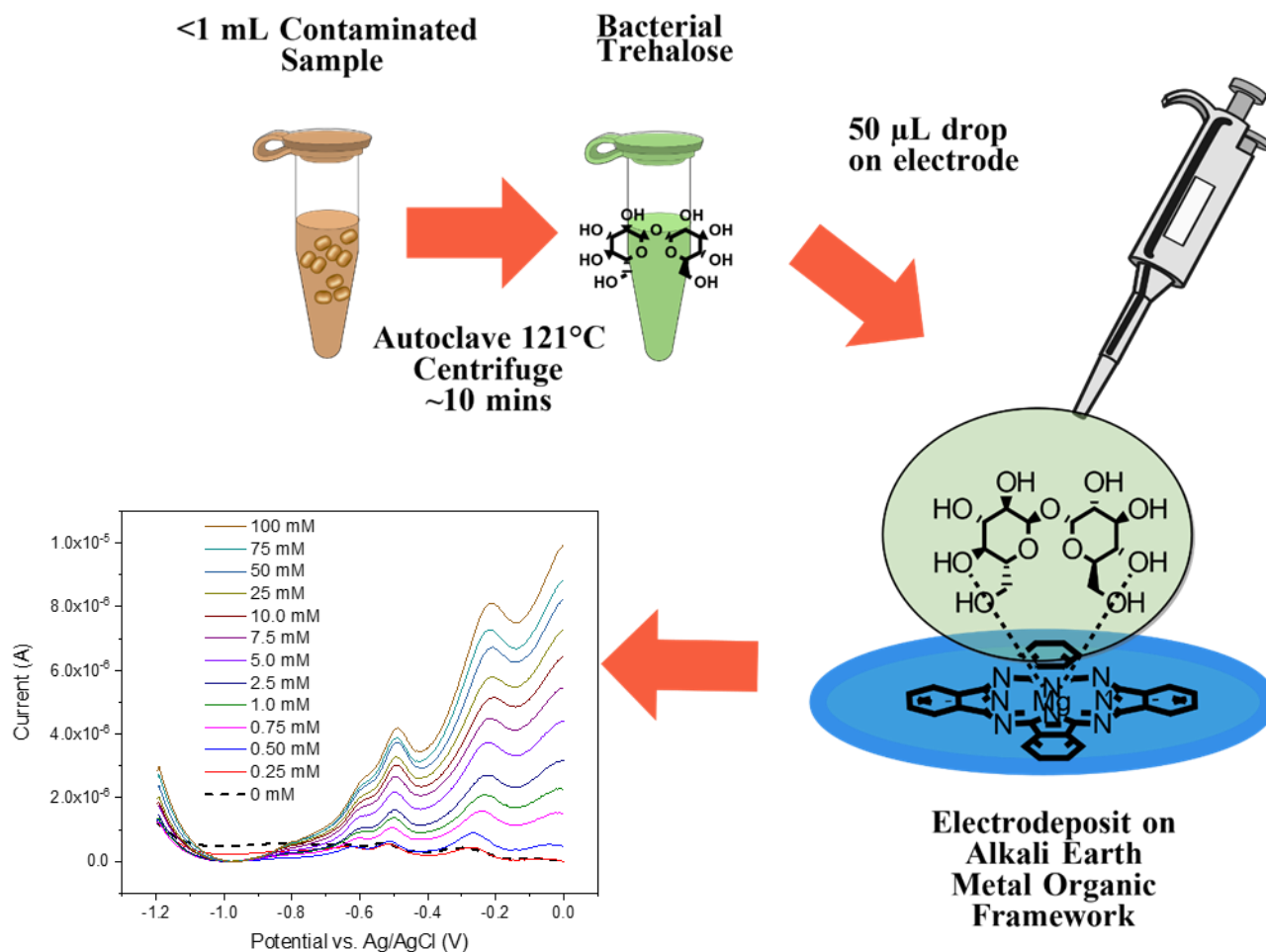
Bacterial trehalose production peaks at 6 h

Sense bacterial count by peak current

### Acknowledgements

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**Graphical Abstract:** A bacteria-contaminated liquid sample is rapidly heated to the point of bacterial lysis (121°C). Then, 50 µL of the lysed sample is directly pipetted onto the surface of an alkali-earth metal-coated working electrode of a three-electrode system. Squarewave voltammetry is performed to directly detect the concentration of trehalose, a protective sugar the bacteria produce in response to cold, dry environments, via the peaks at -0.20 and -0.45 volts.