+1-207-289-3200
contact@fluidimaging.com
www.fluidimaging.com

APPLICATION NOTE

Behavior Analysis of Magnetic Ionic Liquids

OVERVIEW

Magnetic Ionic Liquids (MILs) are novel ionic solvents that are liquid at room temperature and are responsive to magnetic fields. Due to their unique properties, MILs are emerging as a powerful and versatile reagent platform for extraction of a wide variety of bioanalytes from aqueous samples, including hormones, nucleic acids and viable bacterial cells.

A STUDY BY HICE ET AL.

A research group at Iowa State University is studying the use of MILs as a tool to isolate foodborne pathogens in liquid suspensions. Previously, they showed the ability of MILs to capture a species of *Salmonella*. A recent work, published in *Analytical and Bioanalytical Chemistry*, extends the previous work on MILs to the capture of several Gram-negative bacteria of importance to food, agricultural and clinical testing, including subspecies of *Salmonella* and *E. coli* O157:H7.

The Anderson and Brehm-Stecher labs at Iowa State University leveraged the FlowCam to learn more about how MILs work to capture and concentrate bacterial cells prior to molecular or cultural analysis. According to Dr. Byron Brehm-Stecher, the FlowCam "provides unique insights into the mechanism of this novel bacterial capture and concentration reagent".

"The FlowCam allowed us to measure droplet size distributions for the hydrophobic MILs in aqueous media after vortexing" Brehm-Stecher said. "Additionally, the instrument allowed us to actually see how MIL droplets behaved in the presence of the bacterium *Serratia marcescens*" he continued. "We use these data to propose that bacteria bound to MIL droplet surfaces promote formation of droplet-bacterium-droplet 'sandwiches', which in turn form more complex aggregates that lead to eventual separation of bacteria from aqueous suspensions. We had theories about how cells might be interacting with the MILs, but we didn't have any direct evidence to support these ideas until we ran our samples on the FlowCam."

The study found no overt antibacterial effects on the cells by the MILs, and showed the potential suitability of the Ni(II) MIL in "pre-analytical sample preparation". This work suggests that charge-based interactions with various cell surface-associated polymers represent an important mechanism for observed capture and concentration of bacteria. However, because these MILs are intrinsically hydrophobic ("water-fearing"), there may be additional roles for other types of molecular interactions in the capture process, especially for microbes having hydrophobic surfaces.

Read the full paper in Analytical and Bioanalytical Chemistry.

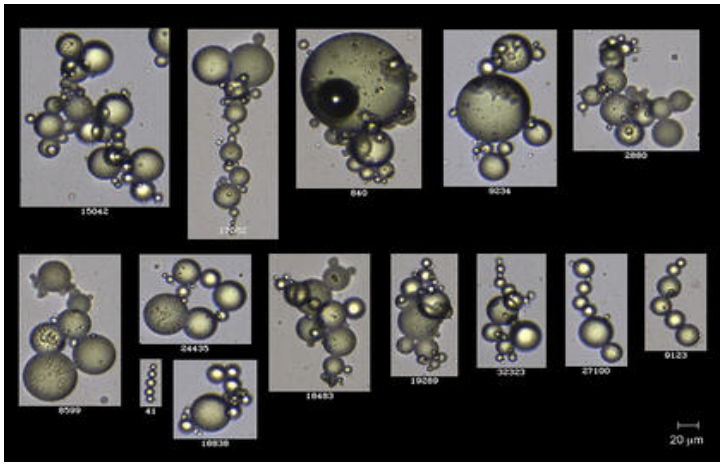

Figure 1: FlowCam images of Serratia marcescens-induced aggregation of Ni(II) MIL Droplets.

REFERENCES

Hice, S.A., Varona, M., Brost, A., Dai, F., Anderson, J.L. and B.F. Brehm-Stecher Magnetic ionic liquids: interactions with bacterial cells, behavior in aqueous suspension and broader applications. Anal Bioanal Chem (2020) 412:1741-1755.