Liquid Crystal Device for Identifying and Validating Cleaning Processes for Biofouling

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Inventors: Nicholas Abbott, Lie Na Tan

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing methods and devices for assessing the ability of cleaning compositions to remove proteins or biofilms from a surface as well as identifying agents that promote protein stability.

Overview

Proteins, polysaccharides, biofilms and other contaminants may collect on surfaces over time in a process known as surface fouling. The identification of agents that prevent the adsorption of biofouling agents to surfaces is technologically important in contexts such as water purification, membrane separations processes, design of surfaces of biomedical devices and storage of therapeutic proteins. Surface-contaminating agents also may be removed from fouled surfaces using a variety of cleaning formulations. Due to increasing material costs and growing environmental concerns, there is a need for improved methods for efficiently identifying cleaning formulations for removing contaminating agents from surfaces and for optimizing the concentrations of the active ingredients contained in such formulations.

Purified proteins such as those used in protein-based therapeutics and other pharmaceuticals often need to be stored for an extended period of time while retaining their original structural integrity and conformation. Stabilizing agents can be used to slow the degradation process during which proteins may unfold, flatten, become cross-linked or break down; however, such agents have exhibited inconsistent results. Improved methods for efficiently identifying agents for effectively stabilizing proteins and other biomolecules also are needed.

The Invention

UW–Madison researchers have developed a model liquid crystal-based system for studying the behavior and conformation of proteins at a surface or other interface. The system can be used to rapidly assess cleaning compositions for removing proteins or biofilms, agents for preventing adsorption of proteins and other molecules to surfaces and potential protein stabilizing agents.

The system includes one or more protein molecules disposed at a liquid crystal-aqueous interface. As proteins are removed from the interface, the liquid crystal surprisingly undergoes a continuous orientational ordering transition, which is correlated to the extent and speed of protein removal. By measuring this ordering transition, the model system can be used to rapidly assay the effectiveness of a given cleaning composition in removing proteins or biofilms from a surface.

In the model system, proteins that have aged or deformed are more difficult to remove from the interface and proteins that are crowded on the interface (i.e., less likely to be deformed) are easier to remove. Accordingly, the system also can be used to assay the state or conformation of proteins.

- Identification of agents that prevent biofouling
- Assaying optimal concentration of proteins to prevent unfolding

Key Benefits

- Efficient
- Cost-effective
- Rapid

Publications

- Tan L.N., Orler V.J. and Abbott N.L. 2012. Ordering Transitions Triggered by Specific Binding of Vesicles to Protein-Decorated Interfaces of Thermotropic Liquid Crystals. Langmuir. 15, 6364-6376.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Sensors
- Research Tools : Protein interactions & function

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854