IMPROVING SENSOR DESIGN TO REDUCE MANUFACTURING TIME AND COST

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A MULTIVARIATE IN-LINE OPTOCHEMICAL SENSOR PLATFORM FOR CONTINUOUS MONITORING OF CROSS-CATEGORY PROCESS PARAMETERS AND PRODUCT ATTRIBUTES IN BIOREACTORS

North Carolina State University, Raleigh, NC

Type:
Academic Research Institution

Participating Organizations:
MilliporeSigma / EMD Sorono and Pfizer, Inc.

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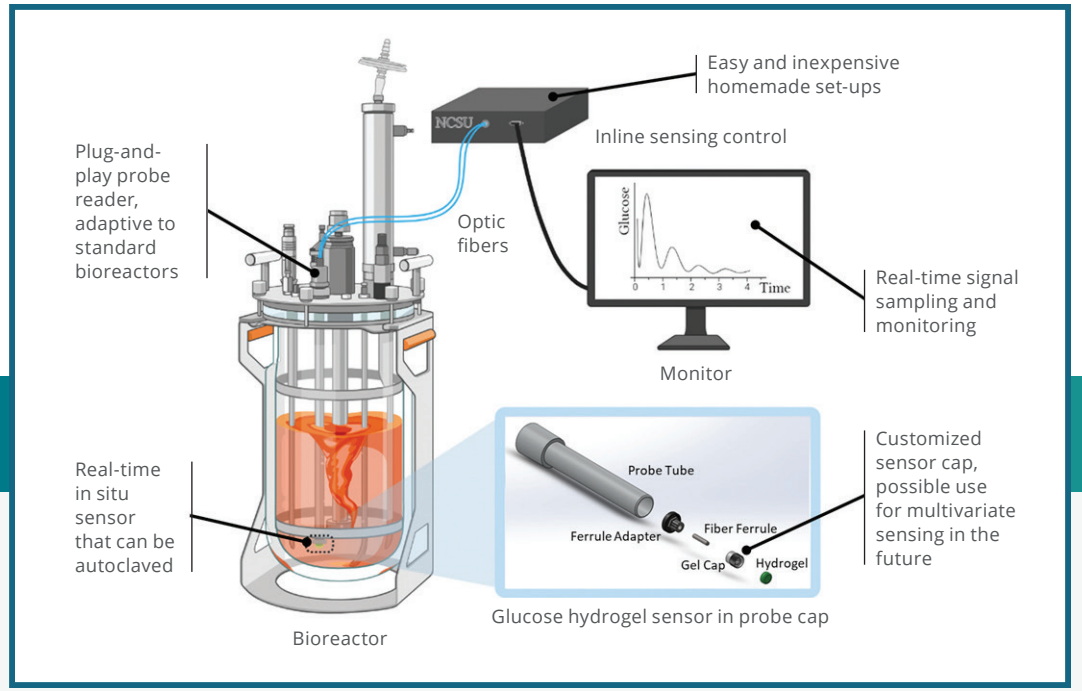

INDUSTRY NEED

During the cell growth phase, known as the upstream process, attributes such as glucose and carbon dioxide are closely monitored as an indicator of cell health and productivity. The current sensor technologies used in bioreactors to measure these attributes are expensive and most are only capable of measuring one attribute at a time. Because of these limitations, analytical tests may take hours to complete, adding time and expense to the manufacturing process.

SOLUTION

North Carolina State University, with partners Pfizer, Inc. and MilliporeSigma, aimed to develop a multi-attribute inline optochemical sensor platform for continuous monitoring of glucose and carbon dioxide in bioreactors at all scales. The optochemical sensor technology uses fiber optics and fluorescent dyes to measure these two attributes. The inline implementation allows for real-time continuous monitoring of cell culture environments, eliminating the need to pull samples for offline analysis. The new sensor platform lowers costs, reduces analytical time, and helps to transition the manufacturing process from batch to continuous production.

OUTCOME

The team developed a prototype device using a hydrogel-based glucose sensor and fiber optic carbon dioxide sensor that can be used in bioreactors of any size. The device reduces measurement time by more than 95%. The glucose sensor produces readings within 10 minutes, while the carbon dioxide sensor provides readings instantaneously. Each of these measurements takes three hours or more with offline approaches. Also, with an estimated total cost of $2,500, the multivariant sensor reduces cost by at least 60% compared to other sensor technologies. For example, carbon dioxide probes alone cost approximately $6,000. This enhanced sensor creates manufacturing efficiency by allowing for continuous real-time monitoring.

> *“Through these collaboration opportunities within NIIMBL, we were able to talk to industry partners and really gain an understanding of the issues they need to address.”*

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