Report

AI & Fermentation Technology

Fermentation is a process that utilizes microorganisms to produce materials that are good for humans. Companies that produce such materials using fermentation need skilled engineers who can expertly design and manage the microbial cultivation. These engineers rely on information from sensors in the cultivation tanks, analysis, and their own senses to resolve issues that may arise. However, there remain some issues that have yet to be resolved.

The first is that the methods for standardizing cultivation differ between engineers due to the reliance on individual knowledge and experience. The second is that even skilled engineers require time to identify the causes of poor cultivation and optimize the process. The third is that when creating cultivation at scale, engineers may not fully understand how to use all of the equipment required, resulting in low yields.

In order to address these issues, Amano Enzyme and Chitose Laboratory collaborated in the NEDO project* to create a system for visualizing enzyme productivity in real time. The project was comprised of five steps: (1) Obtaining culture data using Amano Enzyme's enzyme-producing bacteria, (2) processing said data, (3) developing an AI prediction model, (4) inference, and (5) control testing. In addition to conventional sensors (pH, dissolved oxygen, etc.), new sensors for real-time monitoring of culture conditions (potential, color, smell, wavelength, etc.) developed by Chitose Laboratory specifically for AI learning were used to better follow the progress of the culture.

Our findings showed that the accuracy of the AI prediction model was greatly improved when the data set from the new sensor was added to the data from the conventional sensor. Furthermore, by introducing a non-linear model, the actual enzyme productivity values and the predicted values from the AI prediction model were almost identical (Figure 1). For the production of enzymes using microorganisms, we successfully built an AI prediction model that allows the visualization of enzyme productivity in real time.

As a result of this project, it will be possible to try and achieve automatic operation via AI that would show the conditions of the culture in factories in real time and compare with past data to control the culture appropriately. Amano Enzyme hopes to continue utilizing a wide variety of microorganisms, as well as advanced technologies, such as AI, and traditional technologies, such as breeding and cultivation, to create products with new, never-seen-before value.



st The results of this study were obtained as part of a project consigned by NEDO,

"Bio-Based Product Production Technology Development for the Acceleration of Carbon Recycling Realization."