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Neural network modeling of change in lactic acid concentration during continuous fermentation of bifidobacteria

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Abstract

In this work the changes in the lactic acid concentration during continuous fermentation of bifidobacteria have been investigated to obtain a neural network mathematical description. The fermentation was carried out under the conditions close to those of the descending colon (maintaining pH of 6.8 with 20% sodium hydroxide; anaerobiosis; the medium dilution rate was 0.04 h^{-1}). This colon section is characterized by a large number of microorganisms, as well as their enormous influence on the host organism. The researches were carried out with the probiotic strain of *Bifidobacterium adolescentis* VKPM Ac-1662 (ATCC 15703^T), the concentrations of the prebiotic oligofructose were varied (2, 5, 10, 15 g/l). Until a dynamic equilibrium state and at least 36 h after that, the concentrations of lactic and acetic acids using the of high performance liquid chromatography, optical density and viable bacteria count (CFU/ml) were measured. The neural network was trained on the base on the obtained experimental data.

The multilayer perceptron was chosen as the main architecture of the neural network. The vectors of the training sample include 6 variables: 5 input and 1 output. The training took place synchronously using the error back propagation method. The general error of the neural network was 1.85%. It was proved that the neural network approach helps to well illustrate the influence of various factors on the course of biotechnological processes; it summarizes the multiple experimental data with an acceptable error. The resulting neural network mathematical description proves that the representativeness of the training sample is important for obtaining the most accurate mathematical description. Further researches are needed to obtain a mathematical description of the change in the all environment components concentration in the form of a complex of the trained artificial neural networks.

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