

模拟青霉素分批补料发酵过程的细胞自动机模型

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根据青霉素产生菌的生长机理和青霉素分批补料发酵过程的动力学特性,在Paul等建立的形态学结构动力学模型的基础上,建立了模拟青霉素分批补料发酵过程的细胞自动机模型(简称:CAPFM)。CAPFM采用三维细胞自动机作为菌体生长空间,采用Moore型邻域作为细胞邻域,其演化规则根据青霉素分批补料发酵过程中菌体生长机理和简化动力学结构模型设计。CAPFM中的每一个细胞既可代表单个产黄青霉菌体细胞,又可代表特定数量的产黄青霉菌体细胞,它具有不同的状态。本文对CAPFM进行了仿真实验,实验结果表明:CAPFM不但能一致地复现形态学结构动力学模型所描述的青霉素分批补料发酵过程的演化特性,而且较形态学结构动力学模型更加直观地刻画了青霉素分批补料发酵过程的演化行为。最后,本文对所建模型在实际生产过程中的应用问题进行了分析,指出了需要进一步研究的问题。

A Cellular Automata Model for Simulating Fed-batch Penicillin Fermentation Process

Based on a hyphal differentiation and penicillin production structured kinetic model, according to the growth mechanism of penicillin production bacteria and the characteristic of penicillin fed-batch fermentation, a cellular automata model for simulating penicillin fed-batch fermentation process (CAPFM for short) is established. CAPFM adopts three-dimensional cellular automata as its growth space, adopts Moore type neighborhood as its cell neighborhood. The transition rules of CAPFM are designed based on the mechanism and structured kinetic model of penicillin fed-batch fermentation process. Every cell of CAPFM represents a single or specific number of penicillin production bacteria, and has various states. The simulation experimental results show that CAPFM replicates the evolution behaviour of penicillin fed-batch fermentation process described by penicillin production structured kinetic model accordantly. Finally, the application problem of CAPFM in practical production processes is analyzed, and the future study problems are pointed out.

关键词