

Intelligent Control of Bioprocesses: A Software Application

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Abstract : The main research objective of the experimental bioprocess analyzed in this paper was to obtain large biomass quantities. The bioprocess is performed in 100 L Bioengineering bioreactor with 42 L cultivation medium made of peptone, meat extract and sodium chloride. The reactor was equipped with pH, temperature, dissolved oxygen, and agitation controllers. The operating parameters were 37 °C, 1.2 atm, 250 rpm and air flow rate of 15 L/min. The main objective of this paper is to present a case study to demonstrate that intelligent control, describing the complexity of the biological process in a qualitative and subjective manner as perceived by human operator, is an efficient control strategy for this kind of bioprocesses. In order to simulate the bioprocess evolution, an intelligent control structure, based on fuzzy logic has been designed. The specific objective is to present a fuzzy control approach, based on human expert' rules vs. a modeling approach of the cells growth based on bioprocess experimental data. The kinetic modeling may represent only a small number of bioprocesses for overall biosystem behavior while fuzzy control system (FCS) can manipulate incomplete and uncertain information about the process assuring high control performance and provides an alternative solution to non-linear control as it is closer to the real world. Due to the high degree of non-linearity and time variance of bioprocesses, the need of control mechanism arises. BIOSIM, an original developed software package, implements such a control structure. The simulation study has showed that the fuzzy technique is quite appropriate for this non-linear, time-varying system vs. the classical control method based on a priori model.

Keywords : intelligent, control, fuzzy model, bioprocess optimization

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