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AGENT-BASED MODEL PREDICTIVE FRAMEWORK TO CONTROL CELL CULTURE BIOREACTORS

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Bioprocesses require unique operational conditions and highly specialized process knowledge to obtain consistent product quality and productivity. Optimization and control of these processes are challenging due to the nonlinearities and uncertainties involved, and cell-bioreactor interactions are poorly understood. Automated control of bioreactors using model predictive control (MPC) technologies is less common as translating complex process specific interactions to linear models is challenging. Accurate models of the process are needed for MPC to succeed. Due to the complexity and heterogeneity involved in the culture environment, conventional mechanistic modeling efforts are often incomplete for describing the interactions of cell physiology and environmental conditions and predicting future behavior. Agent-based computational models provide a strong tool for studying mammalian cell culture bioreactor processes where agents (cells) take action based on changing dynamics of their immediate vicinity. An ABM was previously developed to simulate individual mammalian cell behavior and dynamics of bioreactor environment. In this study, applicability of MPC using ABM has been investigated to optimize growth in mammalian cell culture bioreactors.