Inhibitory wastewaters degradation using a discontinuous bioreactor

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Many industrial processes generating wastewater containing toxic compounds are characterized by their variability. Because of the high variations in flow and concentration of contaminants in industrial wastewater, usual treatment processes do not obtain satisfactory removal efficiencies. Besides, due to its toxicity, the biological treatment of industrial wastes containing a high phenol concentration is inefficient because of the inhibition of the microorganisms when traditional operation modes are utilized. Betancur *et al.* (2004) described the mathematical development of a new control strategy called *Event-Driven Time Optimal Control* (ED-TOC). The strategy seeks to control the influent flow rate in such a way to maintain the maximal degradation rate in the reactor. For inhibitory substrates, that follow the Haldane law, there exists a certain substrate concentration (S*) that produces that maximal degradation rate. To implement this strategy it is necessary to follow the substrate concentration. In practice, the substrate concentration could not be easily measured on-line, but can be estimated through a mass balance from the dissolved oxygen in the reactor. The ED-TOC strategy finds a variable related to the reaction rate. Such variable can be estimated in real time by using the dissolved oxygen concentration and the volume of the reactor, as described Betancur *et al.*, (2004). In this paper the practical application of the control strategy is described and analyzed. A good performance of the reactor operated with the ED-TOC strategy was obtained since the degradation and mineralization of the toxic substrates was efficiently completed. The ED-TOC strategy was able to manage increments of toxic concentrations in the influent up to 7000 mg/L of phenol or 4CP without any inhibition problem. It was shown that not only high concentrations of toxics could be treated with the ED-TOC strategy, but also a reduction in degradation time was obtained (around 52%) when the results are compared to the usual operation modes of the discontinuous reactors.

Betancur M.J., Moreno J. and Buitrón G. (2004). Event-driven control for treating toxicants in aerobic sequencing batch bioreactors. *9th International Symposium on Computer Applications in Biotechnology (CAB9)*, March 28-31, 2004. Nancy, France