

MODEL-BASED CONTROL STRATEGIES FOR ANAEROBIC DIGESTION PROCESSES

Neli Dimitrova

Institute of Mathematics and Informatics
Bulgarian Academy of Sciences, Sofia, Bulgaria

Mikhail Krastanov

Faculty of Mathematics and Informatics
Sofia University “St Kl. Ohridski”;
Institute of Mathematics and Informatics
Bulgarian Academy of Sciences, Sofia, Bulgaria

Anaerobic digestion (AD) is a biological process in which organic degradable material is converted into biogas by microorganisms. Recently, AD has been evaluated as one of the most promising processes for waste recovery, environmental protection and bioenergy production. At laboratory or industrial scales the AD process occurs inside an anaerobic digester (bioreactor). Biological processes are known to be highly unstable due to the high complexity of the ecosystem itself or to the presence of disturbances. A good management and control of the AD process can be achieved via validated mathematical models—an area, which is extensively studied in recent years [2].

We consider here a four-dimensional nonlinear model [1], describing anaerobic degradation of soluble organic wastes in a continuous bioreactor with methane production. Different control strategies for asymptotic stabilization of the dynamic system are presented, like input control, output feedback control, extremum seeking control, open-loop control. Numerical simulation results are included as illustration of the theoretical studies.

REFERENCE

- [1] O. Bernard, Z. Hadj-Sadok, D. Dochain, A. Genovesi and J.-P. Steyer, Dynamical model development and parameter identification for an anaerobic wastewater treatment process, *Biotechnology and Bioengineering*, 75, 424–438 (2001).
- [2] J. Jimenez, E. Latrille, J. Harmand et al, Instrumentation and control of anaerobic digestion processes: a review and some research challenges, *Reviews in Environmental Science and Bio/Technology*, 14, 4, 615–648 (2015).