MARION WEEDERMANN, Dominican University

Coupled chemostat with nutrient chain and internal inhibition: a dynamic model for methanogenesis

We propose a model describing two main stages of methanogenesis. The model includes two microorganisms, a nutrient chain and inhibition in case of abundance of one of the nutrients. One nutrient is supplied via the input to the feed vessel. As one species of microorganisms consumes this nutrient, a second nutrient is produced. While this second nutrient is essential for the growth of the second microorganism, a high concentration of this nutrient alters the conditions in the vessel so that the second microorganism cannot survive.

Using the inflow rate and the inflow concentration as parameters, we show that the system undergoes several bifurcations. The inhibition results in the possible bi-stability of two positive equilibria.

This work was motivated by installations of biogas reactors which experienced difficulties in reaching high production levels after start-up. We present numerical results which indicate that close observation and timely intervention are key to optimize the production of methane.