Title: Study of the dark fermentative hydrogen production using modified ADM1 models

Authors: Zineb Guellout, Valentin Clion, Yacine Benguerba, Christine Dumas, Barbara Ernst

PII: S1369-703X(17)30357-1
DOI: https://doi.org/10.1016/j.bej.2017.12.015
Reference: BEJ 6847

To appear in: *Biochemical Engineering Journal*

Received date: 2-8-2017
Revised date: 27-11-2017
Accepted date: 23-12-2017

Please cite this article as: Zineb Guellout, Valentin Clion, Yacine Benguerba, Christine Dumas, Barbara Ernst, Study of the dark fermentative hydrogen production using modified ADM1 models, Biochemical Engineering Journal https://doi.org/10.1016/j.bej.2017.12.015

Study of the dark fermentative hydrogen production using modified ADM1 models

Zineb GUELLOUT[a,b,c], Valentin CLION[c,d], Yacine BENGUERBA[a,b*], Christine **DUMAS[c], B**arbara **ERNST[c]**

[a] Department of Processes Engineering, Université Ferhat Abbas, Sétif-1, 19000 Sétif, Algeria.
[b] Laboratoire de Génie des Procédés Chimiques, Université Ferhat Abbas, 19000 Sétif, Algérie.
[c] Université de Strasbourg, CNRS, IPHC UMR 7178, Laboratoire de Reconnaissance et Procédés de Séparation Moléculaire (RePSeM), ECPM 25 rue Becquerel F-67000 Strasbourg, France
[d] French Environment and Energy Management Agency, Angers, France
[*]E-mail : benguerbayacine@yahoo.fr, Mob: +213-661704929.

Highlights

- **Modeling of the fermentative production of hydrogen using a modified ADM1 model.**
- **The Modified Model with Aiba Kinetic using Correction Factor (MMAK-CF) was found to be the best model.**
- **High substrate concentrations inhibit bacterial growth.**

Abstract

This paper presents a numerical study of the fermentation pathway of a bacterial consortium during production of hydrogen from glucose using three kinetic models. Mathematical expressions were used to describe glucose consumption, microbial growth and the production of hydrogen and metabolites. The numerical results show a good agreement with the experimental data. Microbial growth was described using three different kinetic models. A correction factor (CF) was added to the "Anaerobic Digestion Model number 1" (ADM1) using the Modified Model Aiba Kinetic model (MMAK-CF), allowing to improve the model agreement. Different initial concentrations of substrate were used to study their effect on hydrogen production and bacterial growth. The results show that the cumulative produced hydrogen increases with increasing the substrate concentration to reach a maximum. An optimal value was calculated at the initial substrate concentration of 0.022 mol L^{-1}. Bacterial growth followed the same trend. It was concluded that high substrate concentrations inhibit bacterial growth and hydrogen production, which can distort the metabolism of microorganisms.