PROCEEDINGS OF THE

31st International Symposium on Analytical and Environmental Problems

Szeged, Hungary

October 13-14, 2025

University of Szeged

Edited by:
Tünde Alapi
Róbert Berkecz
István Ilisz

Publisher:
University of Szeged, H-6720 Szeged, Dugonics tér 13, Hungary

ISBN 978-963-688-078-1

2025.
Szeged, Hungary

The 31st International Symposium on Analytical and Environmental Problems

Organized by:
SZAB Kémiai Szakbizottság Analitikai és Környezetvédelmi Munkabizottsága

Supporting Organizations
Hungarian Academy of Sciences
Hungarian Chemical Society Group of Csongrád County
Institute of Pharmaceutical Analysis, University of Szeged
Department of Molecular and Analytical Chemistry, University of Szeged

Symposium Chairman:
István Ilisz, DSc

Honorary Chairman:
Zoltán Galbács, PhD

Organizing Committee:
István Ilisz, DSc
professor of chemistry
University of Szeged, Institute of Pharmaceutical Analysis
Tünde Alapi, PhD
associate professor
University of Szeged, Department of Molecular and Analytical Chemistry
Róbert Berkecz, PhD
associate professor
University of Szeged, Institute of Pharmaceutical Analysis

Scientific Committee:
István Ilisz, DSc
Tünde Alapi, PhD
Róbert Berkecz, PhD
Daniela Sojic Merkulov, PhD
full professor
University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection

COMPARATIVE KINETIC ANALYSIS OF ANAEROBIC BIOLOGICAL DEGRADATION OF SLUDGE

Zoltán Péter Jákói[1], Ákos Ferenc Fazekas[1], Réka Dobozi[2], Sándor Beszédes[1]

[1] University of Szeged, Faculty of Engineering, Department of Biosystems Engineering, H-6725 Szeged, Moszkvai krt. 9
[1] University of Szeged, Faculty of Engineering, Department of Food Engineering, H-6725 Szeged, Moszkvai krt. 5-7
E-mail: jakoiz@mk.u-szeged.hu

The valorization of biologically derived raw materials is strongly influenced by their complex kinetic properties, which fundamentally affect both process efficiency and their applicability at industrial scale. Various mathematical, empirical, and semi-empirical models play a key role in accurately describing these processes, predicting yields, and optimizing operating conditions. In our research, we investigated the biogas fermentation of food industry-derived sewage sludges, with particular emphasis on their biokinetic characteristics and interpretation, as well as on the correlation between kinetic models and analytical and dielectric measurement methods applied for monitoring the fermentation process. Our aim was to determine which kinetic models provide the most accurate description of the biogas production processes of sludge samples subjected to different native and combined pretreatment methods, and whether process monitoring parameters correlate with the kinetic results. Cumulative biogas yields were evaluated using several commonly applied models, including the modified Gompertz model, integrated Monod model, first-order model, and logistic model. Among the kinetic models applied, several exhibited a high degree of fit to the experimental data ($R^2 > 0.98$) and accurately described the lag phase duration, the maximum product formation rate, and the asymptotic biogas potential. The best overall fit, as well as the lowest residual error and AIC values, was obtained with the modified Gompertz model for most sludge samples, confirming its broad applicability in the biogas valorization of the sludge types studied. Our results demonstrated the importance of selecting appropriate kinetic models for the evaluation and interpretation of experimental data, and highlighted the potential of combining biokinetic modeling with advanced process monitoring methods.

Acknowledgements
The Authors are grateful for the financial support provided by the National Research, Development and Innovation Office (NKFIH) under the project number FK 146344.