PROCEEDINGS OF THE

32nd International Symposium on Analytical and Environmental Problems

Szeged, Hungary

October 12-13, 2026

University of Szeged

Edited by:
Tünde Alapi
Róbert Berkecz
István Ilisz

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

ISBN 978-963-688-175-7

2026.
Szeged, Hungary

The 32nd 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
assistant 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

NEW HETEROGENEOUS GREEN CATALYST ZnO/BANANA PEEL EXTRACT FOR WASTE WATER REMEDIATION UNDER SUBCRITICAL CONDITIONS

Tanja Brezo-Borjan[1], Jaroslava Švarc-Gajić[1], Szabolcs Bognár[2], Dušica Jovanović[2], Vesna Despotović[2], Nina Finčur[2], Sandra Jakšić[3] and Daniela Šojić Merkulov[2]

[1]Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia
[2]University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia
[3]Scientific Veterinary Institute "Novi Sad", Rumenački put 20, 21000 Novi Sad, Serbia
e-mail: tanja.brezo.borjan@uns.ac.rs

Abstract
The concentration of organic anthropogenic micropollutants (pesticides, pharmaceuticals, chemicals from personal care products) is rapidly increasing in wastewater, jeopardising aquatic ecosystems and the environment as a whole. The aim of this study was to investigate the treatment of contaminated waters under subcritical conditions in combination with a new heterogeneous green catalyst (ZnO/banana peel extract), as an environmentally friendly process for wastewater remediation without the use of oxidising agents. The catalyst was obtained by mixing aqueous banana peel extract with a $ZnSO_4$ solution, followed by the pH adjustment to 12. The process was tested on model systems containing different concentrations of the pesticides tembotrione and clomazone, the antibiotic ciprofloxacin, the synthetic estrogen hormone 17α-ethinylestradiol, and three mycotoxins (zearalenone, deoxynivalenol, and fumonisin B_1). The treatments were carried out at temperatures from 160 to 200 °C, during time from 30 to 120 min, in a nitrogen atmosphere (10 bar). The treated model systems were analysed by HPLC and compared to systems without catalysts to determine the degradation efficiency. The new catalyst ZnO/banana peel extract showed high efficiency (~83–100%) in the degradation processes and enabled a reduction in treatment time and temperature for almost all pollutants, except for clomazone. For clomazone, the addition of the new green catalyst led to a decrease in degradation efficiency from 71 to 35%.

Keywords: wastewater remediation; subcritical water treatment; heterogeneous green catalyst; micropollutants

Acknowledgements
This work was funded by the Science Fund of the Republic of Serbia (*In situ* pollutants removal from waters by sustainable green nanotechnologies–CleanNanoCatalyze, Grant No. 7747845). The authors are grateful to the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (project numbers: 451-03-33/2026-03/ 200134, 451-03-34/2026-03/ 200134, 451-03-33/2026-03/20012, 451-03-34/2026-03/200125, and 451-03-33/2026-03/200031).