

**4/2015**

**environment  
protection  
engineering**

published quarterly

Wrocław 2015

*Founding Editor*

TOMASZ WINNICKI

*Editor-in-Chief*

KATARZYNA MAJEWSKA-NOWAK

*Vice-Editors*

Jerzy ZWOŹDZIAK, Lucjan PAWŁOWSKI

*Assistant Editor*

IZABELA KOWALSKA

*Editorial Office*

Faculty of Environmental Engineering  
Wrocław University of Technology  
Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland

*Publisher*

Wrocław University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław

Oficyna Wydawnicza Politechniki Wrocławskiej  
Wybrzeże Wyspiańskiego 27, 50-370 Wrocław  
<http://www.oficyna.pwr.wroc.pl>, e-mail: [oficwyd@pwr.edu.pl](mailto:oficwyd@pwr.edu.pl)

© Copyright by Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2015

Print and binding: beta-druk, [www.betadruk.pl](http://www.betadruk.pl)

## CONTENTS

A. MUSZ, M. K. WIDOMSKI, B. KOWALSKA, Benzene propagation during turbulent flow in PEHD water supply pipes .....	5
A. ZENDELSKA, M. GOLOMEOVA, K. BLAZEVA, B. KRSTEV, B. GOLOMEOV, A. KRSTEV, Adsorption of copper ions from aqueous solutions on natural zeolite .....	17
E. PORA, J. KASZUBKIEWICZ, D. KAWAŁKO, Selected methodological aspects of determination of the water desorption curves of superabsorbents .....	37
Z. ZAINUDIN, A. S. AZMI, D. N. JIMAT, P. JAMAL, Determination of waste assimilative capacity (WAC) of rivers located within the Desaru Region, Johor .....	49
I. KOWALSKA, Unit and integrated membrane operations for purification of spent single-phase detergent .....	61
H. OBARSKA-PEMPKOWIAK, M. GAJEWSKA, E. WOJCIECHOWSKA, K. KOLECKA, Sewage gardens – constructed wetlands for single family households .....	71
D. BORUSZKO, A. BUTAREWICZ, Impact of effective microorganisms bacteria on low-input sewage sludge treatment .....	83
M. LECH, A. TRUSEK-HOLOWNIA, Biodegradation of whey waste in a continuous stirred-tank bioreactor .....	97
K. PRUEKSAKORN, T.-H. KIM, Investigation of an odor source in Changwon City using multi-monitoring methods. A case study of Korea .....	109
M. A. ZYTOON, A. H. EL-SHAZLY, M. H. NOWEIR, A. A. AL-ZAHRANI, Biological treatment of hydrogen sulfide in an airlift bioreactor with direct gas injection .....	131
T. MI, J. HAN, X. HE, L. QIN, Investigation of HFC-134a decomposition by combustion and its kinetic characteristics in a laboratory scale reactor .....	143
P. KANCHANAPIYA, W. PINYO, S. JAREEMIT, S. KWONPONGSAGOON, Recycling of non-metallic powder from printed circuit board waste as a filler material in a fiber reinforced polymer .....	151
Z. KOWALSKI, A. GENEROWICZ, A. MAKARA, J. KULCZYCKA, Evaluation of municipal waste land-filling using the technology quality assessment method .....	167
M. ALWAEELI, An overview of municipal solid waste management in Poland. The current situation, problems and challenges .....	181
C. FANG, T. ZHANG, A. CZECHOWSKA-KOSACKA, A. PAWLOWSKI, G. ŁAGÓD, R. JIANG, Q. WANG, Estimation of phosphorus recovery by struvite crystallization from animal manure wastewater in China .....	195