DOI: 10.46991/JISEES.2025.SI1.121

Application of Advanced Oxidation Processes for Ethylene Glycol Degradation in Airport Stormwater

Timur R. Fazliev[1], Maksim D. Pridannikov[1], Mikhail N. Lyulyukin[1,2], Anton A. Pershin[3], Vadim A. Yakovlev[1], Denis V. Kozlov[1], Dmitry S. Selishchev[1*]

[1] Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russian Federation

[2] Arbuzov Institute of Organic and Physical Chemistry KSC RAS, Kazan, Russian Federation

[3] Airlife LLC, Moscow, Russian Federation

ABSTRACT

The increase in air traffic has led to a rise in emissions generated by airport operations. One of the ecotoxicants and pollutants found in airport stormwater runoff is ethylene glycol (EG) as a primary component of de-icing fluids. Despite its moderate acute and chronic toxicity, ethylene glycol serves as a nutrient substrate for microbial growth and promotes the formation of undesirable biofilms, leading to the reduction of dissolved oxygen level in water bodies, fish mortality, and a decline in biodiversity. Current methods for treating airport stormwater runoff include concentration, biodegradation, and anaerobic oxidation. Concentrated EG solutions (>5%) can be collected and rectified for reuse. Diluted ethylene glycol solutions require alternative approaches, such as controlled biodegradation or anaerobic oxidation. Notably, these methods are highly sensitive to EG concentration ranges, which vary significantly depending on weather conditions. Thus, developing an efficient molecular-level degradation method for removing EG from airport stormwater is an urgent task. A promising solution lies in advanced oxidation processes (AOPs), which involve the destruction of organic pollutants using highly reactive species. These methods include electrochemical oxidation, photocatalysis, the Fenton process, and UV-C radiation-driven photochemical processes. This talk presents a comparison of various AOPs in terms of their effectiveness in mineralizing ethylene glycol (EG) and determination of the most optimal operating parameters [2].

Keywords: environmental protection, wastewater treatment, ethylene glycol, advanced oxidation processes

Acknowledgement: This study was funded by the grant of the Ministry of Science and Higher Education of the Russian Federation for large scientific projects in priority areas of scientific and technological development (No. 075-15-2024-646).

References:

1. Exton, B.; Hassard, F.; Medina-Vaya, A.; Grabowski, R.C. Undesirable river biofilms: The composition, environmental drivers, and occurrence of sewage fungus. *Ecol. Indic*. **2024**, *161*, 111949. DOI:10.1016/j.ecolind.2024.111949
2. Fazliev, T.; Lyulyukin, M.; Kozlov, D.; Selishchev, D. Kinetic Aspects of Ethylene Glycol Degradation Using UV-C Activated Hydrogen Peroxide (H2O2/UV-C). *Molecules* **2025**, *30*, 49. DOI:10.3390/molecules30010049

***Corresponding Author:**

Dr. Dmitry S. Selishchev, Leader of Photo- and Electrocatalysis Research Group, Department of Unconventional Catalytic Processes, Boreskov Institute of Catalysis SB RAS, Lavrentieva Ave. 5, Novosibirsk, 630090, Russian Federation**.**

Email: selishev@catalysis.ru