

Understanding Microbial Corrosion in Spent Fuel Pools through Bibliometric Trends and Microbiological Evidence

Wednesday, 5 November 2025 10:00 (15 minutes)

Microbiologically influenced corrosion (MIC) in spent nuclear fuel storage pools presents a critical challenge to the structural integrity of nuclear containment systems, with significant implications for radioactive material safety and long-term waste management. This review combines bibliometric analysis and microbiological insights to explore global research trends from 2013 to 2024, identifying 42 relevant publications through a refined Scopus database search using keywords aligned with the INIS Thesaurus. Analytical tools such as VOSviewer and Biblioshiny revealed evolving research priorities centered on microbial activity, biofilm formation, and corrosion mechanisms, with keyword co-occurrence maps underscoring the prominence of terms like “microbiology,” “biofilm,” and “copper canister.” Detection methods for corrosive microbes include molecular techniques (PCR, qPCR, next-generation sequencing), electrochemical approaches (electrochemical impedance spectroscopy), and advanced imaging (scanning electron microscopy, atomic force microscopy), enabling detailed characterization of dominant microbial groups such as *Chloroflexi* and *Proteobacteria* across various storage surfaces. Conventional mitigation strategies—such as cathodic protection and protective coatings—are being complemented by innovative approaches like quorum sensing inhibition, engineered microbes, and biodegradable inhibitors, though these novel methods require further field validation. By mapping research output, identifying key microbial contributors, and evaluating emerging detection and mitigation technologies, this study provides a valuable resource for researchers, engineers, and policymakers aiming to enhance monitoring systems, develop effective countermeasures, and ensure the long-term safety and environmental sustainability of spent fuel storage infrastructure.

Technical Track

Safety and Severe Accidents

Primary author: Mrs RAHAYU, Dyah Sulistyani (BRIN)

Co-authors: Prof. WISNUBROTO, Djarot Sulistyono (BRIN); Mr SUGORO, Irawan (BRIN); Mrs SUNDARI, Titik (BRIN); YUSUF, Muhammad (Industrial Nuclear Energy (I) - IRC - General)

Presenter: PAMUNGKAS, Niken Siwi (National Research and Innovation Agency)

Session Classification: Fuel Cycle and Waste Management