

Environmental Risk Assessment of Manganese (Mn) Accumulation in Georgia's Black Sea Basin Rivers: A Case Study of the Kvirila River

Tamar Kerdikoshvili

E-mail: tamara.kerdikoshvili@gmail.com

Faculty of Exact and Natural Sciences

Ivane Javakhishvili Tbilisi State University

3, I. Chavchavadze Avenue, Tbilisi, 0179, Georgia

Manganese (Mn) accumulation in freshwater systems has emerged as a pressing environmental and public health concern, particularly in regions affected by intensive mining activities. This study investigates the temporal dynamics and regulatory compliance of manganese (Mn) concentrations in the Kvirila River, Georgia, over the period 2017–2023. Using monthly maximum concentration data obtained from the National Environmental Agency (NEA) of Georgia, the analysis reveals widespread and persistent exceedances of the national regulatory threshold of 0.1 mg/L. Nearly 80% of recorded measurements surpassed the permissible limit, with particularly high concentrations observed near the cities of Zestaponi and Chiatura, regions historically impacted by intensive manganese (Mn) mining activities. Seasonal patterns were evident, with peak concentrations typically occurring during the summer and autumn months. A linear trend analysis indicated no significant decline in manganese levels over time, suggesting that natural attenuation processes are insufficient to achieve compliance. These findings highlight an urgent need for enhanced monitoring, source control measures, and targeted remediation strategies to mitigate the environmental and public health risks associated with elevated manganese (Mn) concentrations in the Kvirila River system.