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Remedial potential of electroactive bacteria for antibiotic compounds treatment

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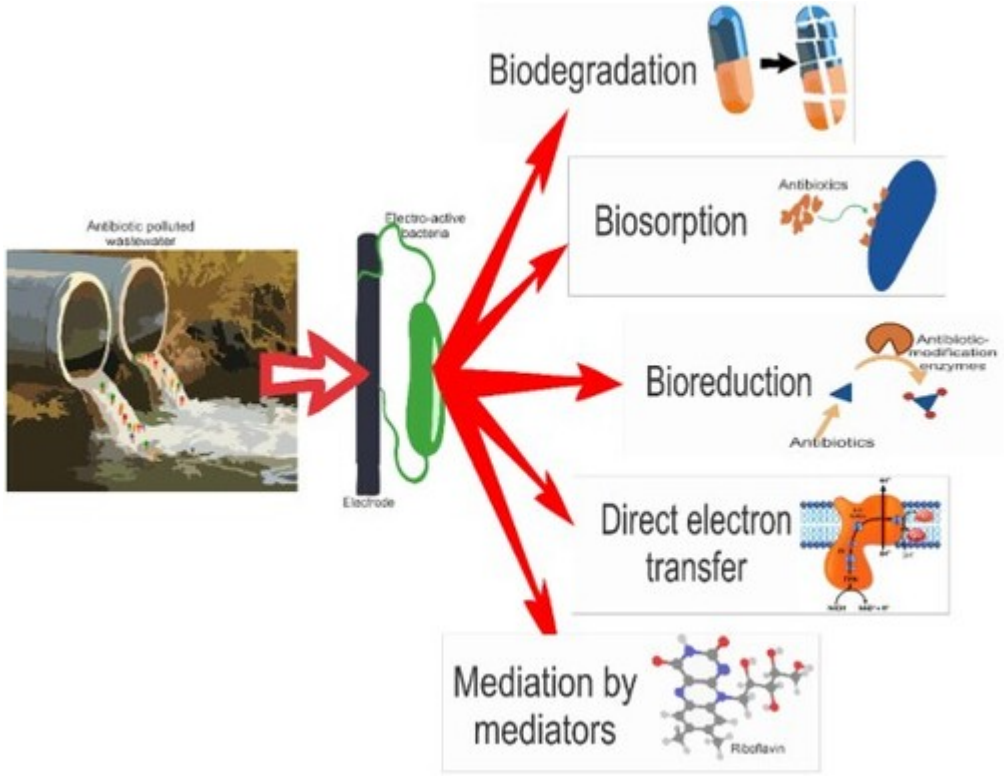
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ABSTRACT

This paper aims to deepen our understanding of the contaminant removal process using electroactive bacteria (EAB), focusing on their recent application in antibiotic degradation and its implications for environmental sustainability. To achieve this, a systematic literature review was conducted using databases such as Scopus, Web of Science, and Google Scholar to identify relevant scientific articles. This review comprehensively explores the antibiotic degradation process mediated by EAB, examining critical aspects such as electron transfer, biochemical mechanisms,

enzymatic pathways, redox processes, and other contributing factors. Unlike previous studies that often focus on isolated mechanisms, this work offers an integrative perspective on the role of microorganisms such as *Geobacter sulfurreducens* and *Shewanella oneidensis*, which can transfer electrons to electrodes, enabling electricity generation while degrading pollutants. Major degradation mechanisms identified include biosorption, bioreduction, biomineralisation, hydrolysis, denitrification, and hydroxylation. The findings suggest that leveraging EAB for contaminant removal enhances the efficiency of wastewater treatment processes and provides a dual benefit by reducing pollution and generating energy. The novelty of the study lies in integrating antibiotic degradation through electroactive bacteria with electricity generation, offering a holistic view of bioelectrochemical processes for sustainable wastewater treatment.

GRAPHICAL ABSTRACT



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KEYWORDS:

Contaminants degradation electrochemical technologies energy organic residues

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Disclosure statement

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Additional information

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Ingrid Maldonado is a Peruvian biologist, recognized for her research on the impact of anthropogenic activities on aquatic ecosystems and human health, as well as for developing ecological technologies for their remediation. She holds a master's degree in Ecology from the Complutense University of Madrid, a PhD in Science, Technology, and Environment from the National University of the Altiplano of Puno, funded by the World Bank, and a postdoctoral fellowship at the National University of Moquegua, supported by PROCIENCIA-CONCYTEC. Her career includes representing Peru in the Ibero-American scientific monologue competition Solo de Ciencia and participating in various scientific research projects focused on environmental sustainability and technological innovation.

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Dr. Franz Zirena Vilca is a distinguished Peruvian academic and scientist, specializing in applied ecology and environmental pollution. He trained as an agricultural engineer at the National University of the Altiplano in Puno and earned a master's degree in Andean Agriculture. He later obtained a Ph.D. in Science with a specialization in Applied Ecology from the University of São Paulo, Brazil, and completed a postdoctoral fellowship at the Centre for Nuclear Energy in Agricultural Applications. Currently, he is a professor at the National University of Moquegua and serves as the scientific lead of the Organic Pollutants and Environment Laboratory. His research has been recognized with multiple awards in academic competitions, and he has participated as a speaker at international events in countries such as Italy and Costa Rica.