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REVIEW OPEN ACCESS

Microbial Fuel Cells in the Treatment of Waste Water

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Abstract
The water is polluted with heavy metals and chemicals released from various industries. This is a serious issue and needs solution for this problem to be solved. The use of chemical approach to treat the waste water is costly and requires time. The use of microbial fuel cells can be effective and ecofriendly approach to treat the waste water. The microbial fuel cells convert wastes into electricity, generate clean water and green energy. This is a sustainable approach to treat the waste water. The review here mentions mechanism and use of microbial fuel cells to treat waste water.

Keywords: Energy; Membrane; Microorganisms; Osmosis; Sludge

Introduction

The environment pollution which includes air, water, soil, and noise is a serious problem. The water pollution is a major serious issue. The water is polluted due to chemicals, toxic compounds, heavy metals released into the water bodies. Such water needs to be treated properly so that it can be used for various purposes. The chemical methods for the treatment of waste water are costly and causes environmental problems. The use of microbial fuel cells in the treatment of waste water is now being used. The research in this area is gaining interest.

Microbial fuel cells

Microbial fuel cells (MFCs) are devices which using microorganisms generate electrical energy. For this, different wastes such as wheat straw, rice husk, etc. can be used as substrates. MFC degrade various contaminants using microorganisms. The microorganisms carry oxidation of the wastes by their anaerobic respiration and metabolism. The electrons move to the cathode which are accepted by oxygen. MFCs convert chemical to electrical energy where microorganisms are the biocatalysts (Afaf J Obaid Al-saned et al., 2021). The working of MFCs for treatment of waste water is represented in Fig. 1.

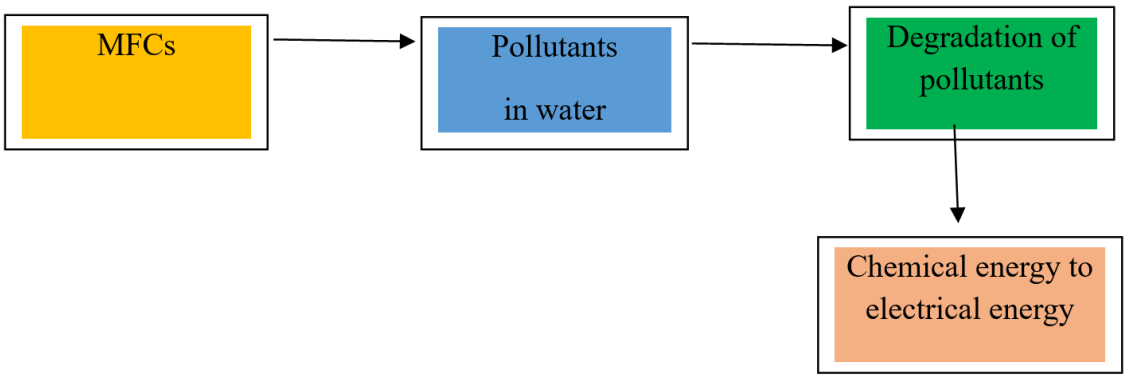

Fig. 1. Working of a microbial fuel cell for treatment of waste water

Anode and cathode materials used in MFCs

The carbon paper, graphite plate, carbon cloth, carbon mesh, granular graphite, activated carbon, carbon felt, carbon brush and stainless-steel mesh are used as anode materials in MFCs (Esfandyari et al., 2024). The air cathodes and aqueous air cathodes are used as cathode materials in MFCs. The organic chemicals in waste water are oxidized by microorganisms at the anode side and convert them into carbon dioxide (CO_2) and water (H_2O).

Removal of pollutants from waste water

Removal of dyes from waste water using MFCs

Dyes are present in waste water and cause waste pollution. The water which has Azo dyes can be treated using MFCs. The colour of azo dyes is oxidized by the microorganisms in the anode compartment of an MFC. The dyes can also be decolorised at cathode compartment of an MFC. *Pseudomonas* sp. has the ability to transmit electrons, which has made use of MFC in degradation of dyes interesting.

Removal of heavy metals from waste water using MFCs

Water is polluted with heavy metals such as zinc (Zn), cadmium (Cd), chromium (Cr), nickel (Ni), arsenic (As), etc. due to the various activities of industries and due to release of effluent in the water bodies (Wang *et al*., 2022). The reduction of heavy metals in MFCs utilizing graphite plate electrodes has shown the recovery of metals such as Cr, Ni, Pt, etc.

Removal of solids from waste water using MFCs

The solids present in waste water can be removed by a dual chamber MFC using graphite electrodes.
The MFC for treatment of waste water is shown in Fig. 2.

Advantages of MFCs in treatment of waste water

The MFCs to treat waste water is economical, easy, and ecofriendly. This is a sustainable approach to treat the waste water.

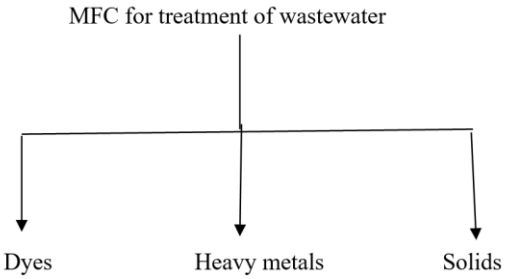

Fig. 2. MFC for treatment of waste water

Conclusion

The waste water can be treated using MFCs and this has gained immense interest from the environment aspect. More study needs to be done on a large scale for the treatment of waste water.

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AG conceived the concept, wrote and approved the manuscript.

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