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Self - sustaining bioelectrochemical cell from fungal degradation of lignin - rich agrowaste

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Abstract

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Abstract

The present work describes a self - sustaining bioelectrochemical system that adopts simple cell configurations and operates in uncontrolled ambient surroundings. The microbial fuel cell (MFC) was comprised of white-rot fungus of *Phanaerochaete chrysosporium* fed with oil palm empty fruit bunch (EFB) as the substrate. This fungal strain degrades lignin by producing ligninolytic enzymes such as laccase, which demonstrates a specific affinity for oxygen as its electron acceptor. By simply pairing zinc and the air electrode in a membraneless, single-chamber, 250-mL enclosure, electricity could be harvested. The microbial zinc/air cell is capable of sustaining a 1 mA discharge current continuously for 44 days (i.e., discharge capacity of 1056 mAh). The role of the metabolic activities of *P. chrysosporium* on EFB towards the MFC's performance is supported by linear sweep voltammetry measurement and scanning electron microscopy observations. The ability of the MFC to sustain its discharge for a prolonged duration despite the fungal microbes not being attached to the air electrode is attributed to the formation of a network of filamentous hyphae under the submerged culture. Further, gradual lignin decomposition by fungal inocula ensures a continuous supply of laccase enzyme and radical oxidants to the MFC. These factors promote a self - sustaining MFC devoid of any control features. © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Author keywords

Lignin - rich agrowaste ; Membraneless MFC; Microbial zinc/air cell ; *Phanaerochaete chrysosporium*; White-rot fungusReaxys Chemistry database information [i](#)

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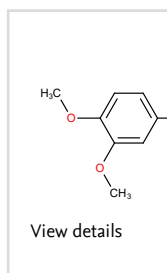
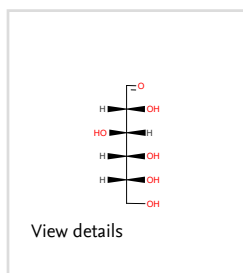
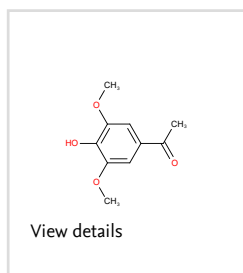
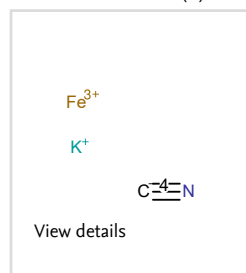
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Engineering uncontrolled terms

Bio-electrochemical systems; Bioelectrochemical cells; Discharge capacities; Fungal degradation ; Ligninolytic enzymes; Linear sweep voltammetry; Oil palm empty fruit bunches (EFB); Submerged cultures

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