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EVALUATION OF A YEAST–POLYPYRROLE BIOCOMPOSITE USED FOR MICROBIAL FUEL CELLS

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One of the most relevant alternative energy sources in recent years is the microbial fuel cells (MFCs). It is an electrochemical device which converts chemical energy into an electric power by using electrons derived from reactions catalyzed by microorganisms which can be found in wastewater and waste from the food industry [1, 2] . Microbial biofuel cell requires continues electron release in the anode and consumption near the cathode to generate electrical power [3]. The MFC efficiency highly depends on the rate of electric charge transfer from the microorganisms to electrodes. Electrically conductive polymers can be used for the modification of living cells to increase charge transfer efficiency from the cell to the electrode in MFCs. Among many polymers used to enhance, stimulate or modify cells, polypyrrole (PPy) is the most promising one due to its inherent characteristics: biocompatibility, high conductivity and stability [4–7]. Yeast cells modified with PPy burdens replication process to a certain degree, and for that reason, cells are getting smaller while the concentration of pyrrole is increased at the modification stage. Yeast affected with the lowest pyrrole concentration showed minimal change and MFC was designed using yeast modified by a solution containing 0.05 M pyrrole and compared with the characteristics of an MFC based on non-modified yeast. The maximum power, generated by the modified system was 47.12 mW/m^2, which is 8.32 mW/m^2 higher than that of the system based on non-modified yeast. Even though applying a PPy layer to yeast periplasm increases the charge-transfer efficiency towards the anode, the damage done to the cells viability due to modification with a higher concentration of PPy diminishes the amount of charge which can be transferred by 846 μA/cm^2. In conclusion, modification with PPy increases charge transfer efficiency however, it may have a cytotoxic effect which hinders not only the metabolic activity of yeast but also the replication process.

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