Yeast-Polypyrrole Composite as Catalyst in Biofuel Cell

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INTRODUCTION

Biofuel cells (BFC) is an electrochemical device which converts energy from microorganism-catalysed reaction into electrical power[1]. Such systems are attractive due to their inherent properties, such as biocompatibility, self-renewability, operation at mild environmental conditions. BFCs' are not widely adopted, it has relatively low power output comparing to other power sources, since electron transfer efficiency between microorganism and electrode is limited[1]. To overcome this problem biocatalyst can be modified with conductive polymer. Main aim of this research was to modify Saccharomyces cerevisiae yeast with polypyrrole and evaluate longevity of BFC.

EXPERIMENTAL STUDY

To evaluate BFC performance two compartment cell was constructed with graphite rod (⌀ 3 mm) modified with polypyrrole-yeast cells composite as anode and high surface area graphite rod as cathode. Cathode and anode are separated by semipermeable polycarbonate membrane. Measurements were performed with external resistances to imitate external load.

RESULTS AND DISCUSSION

Power outputs of polypyrrole modified BFC was checked every-day over the weeks' time. Highest achieved open circuit potential and power output were 441 mV and 206.43 mW/m^2, respectively. Over the week maximal power output dropped from 206.43 to 34.38 mW/m^2 (Fig. 1).

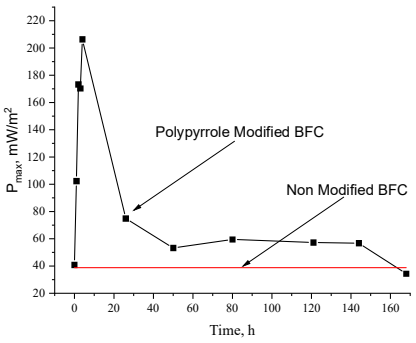

Fig. 1 The maximal calculated power output of the of polypyrrole-yeast-composite based BFC over time compared to maximal power output generated by non-modified yeast-based BFC.

CONCLUSION

Yeast modified with polypyrrole composites is a promising way to increase the charge transfer from yeast towards the electrode. After 7 days BFC reached maximal power output; it would suggest that yeast cells have fully self-renewed.

REFERENCES

1. Inga Morkvenaite-Vilkonciene et. al, Sensors 22, no. 1: 327. (2022)

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