World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:15, No:07, 2021

Deciphering Electrochemical and Optical Properties of Folic Acid for the Applications of Tissue Engineering and Biofuel Cell

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Abstract : Investigation of the vitamins as an electron transfer mediator could significantly assist in merging the area of tissue engineering and electronics required for the implantable therapeutic devices. The present study report that the molecules of folic acid released by Providencia rettgeri via fermentation route under the anoxic condition of the microbial fuel cell (MFC) exhibit characteristic electrochemical and optical properties, as indicated by absorption spectroscopy, photoluminescence (PL), and cyclic voltammetry studies. The absorption spectroscopy has depicted an absorption peak at 263 nm with a small bulge around 293 nm on day two of bacterial culture, whereas an additional peak was observed at 365 nm on the twentieth day. Furthermore, the PL spectra has indicated that the maximum emission occurred at various wavelengths 420, 425, 440, and 445 nm when excited by 310, 325, 350, and 365 nm. The change of emission spectra with varying excitation wavelength might be indicating the presence of tunable optical bands in the folic acid molecules co-related with the redox activity of the molecules. The results of cyclic voltammetry studies revealed that the oxidation and reduction occurred at 0.25V and 0.12V, respectively, indicating the electrochemical behavior of the folic acid. This could be inferred that the released folic acid molecules in a MFC might undergo inter as well as intra molecular electron transfer forming different intermediate states while transferring electrons to the electrode surface. Synchronization of electrochemical and optical properties of folic acid molecules could be potentially promising for the designing of electroactive scaffold and biocompatible conductive surface for the applications of tissue engineering and biofuel cells, respectively.

Keywords : biofuel cell, electroactivity, folic acid, tissue engineering
Conference Title : ICBEB 2021 : International Conference on Biomolecular Engineering and Biomaterials
Conference Location : Berlin, Germany
Conference Dates : July 22-23, 2021