Biostimulation of grape juice for enhanced bioelectricity generation in microbial fuel cells (MFCs)

R.Navanietha krishnaraj, Sheela Berchmans*
CSIR-Central Electrochemical Research Institute, karaikudi-630006, Tamilnadu, India

Abstract:

Biostimulation is a basic and interesting operation to enhance the population of the natural biota and the use of this technique can help to enhance the yield of microbial fuel cell. A dual chamber microbial fuel cell separated by nafion membrane was used for the investigations with fermented grape juice as the substrate. Both the anode and the cathode were made up of glassy carbon foam. The natural protists found in the fermented grape juice function as electrigen. The anolyte contained 5 ml of fermented juice diluted to 25 ml with phosphate buffer whereas the catholyte contained potassium ferricyanide (25 ml) in phosphate buffer. The performance of the microbial fuel cell was assessed by polarization studies, and coulombic efficiency. The microbial fuel cell produced a maximum power density of 3.54 W/m^3 at 12.53 A/m^3.The coulombic efficiency was found to be 7.43%. Then the performance of the microbial fuel cells with calcium alginate and calcium alginate - polyaniline composite modified anodes was studied. Interestingly, the use of calcium alginate and calcium alginate-polyaniline composite modified anodes significantly increased the power density to 10.66 W/m^3 at 24.68 A/m^3 and 16.14 W/m^3 at 28.8 A/m^3 respectively. The coulombic efficiency also increased to 20.10% and 40.58 % on modifying with calcium alginate and calcium alginate-polyaniline composite modified anodes respectively. These results were compared with our previous studies with unfermented (fresh grape juice) fed Microbial fuel cell. It was found that biostimulation enhances the current density, power density and coulombic efficiency by 20 % , 58 % and 42 % respectively. These results obviously show that a biostimulation can be used as a tool for enhancing bioelectricity generation and winery effluent treatment.

Keywords: Microbial fuel cell, biostimulation, polarization.
*the author to whom correspondence should be addressed

E-mail: sheelaberchmans@yahoo.com or sheelab@cecri.res.in
Tel: + 91 4565 241485 Fax: + 91 4565 227779