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A Review on Polyaniline Customized Stainless Steel Fiber Felt for Microbial Cell Anodes

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Abstract: To construct the micro porous anode, stainless steel fiber felts are coated with the polyaniline. In this study, two methods are used to synthesis the nano-polyaniline. They are electrochemical oxidative and chemical oxidative polymerization methods. This three Dimensional (3D) anodes give more reaction because of its increased surface area. More the surface area more the reaction takes place. It's also decomposable because it gives more area for bacterial colonization. The weight is reduced comparatively, so, it's easy to transportation purposes. Polyaniline modified anodes give higher power output and decrease internal resistance. EIS with the polarization curves clearly explains this output. The result also shows polyaniline combining with the 3D macroporous metallic scaffold is a method for microbial fuel cell anode fabrication.

Key words: Microbial cell, polyaniline, polarization, Electrochemical Impedance Spectroscopy (EIS), fabrication, transportation

INTRODUCTION

Microbial power modules (MFCs) change over concoction vitality into electrical vitality straightforwardly by means of electro-dynamic small scale creatures, furthermore have many application for concurrent water treatment over other ordinary wastewater treatment techniques. Waste biomass is a cheap and relatively abundant source of electrons for microbes capable of producing electrical current outside the cell is discussed by Li *et al*. (2012). In any case, the generally low power thickness of MFCs came about because of the huge vitality misfortune stays one of the principle unsolved hindrances for their useful applications. A three-dimensional macro porous anode based on stainless steel fiber felt for high-performance microbial fuel cells is explained by Hou *et al*. (2014). The aggregate vitality misfortune in the Microbial Fuel Cell framework is explained by voltage equation:

$$V = E_t - \eta_{ohmic} - \eta_{act} - \eta_{conc}$$

in which η_{act}, η_{ohmic} and η_{conc} are voltage misfortunes because of ohmic polarization, response energy and mass transport, separately. Examination has demonstrated that initiated misfortune what's more, dissemination resistance representing more than 70% of the all out resistance of MFCs. Morphological and mechanical properties of PP/MWNT/MMT hybrid nano-composites is described by Selvakumar and Manoharan (2014). A powerful path for evacuating these troubles is to utilize macro porous cathodes and nonmaterials. The three dimensional macro porous based-cathodes can provide as macro porous platforms for reaction. Electricity production and electrochemical impedance modeling of microbial fuel cells under static magnetic field is explained by Yin *et al*. (2013) and Lai *et al*. (2011). Nano-materials like grapheme, carbon nano tubes and composites of these polymers changed macro porous platforms can give extensive surface range to response and have been demonstrated productive in reducing the anode vitality misfortune in the MFC framework and altogether expanding the MFC influence thickness yield (Guerrero *et al*., 2010).

MATERIALS AND METHODS

Electrode production: The steel fiber felts were cut into 1.8×1.8 cm pieces and treated with acetone for 3 h to remove the adsorbed organic substances and then washed in pure water before the experiments. Electro polymerization is done by CHI660D (electro chemical workstation), the electrochemical cell with 3 electrodes. The electro polymerization is done with this configuration: Stainless steel fiber felt-working electrode, Platinum mesh-counter electrode, Ag/AgCl-reference electrode. polyaniline was electro polymerized on stainless steel fiber felts for 30 cycles in this way the anode is created. After each cycle, the electrode was dipped in the purified water and dried in the air at atmospheric condition. Polyaniline was fabricated by a rapid combination reaction. The purified aniline was dissolved in 10 mL of HCL. Ammonium peroxydisulfate 0.18 g is mixed with

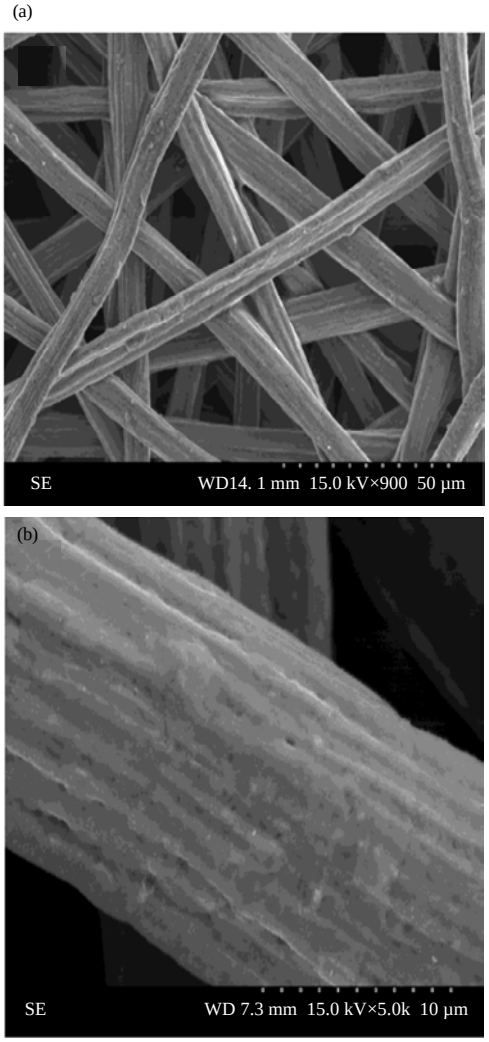

Fig. 1: SEM images of the SSFFs modification

10 mL of HCL at room temperature to obtain aniline solution. polyaniline emeraldine salt appears after 5 min, it is shown in Fig. 1. This mixture was mixed at room temperature for 12 h and then cleaned with the pure water.

RESULTS AND DISCUSSION

MFC system and procedure: An H-shaped microbial fuel cell of 2 chambers each having the volume of 90 mL was used for this experiment. These chambers are separated by a membrane. Microbial fuel cell reactors were connected with a bacterial culture of another H-shaped microbial fuel cell which was inoculated with wastewater. The cell voltage on external resistance of 1000 Ω was recorded every 20 min by a data acquisition system. The anodes like PANIcheSSFF, SSFF-MFC are parallel run and also assemble in the 3 reactors. The phosphate buffer solution and ferricyanide are filled in the e MFCs chambers of cathode (Guerrero *et al*., 2010). When the voltage is goes below the 50 mV the anolyte is replaced in the MFCs. If there is 50-9999 Ω external resistor is changed the polarization curves and power density are obtain in the 3rd circle. If there is normalized power density was occurred.

MFC characteristics: EIS (Electrochemical Impedance Spectroscopy) was used to calculate the internal resistances of the microbial fuel cells and the readings are conducted using the electro chemical workstation (CHI660D) while the microbial fuel cells were operated with a 1000 Ω external resistance. Two experiments were conducted on the whole cell with this configuration anode-working electrode, cathode-counter electrode and reference electrode with an AC signal of 100 kHz-5 mHz and amplitude of 10 mV. Scanning electron microscopy is used to differentiate the surface morphologies of the samples.

CONCLUSION

The concoction is used to incorporate the nanopraticles of the polyaniline. In the MFC the stainless steel felts are adjusted by the electrochemical. The demanding is less in the exchange charge of high movement of the electrochemical and low over potential. The low polarization resistance and force yield are created by the terminals changing which is obtained from the trial results. By the activity of the nano polyaniline in the SSFF framework in the 3D macro the anode's nono structure was created and it was fabulous large scale on the behind of the purpose. The elite anodes manufacturing was done by the successful strategy and it is promising by the SSF. In the thickness consolidated the slim polyaniline layer was fitted by the additional concentrate.

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