CARBON NANOPARTICLES AND NATURAL ELECTROLYTE BIO BATTERY FROM WASTE LEATHER

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Abstract

Bio battery, an innovative alternate natural energy source that utilize nanoparticles from plants to facilitate electricity, over the years, plants have been used as valuable sources of natural products for maintaining animal and human welfare and health. In the present study, the electrolyte paste from waste leather (animal skin) and plant extract for maintaining the electricity generation of bio battery. To analyze and assess the performance, enhancement in term of voltage, current, power caused by the modified electrolyte. As a result that the iron content when estimated in Maringa oleifera lam and electrolyte paste in alkaline (6.2 to 6.8 Ph.) range and voltages. The TGA, DSC, pH, internal resistance. Series DC Voltage, Current were analysed.

Keywords: ***Bio Battery, Waste leather, Electrolyte paste, Plant extract, Collagen, Nano particles.***

1. INTRODUCTION

Nowadays, leather from animal skin has been preserved by tanning techniques. The tanning process alters the collagen (microscopic proteins that give skin its structure & elasticity) [1]. It has the micro-fibers holding the collagen together so that they separate and toughen. This also creates leather's characteristic softness and flexibility [2-5]. Goat hides make thin, fine-grained leather that's excellent for garments and other value added bio products. After skinning, the hide undergoes the following steps to become leather [6-8]. The making of leather undergoes to fleshing, de haring, raw hide, tanning, and finishing. In India, there are about 3000 tanneries processing around 600 million kgs of raw skin and hide per annum, generating around 50 MLD of liquid waste and 305 million kgs of solid waste. It is reported that about 140-200 kg of fleshing, which are putrescible by nature, are generated for every tonne of leather processed [9,10].

2. METHODS

2.1. Materials Required

Waste Skins are collected from the leather processing industry. The collagen extracted from goat, cow, buffalo skins had been used in this study. *Moringaoleifera lam* – 10g, Digital Multimeter, Conducting nanoparticles.AA Battery parts such as anode, cathode. Zinc and copper plates, Conductivity gel, Poly ethylene glycol.

Extraction and purification of collagen

Waste animal leather

↓

Fibrizer machine

↓

Dilute sulphuric acid dissolved (24hrs)

↓

Water washed 2 or 3 times

↓

Filtered (collagen material colourless)

↓

Add polyethylene glycol 1 to 5%

↓

Add conductivity gel

↓

Corbannano particles 1 to 10mg

↓

Add silver ink (conductivity ink)

Flow chart for Electrolyte Paste Making

2.2. Preparation of plant extracts (*moringaoleifera lam*)

2.0 gms of weighed dried powder was treated with 12ml of concentration HNO_3 and boiled till brown fumes ceased. After cooling 2ml of double distilled water was added and 4ml of H_2O_2 to decompose the organic layer. Further it was heated till effervescence ceased and later on after cooling the step was repeated later on after cooling distilled water was added to the solution and boiled this was used for estimation.

2.3. Preparation of reagents for iron estimation:

KSCN (Pottasiumthiosyanate: 19.4gms of KSCN was diluted to 100ml distilled water.

FAS (Ferrous ammonium sulphate):0.215gms of FAS was dissolved in small amount of H_2SO_4 and then diluted to 250ml in distilled water.

2.4. Procedure for Iron Estimation

Dilute the standard FAS solution and *moringaoleifera lam* extract.Into a series of test tubes pipette out 2.0 to 10 ml of the working standard DNA solution corresponding to µg values 1.72 to 8.6. 3.0 ml of the ample was pipette out. 3.0 ml of the given unknown solution was taken. Make up the volume in all the tubes series of 20, 18, 16, 14, and 12, 10, 17 with distilled water. Set up a blank along with the working standard. Added 5.0 ml of Nitric acid solution and potassium thio cyanide to each tube. Read the absorption of yellow colour at 470nm against the blank. A standard graph as drawn by taking the concentration of iron and on X axis and optical density on Y axis. From the graph the amount of iron present in the unknown solution was calculated.

Total Internal Resistance

$$r = V2 - V1 / I2 - I1$$

3. RESULTS

3.1 Iron Content in *Moringa oleifera*

Since Iron is considered to be a good conductor of electricity compared to other metals like lead, an attempt was made to use the plant extract from *Moringa oleifera,* which contain rich source of iron for producing bio batteries to balance the internal resistance. In our study, the iron content when estimated in *Moringa oleifera lam* was found to be 7.15 % per gram.

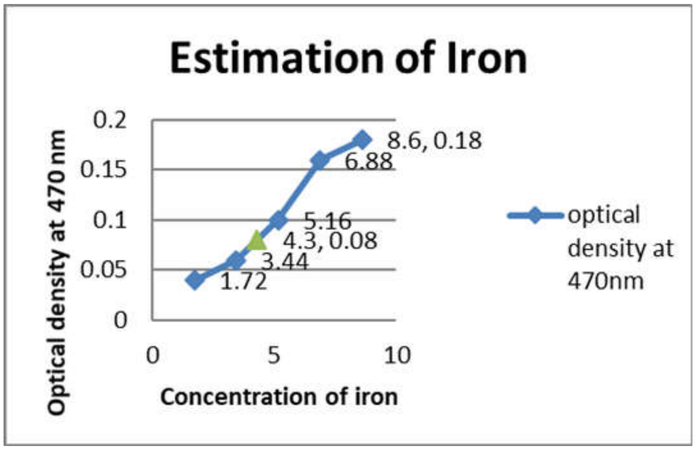

Figure 1. Estimation of iron from *Moringa oleiferalam*

3.2. Measuring of DC voltage in electrolyte paste by using Digital Multimeter

The electricity produced: voltage of 13500mV,for 80 well cells and the current in the range of 25-75 micro A, per cell, 1.2 A for 80 cells, Total internal resistance 2.8 Ω for button like well cell under no load condition.

Table1: Series connectivity of Batteries

DC voltage for ½ litter electrolytes with 5gms electrolyte paste (voltage in DC volte)

S	Cell1	Cell2	Cell3	Cell4	Cell5	Cell6	Cell7	Cell8	Cell9	Cell10
1	526mv	568mv	516mv	553mv	544mv	552mv	466mv	529mv	476mv	485mv
Total internal resistance of each battery : 2.8 Ohms										

3.3. pH stabilization

It has been observed that the pH of the extracts that formulated the electrolyte paste is alkaline ranging between 6 to 6.8. It was important to mention here that the generated electricity was higher in the plant extract with higher degree of acidity.

3.4. Characterization using Thermal Analysis

Thermo Gravimetric Analysis (TGA)

In the TGA weight loss of materials with increase temperature is monitored and noticed. In the present study, the electrolyte powder weight loss is measured for analysis. Thermo gram of control collagen shows single step weight loss from 59 to 213°C and around 96% weight loss is observed. This loss may be due to the decomposition of protein, CO, CO_2 and H_2O molecules. The final residue was found to be 58.26%

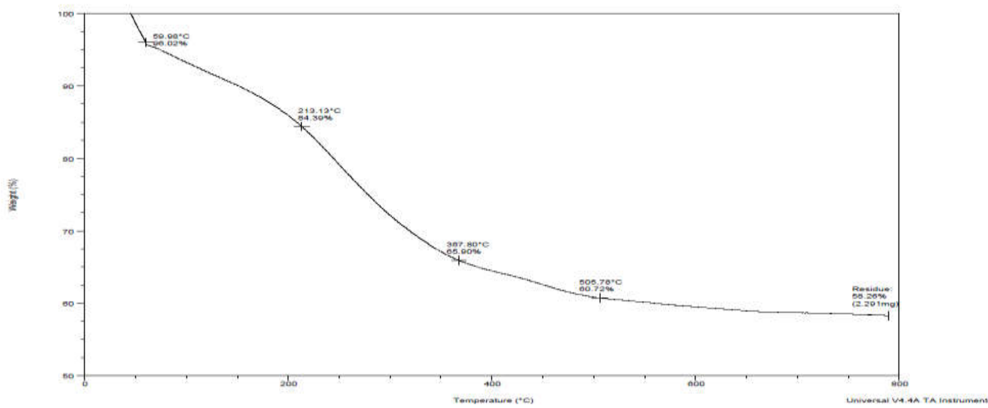

Figure 2. Measurement of melting point in electrolyte powder TGA Analysis

3.5. Differential Scanning Calorimetric (DSC)

The denaturation temperature of electrolyte powder films is determined from DSC curve and is found to be 112.80°C. The DCS results indicate that the denaturation temperature (Td) of collagen is 112.80°C.

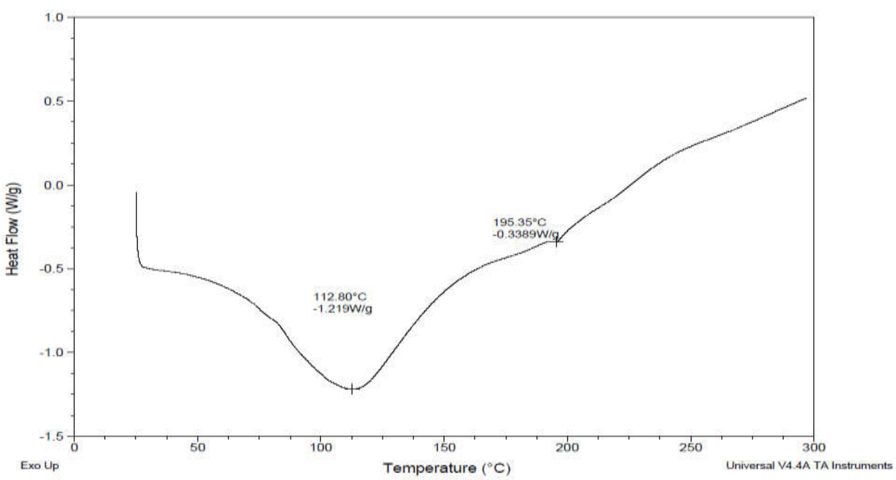

Figure 2. a-c DSC analyses in electrolyte sample

In our study, the iron content when estimated in *Moringa oleifera lam* was found to be 7.15 % per gram. It has been observed that the pH of the extracts that formulated the electrolyte paste is alkaline ranging between 6 to 6.8 The electricity produced: voltage of 13500mV, per 80 cells and the current in the range of 25-75 micro A, per cell, 1.2 A ,Total current in 80 cells

4. DISCUSSION

In the present study, aqueous extracts of *Moringa oleifera* lam and tannery fleshing were used for electrolytes in bio-voltaic cells. Conducting material made of silver ink or paste, nanoparticles with the bio material is used for the generation of electricity. The collagen extracted from waste animal (goat, cow, and buffalo) skin had been used in this study. For this the waste animal skin leather is subjected to chemical and Physical methods to obtain the collagen paste. To the collagen paste, Polyethylene glycol, Carbon nano materials from plant and Conductivity gel are added to form the electrolyte paste. Thus, the present investigation is a process for the generation of eco-friendly bioelectricity, comprising of supplementing *Moringa Oleifera* powder to the tannery fleshings with 15.0-30.0%w/w of polyethylene glycol,10.0-15.0%w/w of carbon materials The Bioelectrolyte paste with a pH 6 to 6.8, is poured into a 80 well plate, each well is setup at a conventional electrodes (cathode-zinc thin pin and anode-copper thin pin) immersed in the mixture and connected both serially and parallel for the production of electricity. Similarly the bio-voltaic cells were connected in parallel arrangement and the generated voltage and current were measured. It has been observed that, maximum 1.30V electricity was detected. Previous studies have reported a maximum of 26.74mV was generated in parallel connection in case of star fruit extract.

5. CONCLUSIONS

The bio batteries are eco- friendly and contain no toxic materials. Normally the batteries sold in market are hazardous pollutant and hence in the present study, the battery is modified in such a way to save from environmental pollutions. This bio battery contains PEG, Plant extract, Conductivity gel, conductivity ink, Carbon nano particles and Leather waste materials. The bio battery is found to perform better than normal battery if the surface area of the electrodes were increased and connected in series parallel connection to generate more DC Voltage and Current for domestic and entrtainemnt electric gadgets and applications. The advantages of this bio electrochemical cell is numerous such as low cost, no harmful effects free from environmental pollution, the corrosive effect (electrolyte) is nominal, easily available materials, zero polarization effect and also the cell can be reused by changing the plant extracts, electrodes and the acidity level.

The present study revealed that the plant powder extract has 7.150% of iron content per gram. And in particular, the iron content obtained from plant *Moringaoleifera lam* is of much useful in the Bio battery production This electrolyte paste is therefore non toxic and also not contaminated by any microorganism. Each AA Bio battery gives energy 1.5V and DC current of 800mA in optimum condition. And in the present study, the electrolyte paste produced 3V current in series connection and this energy can recharge another empty battery quickly and then again may be switched over for AC current. Due to this fact, the Bio battery generates light energy from electrolyte paste and this product may be very useful for future generation. Furthermore, the Bio battery made of modified electrolyte paste comprising of collagen from waste animal leather and *Moringa oleifera* Plant extract may be more useful to villages for generating power supply. Now days many villages do not have power supply hence this project may be very helpful in the large scale production of power supply to villages at low cost.

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