Flexible polyaniline-bacterial nanocellulose conducting composites

Divya Anand¹, Dr. Mudrika Khandelwal²

¹²Department of Materials Science and Metallurgical Engineering
Indian Institute of Technology, Hyderabad
Ordinance Factory Estate, Yeddumailaram, Medak, Telangana 502205
¹Email address: ms13m1004@iith.ac.in
²Email address: mudrika@iith.ac.in

Abstract

Development of new greener material for conducting paper is sought for applications such as security paper, actuators, and anti-static packaging. It is required that the material for these applications possess low density and good mechanical integrity. This work presents a way to produce bacterial nanocellulose (BC) - polyaniline (PANI) nanocomposites by in situ polymerization in suspension of cellulose nanowhiskers. The advantages of using BC over filter paper are its ultrafine network structure, sufficient porosity, high purity and crystallinity, good mechanical properties, great water holding capability and low environmental impact. The BC/PANI composites formed by optimized synthesis of PANI within cellulose nanowhiskers are expected to possess good electrical conductivity in addition to excellent mechanical properties and flexibility. The material has been characterized using Fourier Transform Infra-Red Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM).

Production of Bacterial Cellulose

![Figure 1: Bacterial Cellulose Preparation](image)

Result and Discussion

1. Choice of substrate

A. Visually

![Figure 2: Image of (a) Bacterial Cellulose and (b) Filter Paper](image)

B. Microstructure

![Figure 3: SEM Image of (a) Bacterial Cellulose and (b) Filter Paper](image)

Indicates

1) BC is made up of nanodimensional fibrils while FP is made up of micron dimensional fibrils
2) BC overall has higher porosity than FP

The differences are attributed to different production routes and source.

Experiment 1

![Figure 4: Penetration Study of Bacterial cellulose and Polyaniline](image)

(a) Toluene
(b) Hydrochloric acid

It indicates the better porosity and holding capacity of BC over FP

Experiment 2

Future work

Further composite have to be prepared and characterised through various strategies and we need to optimize the protocol it. Some of the strategies include:

1.Dip process

2.Drop process

3.Solutions mixed together

Conclusion

1. BC is a better candidate as a substrate because of its higher porosity and continuous morphology.
2. Optimised synthesis protocol for conducting polyaniline is 1:1 due to high yield and formation of conductive polyaniline which was confirmed by FTIR
3. Discussion of composite strategies