

Electrochemical sensor by immobilizing Haemoglobin over composite material based on Polyaniline, MWCNTs and Araucaria Columnaris (LATEX) for H₂O₂ detectionVineeta Gautam[#], Harsh Vardhan¹ Bineswar Brahma Engineering College, Kokrajhar, Assam-783370, India.[#] Email: gautamvinita09@gmail.com

Abstract: A novel biocompatible composite based on Polyaniline, MWCNTs and latex (*Araucaria Columnaris*) was prepared and used as matrix for haemoglobin immobilization. Latex, emulsion of group of polysaccharides, was obtained from Christmas tree (*Araucaria Columnaris*). Naturally occurring polysaccharides were incorporated within the Polyaniline matrix along with MWCNTs. MWCNTs improve the bulk conductivity of the materials whereas latex provides biocompatibility (due to the presence of large number of hydroxyl group). The composite material is characterized by using different instrumental techniques such as FTIR, UV-Visible, XRD, SEM, Cyclic voltammetry and amperometry. A capillary electrode was fabricated with carbon paste and hydrogen peroxide is detected by using haemoglobin. Redox behavior of the composites are analyzed by comparing cyclic voltammogram at different scan rate (200, 100, 50, 10 mV/s) and at different pH (PBS buffer solution at 1, 2, 3, 4, 5, 6, 7). Detection of hydrogen peroxide is important in many fields viz industry, environmental protection and clinical control. We have immobilized haemoglobin within the composite material and used for the fabrication of H₂O₂ sensor.

Polyaniline is one of the oldest known conducting polymers, and has been extensively reviewed by the researchers. PANI, originally known as aniline black, is a very promising material because of its ease of synthesis, low cost monomer, redox activity, ion exchange properties, tunable properties and better environmental stability. PANI has potential applications in anti-static and electromagnetic interference shielding, fuel cells, display devices, separation membrane, anticorrosion coating, sensors, supercapacitors, electrodes and batteries fields. Many researchers also used natural fiber for the preparation of composite with PANI.

Protonation of the polymer, also known as doping, is the mechanism by which polyaniline becomes electrically conductive. However its conductivity is influenced by various factors including its electrochemical redox state, pH, humidity, temperature, and the type of anions in the solution. The conductivity of polyaniline, in its pressed-pellet form, is typically in the range 2–10 S/cm. However, it is very difficult to produce the neat PANI films because of its infusibility, poor mechanical properties, and poor solubility in all available solvents except doping with a suitable dopant or modifying the monomer.

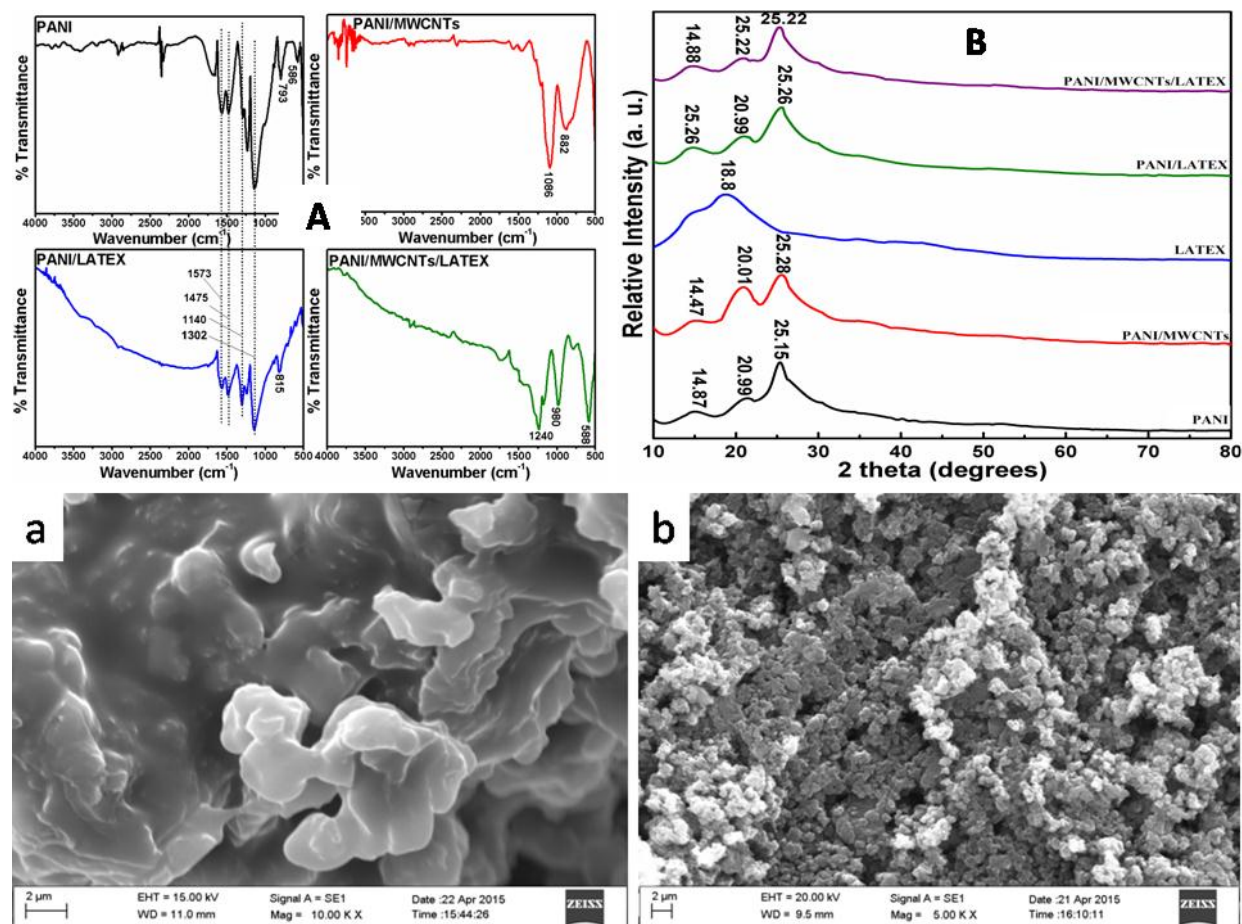


Figure 1: (A) Schematic representation of the FTIR spectra of PANI, PANI/MWCNTs, PANI/LATEX and PANI/MWCNTs/LATEX: (B) XRD spectra of PANI, PANI/MWCNTs, LATEX, PANI/LATEX and PANI/MWCNTs/LATEX: 1(a) SEM image of LATEX and (b) PANI/MWCNTs/LATEX

FTIR spectra provide structural information, i.e., functional groups, aggregation and alignment of chains, and the level of doping. The spectra obtained have all of the characteristic peaks for polyaniline, as reported in the literature. Important stretching frequencies have been summarized and compared.

In this talk, we will present the preparation and characterizations of PANI/MWCNTs/LATEX composite such as FTIR, UV, Raman, XRD, TGA, Cyclic Voltammetry with different scan rates HCL, buffer solution and the performance of H₂O₂ detection. Sensitivity, detection limit.

References:

- [1] Hung C. C., Wen T. C., Wei Y., Materials Chemistry and Physics, 2010, 122, 392–396.
- [2] Gautam V., Pratap Singh K. P., Yadav V. L. ACS Sustainable Chemistry & Engineering, 2018, 6(2), 2256–2268.
- [3] V. Gautam and H. Vardhan, as an Assistant Professor in the department of Chemical Eng. (BBEC), Kokrajhar Assam.

5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN:978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.