

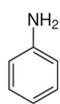
Abstract

This research focuses on the fabrication of electrospun nanofiber film composed of polyaniline (PANI) and poly(3-aminobenzoic acid) (PABA) using the electrospinning technique. The PANi/PABA copolymer was firstly synthesized through chemical polymerization at a 1:1 ratio. The PANi/PABA copolymer was subsequently processed into nanofiber film using the electrospinning technique under controlled parameters, including an applied voltage of 10 kV, a solution flow rate of 1.0 mL/h, a total volume of 5 mL, a processing duration of 10 minutes, and a needle-to-collector distance of 10 cm. The morphological analysis revealed that the PANi/PABA nanofiber film exhibited a fibrous structure with an average fiber diameter of 135.56 nanometers. Fourier-transform infrared spectroscopy with attenuated total reflectance (ATR-FTIR) confirmed the presence of key functional groups, including O-H, N-H, C=O, and C=C, indicating the effective integration of the two polymers. Furthermore, electrochemical characterization using cyclic voltammetry (CV) demonstrated distinct redox behavior in phosphate-buffered saline (PBS), with anodic and cathodic currents increasing as the scan rate increased. These results suggested that the PANi/PABA nanofiber films exhibited favorable electrical properties, making them suitable for electrochemical sensing applications. For sensitivity study, the PANi/PABA nanofiber films presented sensitivity for DA measurement of $7.44 \text{ nA} \cdot \text{cm}^{-2} \mu\text{M}^{-1}$ with linear ranges of 400-900 nM ($R^2 = 0.9886$). This study highlights the potential of the developed PANi/PABA copolymer as a promising material for high-performance biosensor applications.

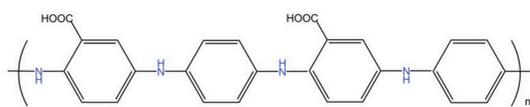
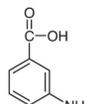
Introduction

The development of conductive polymers for biosensor applications has attracted significant interest, as these materials offer adjustable properties and high specificity in detecting target biomolecules. This study focuses on the fabrication of PANi/PABA copolymer nanofiber films using the electrospinning technique under controlled conditions. The resulting films were evaluated for their electrochemical properties in dopamine detection using cyclic voltammetry (CV) and differential pulse voltammetry (DPV), demonstrating high sensitivity and selectivity.

aniline; ANI



3-aminobenzoic acid; ABA



Polyaniline/Poly(3-aminobenzoic acid); PANi/PABA

Results and Discussions

SEM

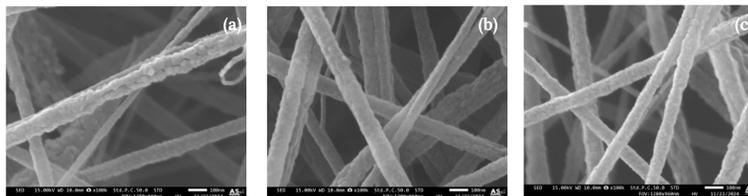


Figure 1: SEM images of electrospun nanofiber (a) PANi (b) PABA (c) PANi/PABA thin film under conditions: 10 kV applied voltage, 1.5 mL/h solution flow rate, 15 cm collector distance, and 5 minutes of electrospinning time.

ATR-FTIR spectra

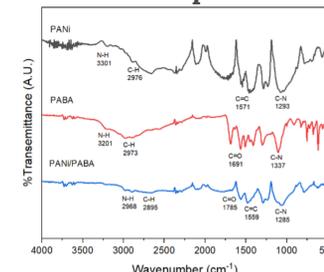


Figure 2: FTIR spectra of powders (a) PANi (b) PABA (c) PANi/PABA

Electroactivity

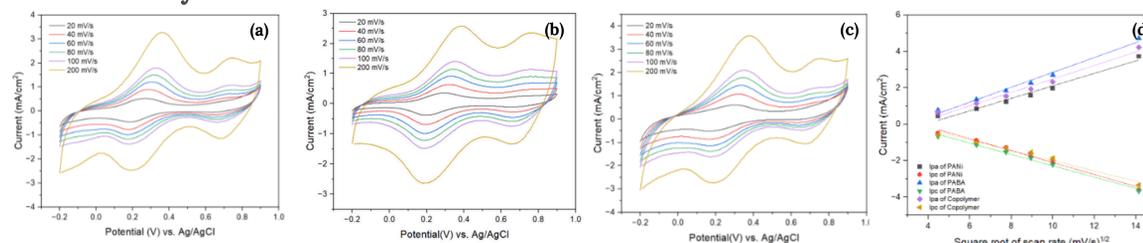
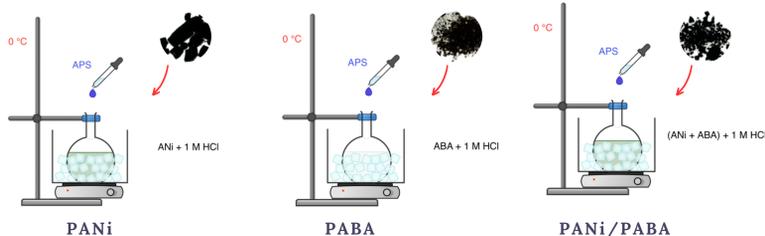


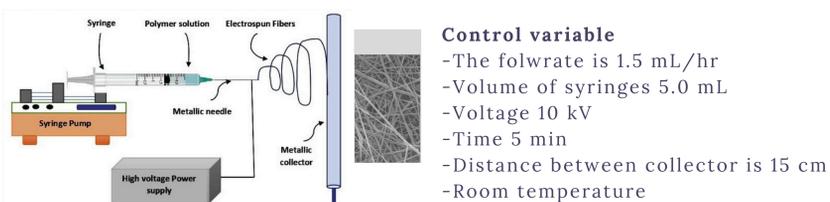
Figure 3: Cyclic voltammograms providing voltage in the range of -0.2 – 0.9 V at scan rates of 20, 40, 60, 80, 100 and 200 mV/s for (a) PANi (b) PABA (c) PANi/PABA (d) linear plot between anodic current and cathodic current of fiber film electrodes in PBS.

Experiment

Synthesis of PANi PABA and PANi/PABA



Electrospinning setup



Electrochemical detection



Electrochemical detection

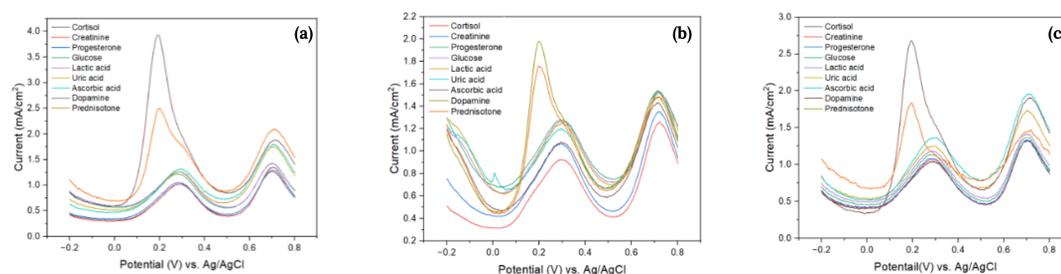


Figure 4: DPV responses for selectivity study of electrospun nanofiber (a) PANi (b) PABA (c) PANi/PABA thin films.

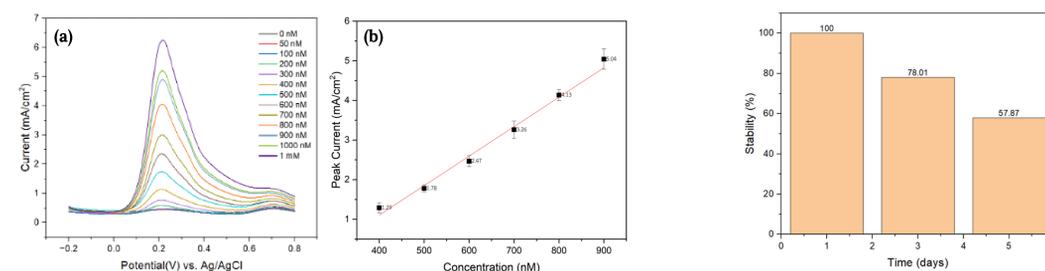


Figure 5: DPV responses for sensitivity study of electrospun nanofiber thin film to measure DA at various concentrations in PBS.

(a) PANi/PABA at various concentrations.
(b) linear plot between dopamine concentration and peak current of the PANi/PABA nanofiber film.

Figure 6: Stability histograms of electrospun nanofiber PANi/PABA thin film for 5 days

Conclusions

- The electrospun nanofiber thin film of PANi/PABA was successfully fabricated using the electrospinning method for use in dopamine detection.
- ATR-FTIR spectra confirmed the presence of functional groups, including O-H, N-H, and C=C of the film.
- The obtained electrospun nanofiber PANi/PABA thin film exhibited high sensitivity and selectivity for dopamine detection.
- The DA detection performances were 400-900 nM, LOD: 0.0633 μM , LOQ: 0.2109 μM , R^2 : 0.98861.
- The film retained 57.87% stability after 5 days, demonstrating its durability over time.
- The film exhibited a reproducibility of 3.888%, indicating good measurement consistency.

Acknowledgements

The authors would like to offer the special thanks to the CMU Mid-Career Research Fellowship for financial support and the Department of Chemistry for giving an opportunity and partial support

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