

RESEARCH PROPOSAL

Title:

Development and Characterization of Natural Biopolymer-Based Polymer Electrodes Using Mustard-Doped Iota-Carrageenan and Fish Gelatin-PVA Composites

1. Introduction:

Natural biopolymers are increasingly being explored as sustainable materials for next-generation electrochemical devices due to their biodegradability, renewability, and environmental compatibility. This project focuses on developing biopolymer-based polymer electrodes using two systems: (1) mustard-doped iota-carrageenan and (2) fish gelatin blended with polyvinyl alcohol (PVA) and doped with sodium iodide. Both systems aim to improve ionic conductivity and electrochemical performance using eco-friendly approaches.

2. Objectives:

- To synthesize biopolymer membranes using mustard-doped iota-carrageenan and fish gelatin-PVA composites.
- To enhance electrochemical properties through doping (mustard, sodium iodide) and blending techniques.
- To characterize the films for structural, optical, and electrochemical properties.
- To evaluate their potential application as polymer electrodes in energy storage devices.

3. Methodology:

- Film Fabrication:
 - Prepare iota-carrageenan and fish gelatin-PVA composites using solution casting in distilled water.
 - Dope iota-carrageenan with mustard and blend fish gelatin with various concentrations of NaI.
- Characterization Techniques:
 - FTIR Spectroscopy: To identify functional groups and confirm interactions.
 - XRD: To analyze crystalline nature and phase structure.
 - UV-Visible Spectroscopy: To study optical absorbance, transparency, and band gap.
 - AC Impedance Spectroscopy: To measure conductivity and charge transfer resistance.

4. Significance of the Study:

Combining natural polymers with functional dopants offers a sustainable route to advanced polymer electrodes. This study explores the structural, electrical, and optical behavior of two distinct biopolymer systems, contributing to the development of environmentally friendly materials for electrochemical technologies like batteries, sensors, and capacitors.

5. Timeline:

Phase	Duration
Literature Survey	3-4 week
Material Preparation	5-8 week
Film Fabrication	4-5 week
Characterization	6-7 weeks
Data Analysis & Report	8-9 weeks

6. Expected Outcomes:

- Biopolymer-based polymer films with enhanced ionic conductivity.
- Comparative data on the effectiveness of mustard and sodium iodide doping.
- Identification of the better-performing composition for future electrochemical device applications.