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REVIEWER'S REPORT

Manuscript No.: **IJAR-50516** Date: 03-03-2025

Title: **AC Conductivity and Dielectric Behavior of Ethyl Cellulose/Polyvinyl Alcohol Polyblend Thin Films**

Recommendation:
Accept as it

Rating	Excel.	Good	Fair	Poor
Originality		√		
Techn. Quality		√		
Clarity			√	
Significance			√	

Reviewer Name: Dr. Manju M **Date:04-03-2025**

Reviewer's Comment for Publication.

1. The study demonstrates that both temperature and frequency significantly affect the AC conductivity, with conductivity increasing at higher temperatures and frequencies, indicating potential for use in temperature-sensitive and high-frequency electronic applications.
2. The dielectric constant of the EC-PVA blend shows a temperature-dependent variation, suggesting its potential use in applications where dielectric properties need to be optimized across a range of temperatures.
3. The results indicate that the EC-PVA polyblend has promising properties for use in electronic and dielectric devices, as it offers tunable conductivity and dielectric behavior that can be adjusted based on temperature and frequency.

Detailed Reviewer's Report

1. The study investigates the AC conductivity and dielectric behavior of Ethyl Cellulose (EC) and Polyvinyl Alcohol (PVA) polyblend thin films to explore their potential applications in electronic and dielectric devices. The primary aim is to analyze the temperature and frequency-dependent electrical properties of these films.
2. The measurements were performed using a 4284 LCR meter, with the temperature range set from 303K to 343K and the frequency range from 1 kHz to 1 MHz. The EC-PVA films were prepared using the solution-casting method and were subjected to various tests to measure their AC conductivity and dielectric constant.

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3. The AC conductivity of the EC-PVA thin films showed an **increase with temperature** at all frequencies, suggesting that higher thermal energy promotes charge carrier mobility. Additionally, at constant temperatures, the AC conductivity increased with frequency, which is typical for polymer materials due to enhanced charge transport at higher frequencies.
4. The dielectric constant of the EC-PVA thin films **decreased with increasing frequency**, a characteristic behavior of most dielectric materials. This is attributed to **dielectric relaxation**, where the molecular dipoles are unable to reorient quickly enough to keep up with the changing electric field at higher frequencies, leading to a reduction in polarization.
5. The dielectric constant also **decreased with increasing temperature**, as higher temperatures increase the thermal motion of the polymer molecules, disrupting the alignment of dipoles and reducing the material's ability to polarize in response to an applied electric field.
6. The reduction in dielectric constant with increasing frequency and temperature is explained by dielectric relaxation. At higher frequencies, the dipoles do not have enough time to reorient in the applied electric field, leading to **anomalous dispersion** and a decrease in the dielectric constant. This relaxation mechanism is typical in polar polymer systems.
7. The findings suggest that EC-PVA polyblend thin films are suitable for use in **electronic devices** like capacitors, dielectric resonators, and other components where temperature- and frequency-dependent conductivity and dielectric properties are crucial. Their **high-frequency dielectric properties** make them promising for use in **RF electronics** and **high-frequency sensors**.
8. The study concludes that EC-PVA polyblend thin films exhibit **temperature- and frequency-dependent behavior** in both AC conductivity and dielectric constant, making them ideal candidates for various **electronic and dielectric applications**. These materials show the potential to be further optimized for use in advanced electronic devices that require tailored electrical properties.

Significant:

- The AC conductivity of EC/PVA thin films increases with both temperature and frequency.
- The dielectric constant decreases with increasing frequency, which is attributed to dielectric relaxation and the inability of polar molecules to align with the electric field at higher frequencies.
- Both the AC conductivity and dielectric constant show variations with temperature, with conductivity increasing and dielectric constant decreasing as temperature rises.