



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University)
Coimbatore – 641 035.



23AGT207 Engineering Properties of Agriculture Produce

Unit III Thermal Properties

3.5. Frictional Properties – Impedance and Admittance of Agricultural Produce

Impedance and admittance, measured using techniques like Electrical Impedance Spectroscopy (EIS), are used to assess the quality and properties of agricultural produce, offering a non-destructive way to analyze aspects like moisture content, ripening, and even freezing damage.

Impedance and Admittance in Agricultural Produce:

Impedance (Z): Opposition to the flow of alternating current through a material, measured in Ohms (Ω).

Admittance (Y): The reciprocal of impedance, representing the ease with which current flows through a material, measured in Siemens (S).

Electrical Impedance Spectroscopy (EIS): A technique that measures the impedance of a material over a range of frequencies, providing information about its electrical properties.

Applications:

- **Quality Assessment:** EIS can be used to determine the quality of agricultural products, such as fruits, vegetables, and grains, by analyzing changes in impedance related to factors like moisture content, ripening, and freezing damage.
- **Non-Destructive Testing:** EIS is a non-destructive method, meaning it doesn't damage the sample during testing, making it a valuable tool for quality control and research.
- **Grain Quality:** EIS has been used to study aspects of grain quality, including seed aging, moisture content, variety discrimination, and frostbite assessment.
- **Ripening:** Changes in impedance during ripening can be used to monitor the progress of ripening in fruits and vegetables.
- **Freezing Damage:** EIS can be used to assess the extent of freezing damage in agricultural products.

Factors Affecting Impedance:

- Moisture Content: Higher moisture content generally leads to lower impedance.
- Temperature: Temperature can affect the impedance of agricultural products.
- Frequency: Impedance can vary with the frequency of the applied alternating current.
- Chemical and Physical Characteristics: The composition and density of the material also influence its impedance.

Case studies

- A study on apples and bananas used EIS to monitor the progress of ripening during 13 days at room temperature.
- The characteristic points Zextra, Zintr, and Zcyt from electrical impedance spectroscopy can be used to indicate the freezing damage level in potatoes.
- The Zcyt value could be used for detecting freezing injury in potatoes.
- A study on A2 milk and UHT milk showed that A2 milk had higher density, fat, protein, and total solids content compared to UHT milk without A2 certification, and it also obtained a higher electrical impedance modulus and lower admittance within the analyzed frequency range (1 kHz a 5 MHz).

Activity:

Case study on the Application of electrical impedance spectroscopy for the characterisation of yoghurts.

<https://doi.org/10.1016/j.idairyj.2023.105625>