



SNS COLLEGE OF TECHNOLOGY

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Application of Non-Destructive Testing (NDT) in Food Quality Assessment for Grains

Introduction

Non-Destructive Testing (NDT) methods are analytical techniques that evaluate the properties of a material **without causing damage**. In the food industry, especially for grains, NDT techniques are widely used for **quality assessment, safety assurance, and grading**, enabling rapid and reliable inspection throughout the supply chain.

Key NDT Techniques for Grain Quality Assessment

1. Near-Infrared (NIR) Spectroscopy

Principle: Measures the absorption of near-infrared light by molecular bonds (O-H, N-H, C-H).

Applications:

Moisture, protein, and starch content determination.

Variety identification and adulteration detection.

Quality grading and maturity assessment.

Advantages: Fast, non-invasive, and suitable for inline analysis.

2. Hyperspectral Imaging (HSI)

Principle: Combines imaging and spectroscopy to capture spatial and spectral data.

Applications:

Detection of fungal infections and insect damage.

Classification based on chemical composition.

Identification of surface defects and contamination.

Advantages: Comprehensive visual and chemical profiling.

3. X-ray Imaging

Principle: Uses X-rays to visualize internal structures of grains.

Applications:

Detection of internal insect infestation and voids.

Identification of foreign materials like stones and glass.

Advantages: Clear internal assessment without destruction.

4. Ultrasound Techniques

Principle: High-frequency sound waves assess physical properties of grains.

Applications:

Determining hardness and bulk density.

Identifying fractures or voids.

Advantages: Cost-effective and suitable for bulk grain screening.

5. Dielectric and Microwave Methods

Principle: Measures dielectric properties related to moisture and quality.

Applications:

Rapid moisture estimation in storage facilities.

Differentiation between healthy and spoiled grains.

Advantages: Real-time, non-contact, and scalable.

Benefits of NDT in Grain Quality Evaluation

Non-invasive, preserving sample integrity.

Rapid, real-time, and reliable analysis.

Reduces labor and subjective errors.

Enables continuous monitoring and automation.

Conclusion

NDT techniques are revolutionizing the way grain quality is assessed. With the integration of **AI and machine learning**, these methods offer enhanced accuracy, faster results, and better control across processing and supply chains—paving the way for **smart and sustainable agriculture**.