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# Development of a System for Measuring the Dielectric Permeability of the Air Environment to Improve the Storage of Pome Fruits

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## Abstract

The article considers the problem of controlling the concentration of ethylene during fruit storage, which critically affects their ripening and quality preservation. The authors propose a new high-precision system for indirect determination of ethylene content based on changes in the dielectric permittivity of the air medium. The methodology is based on a resonant method with a frequency discriminator operating on an open resonator with a frequency autotuning system. Transient processes are simulated and system parameters are optimized. The results demonstrate extremely high accuracy (up to 10<sup>-3</sup> %), sensitivity (10<sup>-9</sup>) and stability of operation (up to 10<sup>-9</sup>) which allows for effective detection of even low concentrations of ethylene. The originality of the development lies in the integration of modern technologies of high-frequency electronics, metrology and automatic control for agricultural applications. The system has significant practical value, in particular for automated monitoring of fruit storage conditions and can be adapted to other areas of gas analysis. ©2025 IEEE.

## Abstract

Author keywords

Indexed keywords

Funding details

## Author keywords

automated control; dielectric constant; ethylene; frequency autotuning; frequency discriminator; fruit storage; gas analytical system; high-frequency electronics; metrology; resonance method

## Indexed keywords

### Engineering controlled terms

Automation; Discriminators; Food storage; Fruits; Permittivity; Process control

### Engineering uncontrolled terms

Analytical systems; Automated control; Autotuning; Dielectric permeability; Frequency autotuning; Frequency discriminators; Fruit storage; Gas analytical system; High-frequency electronics; Resonance methods

### Engineering main heading

Ethylene

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