

United States Department of Agriculture
Project Initiation

Project Data for Accession Number 1033829

Project Title

AI-accelerated detection of microbial spoilage in juice processing for enhanced food quality and waste reduction

Project Details

Sponsoring Institution National Institute of Food and Agriculture	Project Status ACTIVE
Funding Source NIFA Non Formula	Grant Year 2025
Grant No. 2025-67017-44834	Cumulative Award Amt. \$611,000.00
Proposal No. 2024-12011	Multistate No. (N/A)
Project Start Date Sep 01, 2025	Project End Date Aug 31, 2028
Program Code [A1364] Innovations in Food Manufacturing Technologies	

Project Director

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Recipient Organization

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Performing Department

(N/A)

Non Technical Summary

Microbial spoilage of fruit and vegetable juices is a chronic threat to food quality and causes food waste. Yeasts are the predominant contaminants in juices as they can proliferate in acidic pH and high sugar conditions. Detecting yeasts is necessary to monitor processing efficacy and reduce spoilage risks. However, conventional detection methods are either time-consuming or require sophisticated equipment and well-trained personnel. We aim to develop an artificial intelligence (AI)-based imaging approach for the early detection of spoilage yeasts with low labor inputs. The success of this study will provide food industries with a rapid and easy-to-use monitoring tool to verify and optimize the efficacy of processing and sanitation, leading to better preventative control measures and ensuring the microbiological quality and safety of food products.

Animal Health Component

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Animal Health Component: 0%

Research Effort Categories

Basic	0%
Applied	50%
Developmental	50%

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
404	7410	2080	50%
404	4020	2020	50%

Knowledge Area

[404] Instrumentation and Control Systems

Subject Of Investigation

[7410] General technology

[4020] Fungi (includes yeast)

Field Of Science

[2080] Mathematics and computer sciences

[2020] Engineering

Keywords

artificial intelligence, food quality, juice processing, microbial detection, Yeast spoilage

Goals / Objectives

The overall goal is to develop an artificial intelligence (AI)-based imaging approach for the early detection of live spoilage yeasts in the juice manufacturing industry. To achieve this goal, the supporting objectives are: (i) Develop an AI-based imaging approach to rapidly detect different species of spoilage yeast. (ii) Evaluate the detection performance of yeast after processing stress. (iii) Validate the feasibility of the AI-based imaging approach in monitoring spoilage yeast contamination during juice processing at pilot-plant scale.

Project Methods

We will first develop an AI-based imaging approach to detect spoilage yeasts that are associated with juice manufacturing. A representative image dataset of yeast species will be created for training various deep learning models. The best model will be selected based on performance metrics such as accuracy and precision. Additionally, yeast cells will be treated by simulating processing stress. A new machine learning model will be developed to

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optimize the detection of the pre-stressed yeast cells. The feasibility of this approach will be validated in juice pilot plants by spiking yeast into juices under different processing scenarios and comparing AI-based imaging results with conventional plating assays.