Title Onion sour skin detection using a gas sensor array and support vector machine

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Abstract

Onion is a major vegetable crop in the world. However, various plant diseases, including sour skin caused by *Burkholderia cepacia*, pose a great threat to the onion industry by reducing shelf-life and are responsible for significant postharvest losses in both conventional and controlled atmosphere (CA) storage. This study investigated a new sensing approach to detect sour skin using a gas sensor array and the support vector machine (SVM). Sour skin infected onions were put in a concentration chamber for headspace accumulation and measured three to six days after inoculation. Principal component analysis (PCA) score plots showed two distinct clusters formed by healthy and sour skin infected onions. The MANOVA statistical test further proved the hypothesis that the responses of the gas sensor array to healthy onion bulbs and sour skin infected onion bulbs are significantly different ($P < 0.0001$). The support vector machine was employed for the classification model development. The study was undertaken in two phases: model training and cross-validation within the training datasets and model validation using new datasets. The performances of three feature selection schemes were compared using the trained SVM model. The classification results showed that although the six-sensor scheme (with 81% sensor reduction) had a slightly lower correct classification rate in the training phase, it significantly outperformed its counterparts in the validation phase (85% vs. 69% and 67%). This result proved that effective feature selection strategy could improve the discrimination power of the gas sensor array. This study demonstrated the feasibility of using a gas sensor array coupled with the SVM for the detection of sour skin in sweet onion bulbs. Early detection of sour skin will help reduce postharvest losses and secondary spread of bacteria in storage.

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