Field asymmetric ion mobility spectrometry for pre-symptomatic rot detection in stored Ranger Russet and Russet Burbank potatoes

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Abstract

This study was aimed at early detection and rot progression monitoring in stored potatoes using a portable field asymmetric ion mobility spectrometry (FAIMS) system. Tuber samples of Ranger Russet (RR) and Russet Burbank (RB) cultivars were inoculated with *Pectobacterium carotovorum* subsp.*carotovorum* (causes soft rot) and sterile water (control). The samples were stored in jars either at room temperature (25 °C with 30 % relative humidity [RH]) or reduced temperature (4 °C with 95 % RH). Volatile headspace from samples was scanned with FAIMS at regular intervals up to 14 days for room temperature and 31 days for reduced temperature storages. Infection symptoms were detected for higher ion current pertinent to headspace of inoculated samples compared to the controls of both the cultivars. Such discrimination was evident at FAIMS compensation voltage (CV)-dispersion field (DF) ranges of −1.70–1.31 V and 38–90 % for room temperature and −1.58–1.31 V and 36–92 % for reduced temperature storages. The rot was detected as early as one day after inoculation (DAI) under room temperature and five DAI under reduced temperature storages. The ion currents were affected by the storage temperature and humidity, and associated interaction with the DAI and cultivar ($F_{7,712}$ = 21.6–31.4, $p < 0.001$). The FAIMS responses of control and inoculated tubers were also classified by the Naïve Bayes and Random Forest algorithms at accuracies in the ranges of 70–90 % and 75–100 %, respectively. Overall, a portable and tunable FAIMS system was found suitable for high throughput early detection of soft rot in potato tubers. Future studies need to revalidate the FAIMS system in commercial storage facilities for timely rot detection and initiation of potential remedial measures.