Headspace analysis of shelf life of postharvest arugula leaves using a SERS-active fiber

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Abstract

The increasing market demand for Ready-To-Eat fresh produce promotes the keen interest in developing a rapid, sensitive and reliable method for determining the shelf life of fresh-cut produce. In this study, we developed a non-destructive headspace detection approach using gold nanoparticles (AuNPs) coated fibers coupled with surface-enhanced Raman spectroscopy (SERS), to detect volatile biochemical changes during postharvest storage of arugula leaves. The headspace detection revealed significant spectral changes during the freshness decline, in the shifts around 500, 950 and 1030 cm^{-1}. These changes were analyzed using principal component analysis (PCA) to classify and establish a prediction model for remaining shelf life determination. Through analyzing reference standard volatile organic compounds (VOCs), we identified dimethyl disulfide (DMDS), methanethiol (MT) and 1-propanethiol were most likely to account for the signature spectra of arugula headspace at the late storage period due to the growth of spoilage bacteria. In conclusion, the headspace detection based on SERS fibers provides a new strategy for monitoring the quality and shelf life of fresh produce and thus reducing food waste.