

朱 娜,毛淑波,潘磊庆,袁丽佳,屠 康.电子鼻对草莓采后贮藏早期霉菌感染的检测[J].农业工程学报,2013,29(5):266-273

电子鼻对草莓采后贮藏早期霉菌感染的检测

Early detection of fungal disease infection in strawberry fruits by e-nose during postharvest storage

投稿时间: 2012-10-15 最后修改时间: 2013-02-22

中文关键词: [病害](#),[主成分分析](#),[无损检测](#),[电子鼻](#),[草莓](#),[气质联用](#)

英文关键词: [diseases](#) [principal component analysis](#) [nondestructive examination](#) [e-nose](#) [strawberry](#) [gas chromatography mass spectrometry](#)

基金项目:国家自然科学基金(31101282);中央高校基本科研业务费专项资金(KYZ201120);农业部948项目(2011-S10);江苏省高校优势学科建设工程;中农-南农青师开放基金(NC2008004)和大学生创新训练(1218A24)资助

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中文摘要:

为了实现电子鼻对草莓贮藏期常见霉菌感染的早期检测,对草莓果实分别接种灰霉、扩展青霉和根霉3种主要病原菌,以无菌水处理为对照组,每2 d采用PEN3电子鼻取草莓的气味,并用气质联用技术分析草莓气味。结果表明,草莓接种病原菌2 d后,主成分分析能够正确区分正常果实(对照组)与病害果实,且可以较好区分草莓病原菌种类,多元方差分析结果也显示接种不同病原菌对草莓果实挥发性物质的影响差异显著($P < 0.05$),通过Fisher判别建立的回归函数对3种病原菌灰霉、扩展青霉及对对照组的判别正确率分别为100%、93.3%、86.7%和100%。载荷分析及气质联用技术结果表明病原菌对草莓果实挥发性物质的影响主要体现在烃类及酯类的变化。该结果可为实现草莓采后贮藏和流通过程中质量变化和病原微生物的感染进行无损快速检测和监测提供参考。

英文摘要:

Strawberry postharvest diseases usually cause heavy losses in storage. Electronic nose (PEN3) containing an array of 10 different metal oxide sensors was used to detect and classify three kinds of common postharvest fungal diseases of strawberry fruit: Botrytis sp. (BC), Penicillium sp. (PE) and Rhizopus sp. (RH) in this paper. Ripe strawberry fruits were inoculated individually with the three pathogens and non-inoculated samples with sterile water treatment as control. Volatile compounds emanating from strawberry fruit were assessed using PEN3 every two days after inoculation. On the second day after invocation, the principal component analysis (PCA) of volatile profiles can clearly distinguish between normal and infection strawberry fruit; Furthermore, it can discriminate three groups of strawberry fruit with different pathogenic bacteria. Multivariate analysis of variance (MANOVA) was conducted on the e-nose sensors' response to the strawberry fruit with different treatment on the second day and the volatile compounds were analyzed by gas chromatography mass spectrometry (GC-MS). The results confirmed that the four treatments were significantly different ($P < 0.05$). A Fisher classifier was set up and achieved classification accuracy 100%, 93.3%, 86.7% and 100% for treatment of BC, PE, RH and CK, respectively. Loading analysis and GC-MS were used to characterize volatile compounds emanated from the four groups of strawberry fruit, hydrocarbons and esters were identified as contributing mostly in distinguishing differences in the volatiles emanating from the fruit due to infection. This study showed the potential feasibility for the rapidly nondestructive detection and monitoring of quality and fungal disease infection of strawberry fruits during postharvest storage using an electronic nose.

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