基于高光谱成像技术的红枣无损检测及智能分选

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摘要:【目的】探究不同成熟期原料枣热风加工后品质差异，并利用高光谱成像技术实现对干制枣无损检测和品质分选。【方法】以 Kimri（Ⅰ）和 Rutab（Ⅱ）成熟阶段经热风干制的中阳木枣和圆领枣干制枣为研究对象，通过对采集的光谱图像获取其平均光谱数据，利用 PCA 技术实现品质分选的初步探究并集合不同预处理方法对光谱信号进行变换和增强，建立基于 PLSR 的回归定量分析模型和基于 PLS-DA 的分类模型。【结果】总共探究了 304 个样本的可溶性固形物和硬度统计数据，实验结果表明不同成熟阶段的原料枣在相同干制条件下，其指标分布差异显著，通过构建的 PLSR 模型，实现了对 SSC 和硬度的定量预测分析，测试集 R^2 分别为 0.91 和 0.85，通过构建的 PLS-DA 实现了对不同成熟度原料枣的分类，测试集分类准确度达到 91.25%。【结论】基于高光谱成像技术可以有效实现对干制枣的 SSC 和硬度的回归建模，实现定量分析；并且可以有效追踪原料枣成熟度，为进一步研究利用光谱技术快速无损检测果蔬类干制处理后检测研究奠定了基础。

关键词: 成熟度；可溶性固形物；硬度；干制枣；高光谱

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Non-destructive testing and intelligent sorting of Red jujube based on hyperspectral imaging technology.

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Abstract:【Objective】o investigate the quality difference of raw jujube at different maturity stages after hot air processing, and to realize non-destructive testing and quality sorting of dried jujube by hyperspectral imaging technology.【Method】In the mature stage of Kimri (I) and Rutab (II), the hot air dried jujube and round neck jujube were selected as the research objects. The average spectral data of the collected spectral images were obtained, and the quality sorting was preliminarily explored by PCA technology, and different pretreatment methods were combined to transform and enhance the spectral signals. The regression quantitative analysis model based on PLSR and the classification model based on PLS-DA were established. 【Result】 The statistical data of SSC and hardness of 304 samples were explored in total. The experimental results showed that the index distribution of raw dates at different mature stages was significantly different under the same drying conditions. The quantitative prediction analysis of SSC and hardness was realized through the constructed PLSR model, and the test set R2 was 0.91 and 0.85, respectively. The PLS-DA was used to classify raw jujube with different maturity, and the classification accuracy of the test set reached 91.25%. 【Conclusion】The regression modeling of SSC and hardness of dried jujube can be effectively realized based on hyperspectral imaging technology, and quantitative analysis can be realized. And it can effectively track the maturity of raw jujube, which lays a foundation for further research on rapid non-destructive testing of fruits and vegetables after dry treatment by spectroscopic technology