利用近红外漫反射光谱技术进行苹果糖度无损检测的研究

Non-destructive determination of sugar contents of apples using near infrared diffuse reflectance

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英文关键词：apple; sugar content; near infrared spectrum; principal component regression; partial least square

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中文摘要：

　　利用近红外漫反射光谱技术，研究了1300～2100 nm波长范围内无损检测苹果糖度的可行性。采集了每个苹果去皮前、后最大横径上四个点的近红外平均光谱和整个苹果的糖度值。采用主成分回归(PCR)和偏最小二乘法(PLS)对试验数据进行了多元统计分析。结果表明：在1300～2100 nm波长范围内无损检测(即带皮检测)苹果的糖度是可靠的，并且PLS模型的性能更优于PCR模型。本文还对用单测点光谱和多测点平均光谱建立的糖度模型进行了研究，结果表明用单测点光谱预测整个苹果的糖度，其精度明显低于多测点平均光谱。这说明用苹果上一个点的光谱来预测整个苹果的糖度，其精度是不够的。因此，在利用近红外漫反射光谱在线检测苹果糖度时，作者建议采用多个光纤探头来采集多点光谱，然后取其平均值预测。

英文摘要：

　　Diffuse reflectance spectrum of near infrared (NIR) ranging from 1300 nm to 2100 nm was investigated for its feasibility to determine the sugar content (SC) of apple non-destructively. For each sampled Fuji apple before and after being peeled, the mean spectrum was calculated by averaging the spectra collected at four sampling locations around its equator, and the value of SC was measured with a Brix refractometer after the whole apple being squeezed into juice. Then all data were analyzed by principal component regression (PCR) and partial least square (PLS). Results show that NIR diffuse reflectance between 1300 nm and 2100 nm is applicable to non-destructive determination of the SCs of apples, and that the PLS could produce a better prediction effect than PCR. Models for predicting SC of whole apple developed from spectra of single measured sampling locations and from mean-spectrum of four spectra collected on each apple were studied. Result indicates that the latter shows better prediction precision than the former. So, it is suggested that mean-spectrum of several spectra collected by several fibers around the equator of each apple should be a better solution to predict SC on-line.

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