

牛肉嫩度的高光谱法检测技术 Hyperspectral Scattering Profiles for Prediction of Beef Tenderness

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摘要: 为实现对牛肉嫩度的预测和分级, 构建了试验用高光谱检测系统, 在400~1000 nm波长范围内获取牛肉表面的高光谱散射图像。从高光谱图像中提取牛肉的反射光谱曲线, 用step-wise逐步回归法选择 430、496、510、725、760和828 nm 6个波长建立了多元线性回归模型, 用全交叉验证法验证模型的预测效果, 模型的预测相关系数为0.96, 预测标准差为0.64 kg。以嫩度6.0 kg为界将样本分为嫩牛肉和粗糙牛肉2类, 特征波长处反射值为变量, 建立了正则判别函数对牛肉嫩度分级, 用全交叉验证法验证训练的效果。嫩牛肉分级准确率为83.3%, 较粗糙牛肉分级准确率为90.9%, 总的分级准确率为87.0%。研究表明该预测和分级技术具有一定的可行性。 To predict and classify beef tenderness, a laboratory hyperspectral imaging system was developed to capture hyperspectral scattering images from the surface of beef samples in the spectral region of 400~1000nm. Reflectance spectral characters were obtained from hyperspectral image. By using the method of step-wise regression, six optimal bands, 430, 496, 510, 725, 760 and 828 nm were selected for establishing the multi-linear regression (MLR) model. The model gives good prediction values of beef WBSF with the correlation coefficient of cross validation of 0.96 and the standard error of cross validation of 0.64 kg. Based on the measured tenderness values, samples were divided into two classes, i.e., group 0 (<6.0 kg) and group 1 (>6.0 kg). From selected bands, canonical discriminant functions were built to divide samples into two classes. The full cross validation was employed with the classification accuracy of 83.3% and 90.9%. Resultingly, the overall accuracy of classification is 87.0%. This research demonstrates that the hyperspectral imaging technique is useful for nondestructive determination of beef tenderness.

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