探討光學檢測豬肉中揮發性鹽基態氮含量

張為傑 (5110)

12/13/2017

大綱

摘要

傳統檢測揮發性鹽基態氮 (Total volatile basic nitrogen, TVB-N) 作為肉品新鮮度的指標，一般使用化學分析的方法，但檢測耗時，在快速生產線上，傳統的檢測方法已不適用，故本篇比較各項光學成像系統，以找尋最適用之肉品新鮮度光學檢測法。利用光散射成像技術，從感興趣區域 (Region Of Interest, ROI) 提取特徵變數，接著使用正交線性判別分析 (Algorithm adaptive boosting Orthogonal Linear Discriminant Analysis, AdaBoost–OLDA) 建立模組，與線性判別 (Linear Discriminant Analysis, LDA) 和支持向量機 (Support Vector Machine, SVM) 做比較，結果顯示 AdaBoost–OLDA 達到 100% 校準及預測的分類率，皆優於 LDA 和 SVM。 ROI 選定區域後，從高光譜圖像 (Hyperspectral Imaging, HSI) 得到質地分析，再使用最小二乘法預測 TVB-N，並比較二維主成分分析 (2D principal component analysis, 2DPCA)、主成分分析 (principal component analysis, PCA)，結果得到 2DPCA 的預測相關係數與預測均方根誤差分別為 0.995 與 1.86 mg/100g ，相較於 PCA 分析法證明 2DPCA 更能展現非破壞性檢測豬肉 TVB-N 含量。利用近紅外線 (near infrared, NIR) 多光譜成像技術 (multispectral imaging technique, MSI) 在不同波長光源下進行特徵成像，並和人工神經網路 (modeling-back propagation artificial neural network, BP-ANN) 及 AdaBoost 演算法 BP-AdaBoost 並比較。綜上，以光學成像系統搭配不同演算法檢測 TVB-N，相較於傳統的檢測方式更加快速準確，在市場上的使用將更有潛力。

Geesink, G. H., Schreutelkamp, F. H., Frankhuizen, R., Vedder, H. W., Faber, N. M., & Kranen, R. W., et al. (2003). Prediction of pork quality attributes from near infrared reflectance spectra. *Meat Science*, 65, 661–668.

Guo, T., Huang, M., Zhu, Q., Guo, Y., & Qin, J. (2018). Hyperspectral image-based multi-feature integration for TVB-N measurement in pork. *Journal of Food Engineering*, 218, 61-68.

Huang, L., Zhao, J., Chen, Q., & Zhang, Y. (2013). Rapid detection of total viable count (TVC) in pork meat by hyperspectral imaging. *Food research international*, 54(1), 821-828.

Huang, Q., Chen, Q., Li, H., Huang, G., Ouyang, Q., & Zhao, J. (2015). Non-destructively sensing pork's freshness indicator using near infrared multispectral imaging technique. *Journal of Food Engineering*, 154, 69-75.

Li, H.H., Kutsanedzie, F., Zhao, J.W., Chen, Q.S. (2016). Quantifying total viable count in pork meat using combined hyperspectral imaging and artificial olfaction techniques. *Food Analytical Methods*, Methods 9 (11), 1-10.

Li, H., Sun, X., Pan, W., Kutsanedzie, F., Zhao, J., & Chen, Q. (2016). Feasibility study on nondestructively sensing meat's freshness using light scattering imaging technique. *Meat science*, 119, 102-109.

Liu, D., Pu, H.B., Sun, D.W., Wang, L., Zeng, X.A. (2014). Combination of spectra and texture data of hyperspectral imaging for prediction of pH in salted meat. *Food Chemistry*, 160 (10), 330-337.

Panagou, E.Z., Papadopoulou, O., Carstensen, J.M., Nychas, G.-J.E. (2014). Potential of multispectral imaging technology for rapid and non-destructive determination of the microbiological quality of beef filets during aerobic storage. Int. J. *Food Microbiology*, 174, 1-11.

Perkins, E. A., & Squirrell, D. J. (2000). Development of instrumentation to allow the detection of microorganisms using light scattering in combination with surface plasmon resonance. *Biosensors and Bioelectronics*, 14(10), 853-859.

Prieto, N., Roehe, R., Lavin, P., Batten, G., & Andres, S. (2009). Application of near infrared reflectance spectroscopy to predict meat and meat products quality: A review. *Meat Science*, 83(2), 175-186.

Xiong, Z., Sun, D.W., Xie, A., Han, Z., Wang, L. (2015). Potential of hyperspectral imaging for rapid prediction of hydroxyproline content in chicken meat. *Food Chemistry*, 175, 417-422.

Ye, X., Iino, K., Zhang, S. (2016). Monitoring of bacterial contamination on chicken meat surface using a novel narrowband spectral index derived from hyperspectral imagery data. *Meat Science*, 122, 25-31