Design and development of an on-line fluorescence spectroscopy system for detection of aflatoxin in pistachio nuts

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Abstract

The on-line detection for aflatoxins contaminated agricultural products using fluorescence spectroscopy method is still a significant challenge due to its weak signal intensity and limitation of detection mode. Thus, the study for real-time aflatoxin B_1 (AFB_1) contaminated pistachios detection by a self-built laser induced fluorescence spectroscopy (LIFS) system coupled with three collection probes was investigated. A total of 600 kernels consisting of two pistachio varieties including "Yaoshengji" and "Wanlong" were artificially contaminated with five different concentrations of AFB_1 (5, 10, 20, 30, and 50 µg kg^{-1}). Good accuracy (> 91.0%) was obtained for classifying single variety of pistachios contaminated with low concentration of AFB_1 even for 5 µg kg^{-1} by linear discriminant analysis (LDA), irrespective of varietal differences. The partial least square regression analysis (PLS) model based on the variation selection method of competitive adaptive reweighted sampling (CARS) presented a considerable predictive precision (root mean square error of prediction (RMSEP) < 6.20 µg kg^{-1}) for pooled lot using 174–1100 nm at a detection speed of 1 kernel s^{-1}. Despite the preliminary feasibility for detection AFB_1 in pistachio kernels, the on-line LIFS system should be validated further using naturally contaminated samples.