

光学计量与测试

基于BP神经网络的荧光光谱法农药残留检测

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摘要:

针对目前农药残留难以实现快速准确检测的问题,利用神经网络方法对啶虫脒农药残留测量中的荧光混合光谱进行分离,设计了能够快速检测固体表面啶虫脒农药残留量的荧光光谱测量系统。根据反向传播算法,应用三层人工神经网络原理,对荧光光谱严重重叠的啶虫脒和滤纸混合体系进行啶虫脒残留量检测。在340nm~400nm范围内,以20个特征波长处荧光强度值作为网络特征参数,经网络训练和测试,啶虫脒浓度为40mg/kg和90mg/kg的回收率分别为102%和97%,测定结果相对标准偏差分别为1.4%和1.9%。实验结果表明, BP神经网络辅助荧光光谱法测定滤纸上啶虫脒农药残留,具有网络训练速度快、检测周期短、测量精度高等特点。

关键词: 神经网络 荧光光谱法 BP算法 啶虫脒

Pesticide residue detection by fluorescence spectral analysis based on BP neural network

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Abstract:

At present, it is a difficulty to achieve rapid and accurate detection of pesticide residues. In the paper, an overlapped spectrum in fluorescence spectroscopy measurements of acetamiprid residues was separated using artificial neural networks, and a fluorescence spectrum measuring system of solid surface acetamiprid residues was designed. By means of artificial neural network principle and back-propagation training algorithm, acetamiprid concentration was determined in mixed components of residues and filter paper with overlapped fluorescence spectrum. In the range of 340nm~400nm, the fluorescence intensities corresponding to 20 wavelengths were used as character parameters, and the neural network was trained and tested. The mean recoveries of 40mg/kg and 90mg/kg acetamiprid were 102% and 97% respectively. The RSDs of the results were 1.4% and 1.9%. The results have shown that the method to using BP network in fluorescence spectral analysis of acetamiprid residue has some advantages such as shorter measurement cycle, faster training speed and higher accuracy.

Keywords: artificial neural network fluorimetry back-propagation algorithm acetamiprid

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参考文献:

[1] TING K C, TAMASHIRO G S. Off-line high-performance liquid chromatography and solid-phase extraction clean-up for confirmation of pesticide residues in fresh produce by gas chromatography-mass spectrometry [J]. Journal of Chromatography, 1996, 754: 455-462.
[2] JOSE M C, ANA V, GUILLERMO S M, et al. Pesticide residue analysis by RPLC-GC in lycopene and other carotenoids obtained from tomatoes by supercritical fluid extraction [J]. Food Chemistry, 2009, 113: 280-284.

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[3] 吴根华, 何池洋. 人工神经网络-荧光光谱法同时测定维生素B1,B2,B6 [J] . 光谱学与光谱分析, 2003, 23(3): 535-538.

WU Gen-hua, HE Chi-yang. Application of artificial neural network to simultaneous spectrofluorimetric determination of vitamin B1, B2 and B6 [J] . Spectroscopy and Spectral Analysis, 2003,23(3):535-538. (in Chinese with an English abstract)

[4] RAUL R. Neural networks-A systematic introduction [M] . Berlin: Springer-Verlag, 1996:151-184.

[5] 葛哲学, 孙志强. 神经网络理论与MATLAB R2007实现 [M] . 北京: 电子工业出版社, 2007: 46-55.

GE Zhe-xue, SUN Zheng-qiang. Neural network theory and matlab application [M] . Beijing: Publishing House of Electronics Industry, 2007:46-55. (in Chinese)

[6] 王忠东, 王玉田. 常用农药荧光特性的理论与实验 [J] . 发光学报, 2005, 26(1): 120-124.

WANG Zhong-dong, WANG Yu-tian. Theoretical and experimental study on fluorescence characteristics of common pesticides [J] . Journal of Luminescence,2005,26(1):120-124. (in Chinese with an English abstract)

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