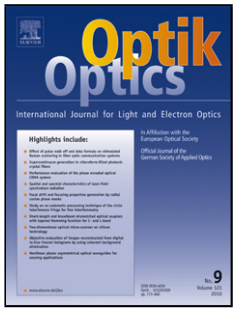

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Determination of Transgenic Organisms from Non-transgenic using Terahertz Spectroscopy and Chemometrics

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Abstract: A methodology is proposed to identify transgenic sugar beet from non-transgenic ones by using terahertz spectroscopy combined with chemometric techniques in this paper. Principal component analysis (PCA) is applied to reduce the dimension and extract the feature spectrum of original spectral information. instead of original spectral information, the characteristic spectrum is selected to fed into the model of weighted linear discriminate analysis (WLDA)which an improved linear discriminate analysis method. The experimental results indicates that the terahertz spectroscopy coupled to PCA-WLDA can provide a rapid, nondestructive and reliable method to distinguish transgenic and non-transgenic sugar beets.

Keywords: Spectroscopy, Sugar beet, Terahertz, Distinguish, Transgenic

1. Introduction

Sugar beet is one of the important vegetables. the study found that the sugar beet contains a substance called propanol diacid with can inhibit carbohydrate into fat. Due to the dangers of insect pests, the producers of sugar beet suffer huge economic losses. It increases the cost of production in spite of the damage may be alleviated by chemical pesticides. With the development of biotechnology, people can insect resistant genes into biological to improve the ability of resist insect[1-5]. Although the transgenic technology contribute to improve the production of plants and increase the resistance of plants to a certain extent, the potential threat of transgenic organisms is not ignored, such as agriculture, livestock, industry and medicine. Therefore, it is very importance to seek affordable and effective methods for rapid detection of transgenic products.

Although, the traditional gene detection method, including protein detection(PCR, ELISA, Western blot and so on) and DNA detection(Southern blot, GC/MS and so on)[6-11], are used to distinguish transgenic products, the disadvantages of above methods, such as high costs, time consuming, difficult operations and destructive of the sample, cannot be ignored. As an nondestructive detection tool, spectroscopy technology is widely adopted due to fast, simple operation and easy preparation. At present, Numerous literature proved that using Raman, near infrared(NIR) and visible near infrared can successfully to detect transgenic material [11-18].

Terahertz is an electromagnetic wave, whose frequency range is 0.1Tz to10THz (wavelength $30\,um$~$3\,mm$)[19,20]. Studies have shown that the vibration and rotational energy levels of most biological molecules locate in THz band. Duo to the terahertz have potential application of security, biological, medical detection and so on. However, there are rarely reported focusing on transgenic material using THz spectroscopy combined with chemometrics methods[21-24].