

空氣污染物對甘蔗葉片色素與反射光譜特徵之影響

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摘要

本文初步探討甘蔗受到空氣污染物傷害後,其葉片葉綠素、類胡蘿蔔素、花青素及類黃酮含量,以及葉片反射光譜之變化,並進行甘蔗葉片在此逆境中有最大反應光譜波段之檢定。試驗結果顯示,隨著葉片傷害的加劇,葉綠素及類胡蘿蔔素之含量逐漸減少時,花青素則呈增加之趨勢,而類黃酮含量則變化不大。葉片反射光譜對於空氣污染物逆境之反應,在可見光波段 400-500 nm 及 600-700 nm 會有反射率增加之趨勢,但在 550 nm 左右之反射率則無明顯變化。在空氣污染物逆境危害之下,敏感波段 680 nm 反射率與 SR_{680} 、 ND_{680} 、 SR_{705} 、 ND_{705} 、 SR_{broad} 、 ND_{broad} 及 λ_{Re} 與葉綠素含量之間具有顯著相關性。因此敏感波段 680 nm 反射率與 SR_{680} 、 ND_{680} 、 SR_{705} 、 ND_{705} 、 SR_{broad} 、 ND_{broad} 及 λ_{Re} 可作為甘蔗在遭受空氣污染逆境危害、葉片老化及葉綠素含量大量降低時的指標。利用反射光譜計算植生指數,非破壞性地估算葉片色素含量之變化進而監測作物生長狀況,應為有效可行的方法。而欲以衛星遙測技術監測作物遭受空氣污染危害,建立其預警及災損評估系統值得研究,但尚需進一步有系統的研究。

關鍵詞：空氣污染物、甘蔗、色素、反射光譜、植生指數

Effect of air pollutant on the pigments and spectral reflectance in sugarcane leaf

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Abstract

This study examined the change of the contents of chlorophyll, carotenoid, anthocyanin and flavonoid of sugarcane damaged by air pollutant. The leaf reflectance spectra were measured to determine the leaf reflectance wavelengths being the most sensitive to stress, such as air pollution. The results showed that the contents of chlorophyll and carotenoid decreased, and the contents of anthocyanin increased during the occurrence of this stress, but flavonoids kept the similar level. Increased reflectance in the visible spectra is the most common response of leaf reflectance under stress. Leaf reflectance in the 680 nm, as well as the SR_{680} , ND_{680} , SR_{705} , ND_{705} , SR_{broad} , ND_{broad} and λ_{Re} were significantly correlated with total chlorophyll content of sugarcane damaged by air pollutant. Thus, the sensitive wavelength, as well as these vegetation indices, was good indicator of chlorophyll dramatic loss and leaf senescence caused by the stress damage. It appears possible to create indices using reflectance spectra as a non-destructive method to determine pigment content and to monitor crop growth. However, more systematic research is required and worthy to build a precaution and evaluation system to monitor crop under air pollution stress by satellite remote sensing..

Keywords: air pollutant, sugarcane, pigment, reflectance spectra, vegetation index.