Research Article

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Discrimination of organic coffee via Fourier transform infrared – photoacoustic spectroscopy

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Abstract

BACKGROUND: Procedures for the evaluation of the origin and quality of ground and roasted coffee are constantly needed for the associated industry due to complexity of the related market. Conventional Fourier transform infrared (FTIR) spectroscopy can be used for detecting changes in functional groups of compounds, such as coffee. However, dispersion, reflection and non-homogeneity of the sample matrix can cause problems resulting in low spectral quality. On the other hand, sample preparation frequently takes place in a destructive way. To overcome these difficulties, in this work a photoacoustic cell has been adapted as a detector in a FTIR spectrophotometer to perform a study of roasted and ground coffee from three varieties of *Coffea arabica* grown by organic and conventional methods.

RESULTS: Comparison between spectra of coffee recorded by FTIR-photoacoustic spectrometry (PAS) and by FTIR spectrophotometry showed a better resolution of the former method, which, aided by principal components analysis, allowed the identification of some absorption bands that allow the discrimination between organic and conventional coffee.

CONCLUSION: The results obtained provide information about the spectral behavior of coffee powder which can be useful for establishing discrimination criteria. It has been demonstrated that FTIR-PAS can be a useful experimental tool for the characterization of coffee.

Keywords: photoacoustic; FTIR spectroscopy; organic coffee; chemical composition; discrimination criteria

INTRODUCTION

The coffee market has been expanded as a result of globalization. Special coffees that are defined by their characteristics of origin are demanded by consumers and therefore they need certification, which is frequently an empirical, complicated and expensive process of inspection. For this reason, it is pertinent to look for a scientific discrimination criterion that allows for the certification procedure to be done in an efficient and economical way that improves commercialization. In particular, the organic coffee market needs special attention because organic coffee is cultivated without the use of fertilizers of synthetic origin or of toxic pesticides. This is in contrast to conventional cultivation techniques, which have a high environmental cost because they cause soil damage that eliminates the sustainability of agricultural products for a long time and can influence climate changes that are being experienced at present.[1,2]

Knowledge about the chemical composition of coffee allows the search for discrimination criteria of organic or conventional coffee by considering local growing conditions that give the organoleptic identity of the product. It can reduce prices of crop inspection and cup test for certification.[3]

The use of medium-infrared (MIR) spectrophotometry for discrimination of coffee characteristics such as variety and purity according to different organoleptic properties of these variables has been researched for more than 15 years.[4] Briandet and Kemsley differentiated between *Coffea arabica* and *robusta* via diffuse reflectance with Fourier transform (FT) in the MIR (MIR-FT).[5] By using Fourier transform infrared (FTIR) spectrophotometry and chemometric methods Briandet's team also identified the glucose and starch adulterants in lyophilized coffee.[6] Recent work using FTIR spectrophotometry has shown methods for identifying the volatile substances that give coffee infusions their special smell and taste.[7] The determination of caffeine and chlorogenic acid has been another application of this technique.[8] However, research continues because industrial methods have not been

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