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FTIR characterization of Mexican honey and its adulteration with sugar syrups by using chemometric methods

M A Rios-Corripio[1], E Rios-Leal[2], M Rojas-López[1], R Delgado-Macuil[1]

[1] *CIBA-Tlaxcala, IPN, Tlaxcala, Tlax. México*
[2] *CINVESTAV, Zacatenco, México D.F., México*

E-mail: marlonrl@yahoo.com.mx

Abstract. A chemometric analysis of adulteration of Mexican honey by sugar syrups such as corn syrup and cane sugar syrup was realized. Fourier transform infrared spectroscopy (FTIR) was used to measure the absorption of a group of bee honey samples from central region of Mexico. Principal component analysis (PCA) was used to process FTIR spectra to determine the adulteration of bee honey. In addition to that, the content of individual sugars from honey samples: glucose, fructose, sucrose and monosaccharides was determined by using PLS-FTIR analysis validated by HPLC measurements. This analytical methodology which is based in infrared spectroscopy and chemometry can be an alternative technique to characterize and also to determine the purity and authenticity of nutritional products as bee honey and other natural products.

1. Introduction

Honey is a natural product of high nutritional value which is believed to be a target for adulteration. Sugar and water represent the main chemical constituents of honey (typically 80% carbohydrate and 17% water), whereas proteins, flavors and aromas, pigments, vitamins, free amino acids, and numerous volatile compounds constitute the minor components [1]. Given its composition, this would most simply take the form of extension by cheaper, commercially-available sugar syrups. Fourier transform infrared spectroscopy offers a fast and non-destructive alternative to chemical measurement techniques for qualitative characterization [2]. The multivariate methods such as principal component regression (PCR) [3] and partial least squares (PLS) [4] provide a useful way to develop prediction models able to predict several variables such as sugar contents or adulteration contents in honey or other food products. The first reports on this subject include those that showed the ability of near (NIR) and middle (MIR) infrared spectroscopy to detect adulteration of authentic honey by either added corn syrup (CS) [5], beet invert syrup (BI) [6], sucrose syrup (SS) [7], and more recently on adulteration of honey with high fructose corn syrup (HFCS) [8]. In addition to that, other researchers have reported on the chemometrical methods to provide a useful way to develop prediction models able to predict several variables such as sugar contents or adulteration contents in honey or other food products [9, 10]. In this work we have used a combination of FTIR spectroscopy and chemometry for