DISCRIMINATION OF MALAYSIAN SWIFLET'S NEST AND IT'S POTENTIAL ADULTERANTS USING HANDHELD PORTABLE FTIR SPECTROSCOPIC SYSTEM

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Introduction

Edible bird nest (EBN) is woven from gelatinous strands of Swiftlet's saliva mixed with minor feathers during their breeding season (*1*). The Chinese has been enjoying this cuisine for thousands of years back since Tang (618-907 AD) and Sung (960-1279 AD) dynasties. EBN can be sold at very high price due to its high nutritional and medicinal values. Besides, it is also considered as the world most expensive animal product (*2*). These reasons led to rampant adulteration of the expensive pure EBN. Various adulterants can be added into the pure EBN which includes Tremella fungus, karaya gum, red seaweed, fried pork skin, egg white, gelatin, vermicelli rice, rice, cellophane noodles, starch, milk, and jelly. Other adulteration methods include staining, bleaching and incorporating cheaper EBN into the more expensive ones (*3; 4; 5*).

A variety of techniques of authentification had been established (4) and all have both advantages and disadvantages. The empirical method is rather simple compared to chemical method that requires extraction of the EBN prior to analysis and mostly not environmental friendly.

Handheld Portable Fourier Transform Infrared (FTIR) system can be used in the laboratory and in the field in the same manner with no sample preparation needed (*6*). This system is versatile, rugged and come with interchangeable sampling interfaces; diffuse, grazing angle, specular reflection or spherical attenuated total reflectance (ATR) that make it a highly useful handheld mid-IR spectrometer that suits with any type of samples. A resulting spectrum represents molecular absorption and transmission, creating a molecular fingerprint of the EBN. Like any fingerprint, no two unique molecular structures produce the same infrared spectrum.

This study was carried out to discriminate the EBN and its' potential adulterants through the EBN fingerprint using the handheld portable FTIR system.

Materials and Methods

Three hundred pure raw-clean and raw-unclean EBN were sampled by the Department of Veterinary Services (DVS) and sent to Veterinary Public Health Laboratory (VPHL) Salak Tinggi from the year 2012 until 2013. Whereas possible adulterants such as jelly, vermicelli rice, cellophane noodles, egg white, seaweed and karaya gum were bought from superstore. All EBN samples were analyzed without any treatment. Six EBN samples were treated in-house with the possible adulterants.

The FTIR fingerprint spectral data for all samples were recorded in the region between 4000-650 cm^{-1} using FTIR spectrometer with diffuse reflectance interface (Agilent handheld 4100 ExoScan FTIR) by scanning 64 times at 4 cm^{-1}.

The library for pure raw EBN and its' adulterants were created using MicroLab PC software (Agilent). The spectra were converted to Windows Bitmap using Spekwin32-spectrophotometer software Version 1.71.6.1, 2012. Interpretation of the spectrum was carried out with the aid of Structure Correlation Charts.

Results and Discussion

The FTIR fingerprint spectra of pure EBN and adulterants are presented in Figure 1. Figure 2 represents the fingerprints of pure EBN and adulterated EBN. The spectra showed intense peaks and several spectra visibly overlapped. The most characteristic FTIR absorption bands of pure EBN were found at about 1640 cm^{-1} to 1320 cm^{-1} representing the secondary protein which is the amide (CO-NH2), mono substitution amide (CO-NH-R) and di substitution amide (CO-NR2). Another major band observed was carbohydrate at 1090 cm^{-1} until 900 cm^{-1}. The adulterants and adulterated EBN fingerprint spectra did not have all the amides while the carbohydrate peak is higher compared to pure EBN fingerprint which indicated that the carbohydrate concentration was higher (7). However, the seaweed and adulterated EBN with seaweed had lesser carbohydrate bond. These correlates with high crude protein level in pure EBN and high carbohydrate level in the adulterants and adulterated EBN except for seaweed (8). An EBN purity library was created by inserting all the pure EBN, adulterants and adulterated EBN fingerprint spectra. The library was tested using other pure EBN and similarities were found to be more than 90%.

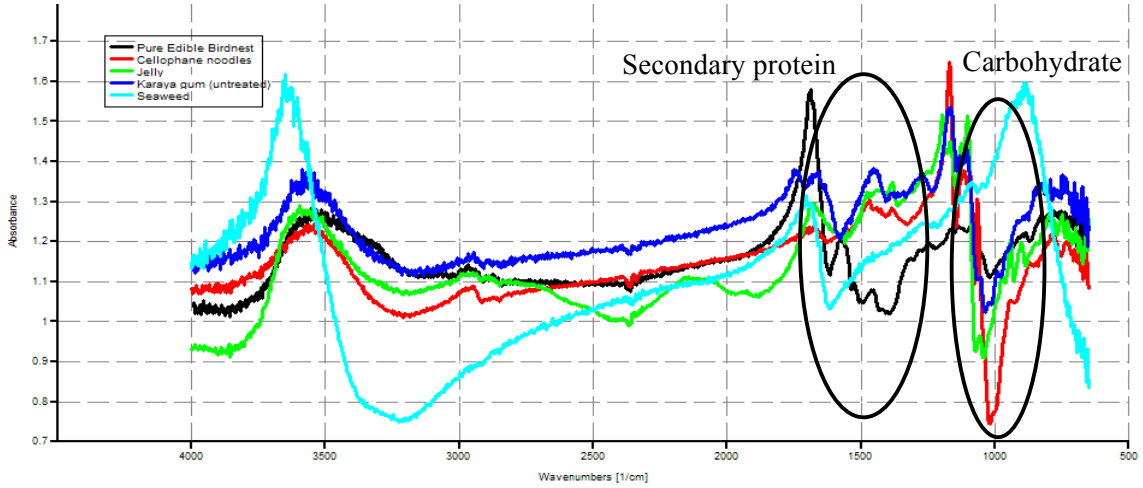

Figure 1: Fingerprint of pure EBN and its' potential adulterants

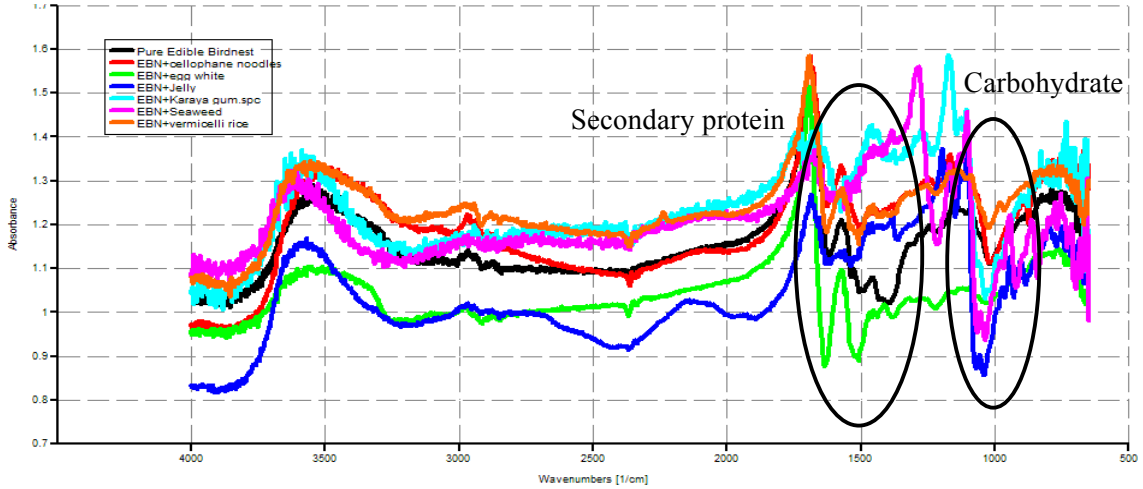

Figure 1: Fingerprint of pure EBN and adulterated EBN

Conclusion

Based on the results, the FTIR spectroscopy with the purity library created demonstrated that this technique is nondestructive, effective, simple and reliable. Unlike other common techniques, handheld portable FTIR-diffuse spectroscopy can be used in the field as it does not require laborious sample preparation procedures and simple interpretation from the library.

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