

CURRENT APPLICATION TECHNIQUES FOR DETECTION OF EDIBLE BIRD NEST ADULTERATION AND FRAUD BY THE DEPARTMENT OF VETERINARY SERVICES MALAYSIA

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Abstract: Edible bird's nest (EBN) is made from the saliva of swiftlet from the *Aerodramus* species. It is one of the most widely consumed traditional health food by the Chinese community due to its claimed medicinal value. The global market for EBN is expanding because of its beneficial effects to human beings. Authentication of this precious and expensive food material became an urgent task following the increasing occurrence of adulteration in the market due to its high price. Various techniques can be applied to detect adulteration and the presence of contaminants in EBN namely the infrared spectroscopy and liquid chromatography fingerprinting. Herein we report the combination of fingerprinting technologies for rapid and reliable identification of genuine EBN product employed by the DVS.

Keywords: *edible bird's nest, fingerprinting, food adulteration and fraud*

INTRODUCTION

Edible bird's nest (EBN) is the nest of swiftlet constructed using salivary glue. EBN is one of the premium foods among the Chinese community worldwide and it is one of the most expensive animal products consumed by humans. The EBN is also esteemed for its high medicinal value, which includes anti-ageing, growth promoting and immune enhancing properties. Nowadays, the edible bird's nest has been developed into value added products, including mixed congee, mask, face cream, etc. (Zhang et. al., 2012). Three major categories of bird's nest products (EBN) exported from Malaysia are raw-unclean EBN, raw-clean EBN and downstream and its value added products. Projected an export value of EBN by 2020 is RM 5.2 billion with increasing annual production of 11.6% (M0A, 2011).

EBN is mainly composed of glycoproteins. EBN contains all eighteen types of amino acids that act as an agent necessary for mediating ganglioside distribution and structure in the brain. Exogenous source of sialic acid might contribute to neurological and intellectual advantages in infants (Kathan & Weeks, 1969).

Due to its scarcity and high value in the market, some unethical suppliers adulterate the genuine bird nest with cheaper materials and additives. These materials make the bird nest heavier and bigger. The suppliers can therefore sell the bird nest at higher prices. The adulteration substitute commonly used is the edible plant-exude, karaya gum, sterculia, fishes' skin, mushroom, red seaweed, pork skin, egg white, Tremella fungus or algae (Tung et. al., 2008). Adulterated and fake edible bird's nest has aroused grave public concerns towards food safety. In the event of fraud or commercial disputes, it is necessary to introduce some sensitive and accurate detection method as the supplement of the food traceability system to detect authentic edible bird's nest. The Department of Veterinary Services Malaysia (DVS) has employed fingerprinting technology that includes spectral fingerprinting and chromatographic fingerprinting.

APPLICATION OF SPECTRUM AND CHROMATOGRAPHIC FINGERPRINTING

- (i) *Infrared Spectroscopy Fingerprinting* - Infrared (IR) spectroscopy is a powerful tool for qualitative analysis of organic compounds that have specific infrared absorption spectrum. IR spectroscopy measures the covalent chemical bonds, creating a molecular 'fingerprint' of the chemicals' presence. This

fingerprint can be used to identify and quantify chemicals presence in a sample. A Handheld Agilent 4100 ExoScan FTIR, which provides non-destructive testing, is used for the identification of adulteration and contamination of EBN. Figure 1 shows that major bands can be observed resulting from protein at 1640 and 1550 cm^{-1} , carbohydrate near 1030 cm^{-1} , and lipids near 2930 cm^{-1} . Clear differences can be seen between the clean and adulterated samples (Set, J., 2012).

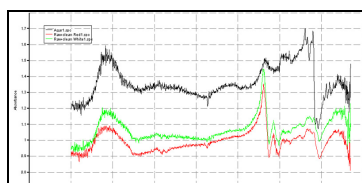


Figure 1 Jelly (Agar) and EBN Spectrum

- (ii) *Liquid Chromatography with Fluorescence* - HPLC is the predominant method for the determination of amino acids. The hydrolysed amino acids will derivatize with derivatising agents, separated by reversed-phase HPLC and quantitated by fluorescence detector. This method can detect 18 types of amino acids in EBN in sub-picomole concentration. The excitation and emission wavelength are monitored at 250nm and 395nm. The amino acids profile between clean and adulterated EBN will be compared focusing on non-essential amino acids (aspartic acid, glutamic acid, proline) and essential amino acids (threonine and valine).
- (iii) *Liquid Chromatography Fingerprinting* - A simple, reliable and sensitive liquid chromatography-tandem mass spectrometry method (LC-MS/MS) is developed for determination of free sialic acid and galactosamine in EBN. The method utilizes a simple sample extraction procedure. The negative electrospray ionisation is used to monitor the transition m/z 307.9 > 87.0 and 307.9 > 170.0. The quality was also judged by the Neuraminic acid/Galactosamine ratio.

CONCLUSION

The three techniques described above have their own strength and capability in the detection of adulteration and contaminants in EBN. Handheld FTIR is a fast, easy and non-destructive method to determine adulteration of EBN by reading the molecular fingerprint (spectral) of unadulterated EBN and adulterated EBN thus comparing both spectral to conclude if any adulteration occurs. The second method, liquid chromatography with fluorescence detects 18 types of amino acids present in EBN and creates an amino acid profile. This profile in turn is compared with amino acids profile in unadulterated EBN and literature values. The LC-MS/MS technique provides a highly reliable method in the detection of major carbohydrates such as sialic acid and galactosamine that should be uniquely present in EBN with certain ratios hence eliminating any fraudulent attempt on EBN. In conclusion, all three techniques are current fingerprinting technologies used by DVS that are applicable in the identification of adulteration and contaminants in edible bird's nest (EBN).

REFERENCES

- Kathan, R. H., & Weeks, D. I. 1969. Structure studies of Collocalia mucoid I. Carbohydrate and amino acid composition. Archives of Biochemistry and Biophysics, 134(2), pp. 572–576.
- Tung, C.H., Pan, J.Q., Chang H.M., and Chou, S.S. 2008. Authentic Determination of Bird's Nests by Saccharides Profile. J. Food Drug Anal., 16, pp. 86-91.
- Zhang, S., Lai, X., Liu, X., Li, Y., Li, B., Huang, X., Zhang, Q., Chen, W., Lin, L. and Yang, G., 2012. Competitive Enzyme-Linked Immunoassay for Sialoglycoprotein of Edible Bird's Nest in Food and Cosmetics. J. Agric. Food Chem. 60, pp. 3580–3585.
- Set, J. 2012. Fast, effective evaluation of edible bird nests using the handheld Agilent 4100 ExoScan FTIR.
- MOA. 2011. Dasar Agromakanan Negeran 2011-2020. pp 80.

SINOPSIS

Sarang burung walit dihasilkan daripada pengumpulan air liur oleh burung walit dari spesis *Aerodamus*. Sarang burung walit adalah makanan kesihatan tradisional yang paling banyak digunakan oleh masyarakat Cina di seluruh dunia kerana nilai kesihatannya yang diakui ramai. Pasaran global untuk penjualan sarang burung walit semakin meluas kerana khasiatnya yang memberi manfaat kepada kesihatan tubuh badan manusia. Penentuan keaslian dan ketulenan bahan makanan yang berharga dan mahal ini telah menjadi satu keperluan disebabkan faktor kekerapan berlakunya pemalsuan sarang burung walit dalam pasaran kerana harganya yang tinggi. Pelbagai teknik boleh diaplikasikan untuk mengesan adulterasi dan kehadiran bahan kontaminan di dalam sarang burung walit seperti spektroskopi infra merah dan kromatografi cecair. Oleh itu, dihasilkan satu laporan kombinasi teknologi pengesanan yang pantas dan tepat untuk menentukan keaslian dan ketulenan sarang burung walit oleh Jabatan Perkhidmatan Veterinar.