A STUDY ON CONTAMINATION OF NITRITE IN EDIBLE BIRD'S NEST (SWIFTLETS)

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Abstract- Edible bird's nest (EBN) derived from the hardened saliva of swallows and considered as high-end health food with organic nutrients. Excessive of nitrite were found in EBN imported from Malaysia to China in past few years and still an issue till today. Therefore the purpose of this study is to investigate the source of EBN contamination. EBNs were collected in Aspa Cottage, Kuantan and divided into two treatment (a) treated EBN (tEBN), which exposed to bird soil; (b) untreated EBN (uEBN). The nitrite (NO_2) and nitrate (NO_3) level were analyzed using ion chromatography for 14 days. Result showed the level of NO_2 and NO_3 level for treated EBN reported significantly more than untreated EBN. The source of NO_2 and NO_3 could have been derived mainly from the bird soil. It is suspected also the color of EBN change from yellowish and brownish simultaneously as levels of NO_2 and NO_3 of EBN increased. Thus, the bird soil could be the source of the NO_2 contamination in EBN.

Introduction- Edible bird's nest (EBN) is made from the saliva of swiftlets, which derived from salivary glands under their tongue which is then wound into a half-cup nest and integrates a salivary secretion (a mucin-like glycoprotein), relatively tasteless and usually served in soup or jelly (7). The EBN is actually the nest of male swallows which is functional for them during breeding and nesting season (8). The male swiftlet built the nest approximately 35 days with 7-20 g in weight (5).

Swiftlet industry in Malaysia is facing difficult time since August 2011 because Chinese government has banned on EBN and its products from Malaysia. This is due to high level of nitrite (NO_2^-) spotted in edible bird's nest (1). As the consequences, the edible bird's nest and swiftlet ranching industry in Malaysia has been hit hard. The toxicity of NO_3^- is generally due to its reduction to NO_2^-. Nitrite (NO_2^-) may react with some amine compounds to form N-nitroso compounds which were found to cause cancer in animal study and thus are suspected carcinogens. Thus, both NO_2^- and NO_3^- must be monitored to ensure the quality and safety of food products (10).

Materials and methods- EBNs and wet bird soil were obtained from a swiftlet farm house located in Aspa Cottage, Kuantan. The samples of tEBN and uEBN samples were prepared in duplicate. Wet bird soil (200 g) and a piece of EBN from swiftlet was moistened with distilled water and placed in a container and labelled with tEBN. The jar was placed in incubator with temperature of 50°C. Color of EBNs also was monitored and the NO_2^- and NO_3^- content in EBN were analyzed using ion chromatography for 14 days. Meanwhile, uEBN was just analyzed to check the NO_2^- and NO_3^- contents.

Both tEBN and uEBN were sent to laboratory for analysis of NO_2^- and NO_3^- by using Ion Chromatography (IC) instrument based on Malaysian Standard (MS 2509:2012 (P)) (9). About 1 g of dry both tEBN and uEBN, were weighed in the conical flask. Then, 100 mL of water were poured into the flask before putting it in the water bath. The mixture was stirred occasionally while heating to make sure it is homogenized. The mixture was allowed to cool and lastly, the supernatant fluid was filtered and subjected for IC analysis.

Results and discussion

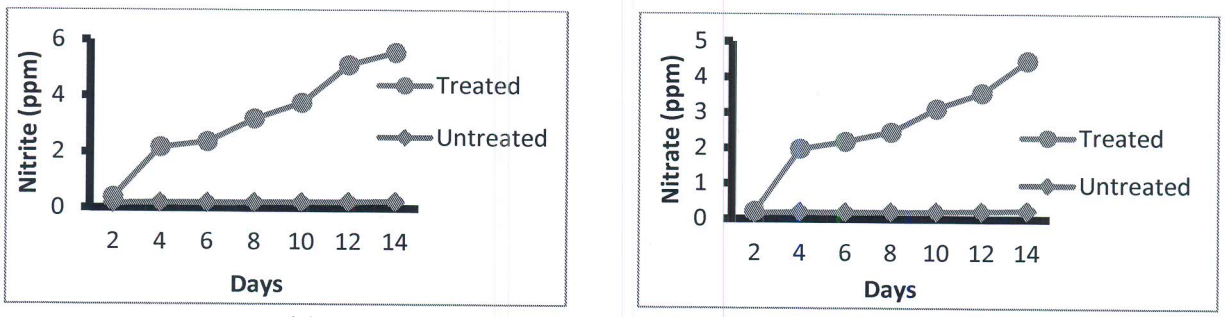

Figure 1: (a) Nitrite (NO_2^-) level for treated (tEBN) and untreated EBN (uEBN); **(b)** Nitrate (NO_3^-) levels for treated (tEBN) and untreated EBN (uEBN).

As can be seen from the Figure 1, the NO_2^- and NO_3^- level for tEBN reported significantly higher more than uEBN. The source of NO_2^- and NO_3^- could have been derived from ammonia through anaerobic fermentation by the bacteria in bird soil (8). A high amount of NO_3^- from bird soil was triggered to form NO_2^- under the enzymatic conversion by nitrate reductase (3). Nitrate (NO_3^-) is more stable form of oxidized nitrogen but can be reduced by microbial action to NO_2^-, which is moderately reactive chemically. It is also suspected that these variations of nitrite levels among EBNs derived from different sources which subjected to different environment, humidity, and climate of the habitat (4).

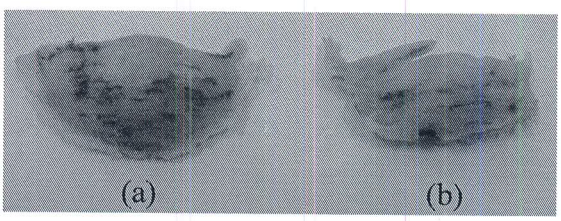

Figure 2: **(a)** Color changes of tEBN induced by bird soil on day 14 **(b)** no color changes of uEBN on day 14.

Based on Figure 2, tEBN which exposed to vapours from bird soil definitely turned weakly yellow on day 14. The present findings seem to be consistent with those of other studies indicate that bird soil could induce a color change in EBN (2). From wet decayed organic of bird soil, NO_2^- gas would evaporates and this is the main air pollutant in swiftlet farm. In spite of this,

it leads to food safety issue as EBN could adsorb NO_2^- gas (4). In general, yellowish and brownish EBNs showed high reading of NO_2^- and NO_3^- level compared to some swiftlet house owners claimed that incubating the EBN in bird soil could induce EBNs' color changes from white into yellowish and brownish. In this process, it is suspected nitric oxide was involved when vapors from bird soil could turn white change to red color (2).

Conclusion- From this preliminary study, the contamination of NO_2^- in EBN mainly comes from the bird-soil, which involved enzymatic reaction by bacteria in natural environment at certain temperature, and humidity. Color of EBN also would become an indicator of NO_2^- level. The higher the level of NO_2^-, the color of EBN changes from white to yellowish and brownish.

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References

(1) Administration of Quality Supervision, Inspection and Quarantine (AQSIQ). 2011. Edible-Birdnest (EBN) Processing.

(2) But, P.P.H., Jiang, R.W., Shaw, P.C. 2013. Edible bird's nests-how do the red ones ged red? *J. Ethuopharmacol*. **145**: 378-80.

(3) Chan, G.K.L., Zhu, K.Y., Chou, D.J.Y., Guo, A.J.Y., Dong, T.T.X. and Tsim, K.W.K. 2013. Surveillance of nitrite level in cubilose: Evaluation of removal method and proposed origin of contamination. *Food Control*. **34**: 637-644.

(4) Jong, C.H., Tay, K.M. and Lim, C.P. 2013. Application of the fuzzy Failure Mode and Effect Analysis methodology to edible bird nest processing. *Computers and Electronics in Agriculture*. **96**: 90-108.

(5) Goh, D.L.M., Chua, K.Y., Chew, F.T., Seow, T.K., Ou, K.L., Yi, F.C. and Lee, B.W. 2001. Immunochemical characterization of edible bird's nest allergens. *Journal of Allergy and Clinical Immunology*. **107**(6): 1082-1088.

(6) Jong, C.H., Tay, K.M. and Lim, C.P. 2013. Application of the fuzzy failure mode and effect analysis methodology to edible bird nest processing. *Computers and Electronic in Agriculture*. **96**. 90-108.

(7) Lim, C. K., and Cranbrook, Earl of. 2002. Swiftlets of Borneo: Builders of Edible Nests. Natural History Publications (Borneo), Kota Kinabalu.

(8) Langham, N. 1980. Breeding biology of the Edible-nest Swiftlet *Aerodramus fuciphagus*. Ibis **122**: 447-461.

(9) Malaysian Standard (MS 2509:2012(P). 2012. Test method for Edible-birdnest (EBN)-Determination for nitrite (NO_2^-) and nitrate (NO_3^-) contents.

(10) Percheron, G., Beruet, N. and Moletta, R. 1999. Interactions between methanogenic and nitrate reducing bacteria during the anaerobic digestion of an industrial sulfate rich wastewater. *FEMS Microbiol Ecol*. **29**(4): 341-50.

(11) Sanichem Resources. 2012. Background on Nitrate and Nitrite in Edible Bird Nest (online). http://www.sanichem.com.my/Bird%20Nest%20Testing.html (20 October 2014)