

ESTABLISHMENT OF HACCP SYSTEM FOR RAW UNCLEAN EDIBLE BIRD'S NEST PROCESSING PLANT IN MALAYSIA

(Penubuhan Sistem HACCP untuk Loji Pemprosesan Sarang Burung Walet Mentah Belum Bersih di
Malaysia)

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ABSTRACT

The focus of the study is on the establishment of HACCP system for raw unclean edible bird's nest (RUC EBN) processing plant in Malaysia. Exploratory hazard analysis was applied to examine and prognose the possible failure modes in processing of raw unclean EBN based on characteristics, purpose or the interaction of processes where the system affixed to. Critical Control Points were determined and administered in the Ishikawa diagram. Deployment of the Ishikawa diagram is to discover the major causes that lead to failure in the heat treatment process. Application of cause-and-effect diagram ascends us to promising results which validate and verify outcomes attained from Failure Mode and Effect Analysis (FMEA). Risk assessment outputs from FMEA and food safety hazard matrix were compared concurrently. FMEA is deployed as part of risk assessment in Hazard Analysis and Critical Control Point (HACCP) system of raw unclean edible bird's nest processing. Enrollment of FMEA within Food Safety Management System (FSMS) contribute to a more definite qualitative assessment where rapid preventive or corrective intercession is possible.

Keywords: edible bird's nest; HACCP; FMEA; hazard analysis

ABSTRAK

Fokus kajian adalah terhadap penubuhan sistem HACCP untuk loji pemprosesan sarang burung walet mentah belum bersih (RUC EBN) di Malaysia. Analisis bahaya penerokaan telah digunakan untuk memeriksa dan meramalkan kemungkinan mod kegagalan dalam pemprosesan EBN mentah yang tidak bersih berdasarkan ciri, tujuan atau interaksi sistem yang dilaksanakan padanya. Titik Kawalan Kritikal telah ditentukan dan dipantau menggunakan rajah Ishikawa. Penggunaan rajah Ishikawa adalah untuk mencari punca utama kegagalan dalam proses rawatan haba. Penggunaan gambar rajah sebab dan akibat membawa kita kepada keputusan yang mengesahkan hasil yang diperolehi daripada Mod Kegagalan dan Analisis Kesan (FMEA). Output penilaian risiko daripada FMEA dan matriks bahaya keselamatan makanan dibandingkan secara serentak. Kaedah FMEA digunakan sebagai sebahagian daripada penilaian risiko dalam sistem HACCP pemprosesan sarang burung mentah belum bersih. Maklumat FMEA dalam sistem pengurusan keselamatan makanan menyumbang kepada penilaian kualitatif yang lebih pasti yang mana perantaraan pencegahan atau pembetulan adalah serta-merta.

Kata kunci: sarang burung walet; HACCP; FMEA; analisis risiko

References

- Arvanitoyannis I.S. & Varzakas T.H. 2008. Application of ISO 22000 and failure mode and effect analysis (FMEA) for industrial processing of salmon: A case study. *Critical Reviews in Food Science and Nutrition* **48**: 411-429.
- Attrely D.P. 2017. Role of risk analysis and risk communication in food safety management. *Food Safety in the 21st Century* 53-68.

- But P.P.H., Jiang R.W. & Shaw P.C. 2013. Edible bird's nests - How do the red ones get red. *Journal of Ethnopharmacology* **145**(1): 378-380.
- Chen C.X., Fan X.Q., Lin L.J., Li Q.P., Cai X.H., Yang S. & Li L.Y. 2018. Application of HACCP in the processing of edible bird's nest. *Journal of Food Safety & Quality* **9**(14): 3846-3853.
- Chok K.C., Ng M.G., Ng K.Y., Koh R.Y., Tiong Y.L. & Chye S.M. 2021. Edible bird's nest: recent updates and industry insights based on laboratory findings. *Frontiers in Pharmacology* **12**: 1-19.
- Chua L.S. & Zukefli S.N. 2016. A comprehensive review of edible bird's nests and swiftlet farming. *Journal of Integrative Medicine* **14**(6): 415-428.
- Cote C.K., Heffron J.D., Bouze J.A. & Welkos S.L. 2015. *Molecular Medical Microbiology*. 2nd Ed. London: Academy Press Elsevier Ltd.
- Cusato S., Tavolaro P., de Oliveira C.A.F. 2012. Implementation of Hazard Analysis and Critical Control Points System in the Food Industry: Impact on Safety and the Environment. In McElhatton A. & Sobral P.J.A. (ed.). *Novel Technologies in Food Science Their Impact on Products, Consumer Trends and the Environment*, pp. 21-37. New York: Springer.
- Dahiya S., Khar R.K. & Chikara A. 2009. Opportunities, challenges and benefits of using HACCP as a quality risk assessment tool in pharmaceutical industry. *The Quality Assurance Journal* **12**: 95-104.
- Dalgic A.C. & Belibagli K.B. 2008. Hazard analysis and critical control points implementation in traditional foods: A case study of Tarhana processing. *International Journal of Food Science and Technology* **43**(8): 1352-1360.
- Damikouka I., Katsiri A. & Tzia T. 2017. Application of HACCP principles in drinking water treatment. *Destination* **210**: 138-145.
- Department of Veterinary Malaysia. 2018. *Standard Operating Procedures for Operational Raw Unclean Edible Bird's Nest Primary Processing Establishment Export to China*. Putrajaya: Ministry of Agriculture and Food Industries.
- Ferreira A.M., Bonesso M.F., Mondelli A.L. & de Souza da Cunha M.L.R. 2012. Identification of staphylococcus saprophyticus isolated from patients with urinary tract infection using a simple set of biochemical tests correlating with 16S-23S interspace region molecular weight patterns. *Journal of Microbiological Methods* **91**: 406-411.
- Fetsch A. & Johler S. 2018. Staphylococcus aureus as a foodborne pathogen. *Current Clinical Microbiology Reports* **5**: 88-96.
- Goh K.M., Lai W.K., Ting P.H., Koe D. & Wong J.K.R. 2017. Size characterisation of edible bird nest impurities: A preliminary study. *Procedia Computer Science* **112**: 1072-1081.
- Gwee K.L., Cheng L.H. & Yen K.S. 2019. Optimization of lightning parameters to improve visibility of impurities in edible bird's nest. *Journal of Electronic Imaging* **28**(2): 1-8.
- Harris L.J. 1999. *HACCP 101 Part 11 – Principle 1*. California: University of California.
- Hou Z., Imam M.U., Ismail M., Ooi D.J., Ideris A. & Mahmud R. 2015. Nutrigenomic effect of edible bird's nest on insulin signaling in ovariectomized rats. *Drug Design, Development and Therapy* **9**: 4115-4125.
- Jeßberger N., Krey V.M., Rademacher C., Bohm M.E., Mohr A.K., Ehling-Schulz M., Scherer S. & Martlbaeur E. 2015. From genome to toxicity: A combinatory approach highlights the complexity of enterotoxin production in *Bacillus cereus*. *Frontiers in Microbiology* **6**: 560.
- Jiang L. 2016. *Into the Bird's Nest World*. 1st Ed. Guangdong: Guangdong Ditu Publishing House.
- Jong C.H., Tay K.M. & Lim C.P. 2013. Application of fuzzy failure mode and effect analysis methodology to edible bird nest processing. *Computers and Electronics in Agriculture* **96**: 90-108.
- Kamaruddin R., Engku Ismail C.E.M. & Ahmad S.A. 2019. Key factors for the sustainable production of swiftlet birds' nest industry in Malaysia: A case study in Northern Peninsular Malaysia. *International Journal of Supply Chain Management* **8**(1): 724-733.
- Kingphadung K. & Choothian W. 2017. Challenges of HACCP implementation in agricultural food products in Thailand. *International Journal of GEOMATE* **12**(30): 102-108.
- Krabeethong C., Vuthimedhi Y. & Sangsuwan T. 2021. Supply chain management of swiftlets nest business in Thailand. *Hatyai Academic Journal* **19**(2): 271-292.
- Kurniawan R.E., Basri C. & Latif H. 2021. A review on food safety animal origin implementation by hazard analysis critical control point (HACCP) in swiftlet birdnest processing unit. *Acta Vet Indones* **9**(2): 72-81.
- Kumar M.S. 2015. A study on implementing food safety management system in bottling plant. *Procedia – Social and Behavioral Sciences* **189**: 433-441.
- Lai X.J., Liu X.Q., Ma F.C., Lan Q.X. & Yang G.W. 2016. The summary on processing techniques of edible bird's nest. *Guangdong Chemical Industry* **43**(6): 98-99.
- Lim K.H., Khoo C.K., Laurentius N.A. & Yeo B.K. 2012. A preliminary report on the surveillance of highly pathogenic avian influenza (H5N1) and Newcastle disease (ND) viruses in edible bird nest swiftlet (*aerodramus fuciphagus* and *aerodramus maximus*). *Malaysian Journal of Veterinary Research* **3**(1): 1-5.
- Lee T.H., Wani W.A., Koay Y.S., Kavita S., Tan E.T.T. & Sheraz S. 2017. Recent advances in the identification and authentication methods of edible bird's nest. *Food Research International* **100**: 14-27.

- Maldonado-Siman E., Bai L., Ramirez-Valverde R., Gong S. & Rodriguez-deLara R. 2014. Comparison of implementing HACCP systems of exporter Mexican and Chinese meat enterprises. *Food Control* **38**: 109-115.
- Mohd Bakri J., Maarof A.G. & Norazmir M.N. 2017. Confusion determination of critical control point (CCP) via HACCP decision trees. *International Food Research Journal* **24**(2): 747-754.
- Mortimore S. & Wallace C. 2013. *HACCP: A Practical Approach*. New York: Springer.
- Motarjemi Y. 2000. Regulatory assessment of HACCP: A FAO/WHO consultation on the role of government agencies in assessing HACCP. *Food Control* **11**(5): 341-344.
- Motarjemi Y. & Lelieveld H. 2014. *Food Safety Management - A Practical Guide to Food Industry*. London: Elsevier.
- Munirah A.R., Puspa L.G., Chong J.L., Norasmah B., Mustafa M., Hazimi F. & Asyraf A. 2019. Suitable ranching practices in successful edible bird nest swiftlet houses in Terengganu. *International Journal of Recent Technology and Engineering* **7**(5): 600-604.
- Mohd Shahar F. 2017. Kelantan H5N1 outbreak: China slaps ban on import of Malaysian bird's nest. <https://www.nst.com.my/news/2017/03/222502/kelantan-h5n1-outbreak-china-slaps-ban-import-msian-birds-nest> (1 May 2022).
- Powell D.A., Erdozain S., Dodd C., Costa R., Morley K. & Chapman B.J. 2013. Audits and inspections are never enough: A critique to enhance food safety. *Food Control* **30**: 686-691.
- Reason J.T. 1997. *Managing the Risks of Organizational Accidents*. Aldershot: Ashgate.
- Shim E.K.S. & Lee S.Y. 2018. Nitration of tyrosine in the mucin glycoprotein of edible bird's nest changes its color from white to red. *Journal of Agricultural Food Chemistry* **66**(22): 5654-5662.
- Sperber W.H. 2001. Hazard identification: From a quantitative to a qualitative approach. *Food Control* **12**: 223-228.
- Stamov T. 2019. Hazard analysis and critical control point (HACCP). *Trakia Journal of Sciences* **17**(1): 307-309.
- Stephens C.B. & Spackman E. 2017. Thermal inactivation of avian influenza virus in poultry litter as a method to decontaminate poultry houses. *Preventive Veterinary Medicine* **145**: 73-77.
- Stevenson K.E. & Bernard D. 1999. *A Systematic Approach to Food Safety*. 3rd Ed. Washington: Food Processors Institute.
- Swayne D.E. 2006. Microassay for measuring thermal inactivation of H5N1 high pathogenicity avian influenza virus in naturally infected chicken meat. *International Journal of Food Microbiology* **108**: 268-271.
- Tan K.H., Chia F.C. & Ong, A.H.K. 2018. Approach to improve edible bird nest quality & establishing better bird nest cleaning process facility through best value approach. *Journal for the Advancement of Performance Information and Value* **10**(1): 38-50.
- Thorburn C.C. 2015. The edible nest swiftlet industry in Southeast Asia: Capitalism meets commensalism. *Human Ecology* **43**: 179-184.
- Toropilova J. & Bystricky P. 2015. Why HACCP might sometimes become weak or even fail. *Procedia Food Science* **5**: 296-299.
- Trafialek T. & Kolanowski W. 2014. Application of failure modes and effect analysis (FMEA) for audit of HACCP system. *Food Control* **44**: 35-44.
- Wallace C. & Williams T. 2001. Pre-requisites: a help or a hindrance to HACCP. *Food Control* **12**: 235-240.
- Wong Z.C.F., Chan G.K.L., Wu L., Lam H.H.N., Yao P., Dong T.T.X. & Tsim K.W.K. 2018. A comprehensive proteomics study on edible bird's nest using new monoclonal antibody approach and application in quality control. *Journal of Food Composition and Analysis* **66**: 145-151.
- Yaacob M.R., Khairy W.I.W., Munirah A.R., Nur Fatimah Nabilah A.J. & Zulhazman H. 2021. Pest disturbance in edible bird nest swiftlet house. *Annals of the Romanian Society for Cell Biology* **25**(1): 3081-3085.
- Yeo B.H., Tang T.K., Wong S.F., Tan C.P., Wang Y., Cheong L.Z. & Lai O.M. 2021. Potential residual contaminants in edible bird's nest. *Frontiers in Pharmacology* **12**: 1-15.
- Zainab H., Sarojini J., Nur Hulwani I., Othman H., Lee B.B & Kamarudin H. 2013. A rapid technique to determine purity of edible bird nest. *Advances in Environmental Biology* **7**(12): 3758-3765.

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