Approach to Improve Edible Bird Nest Quality & Establishing Better Bird Nest Cleaning Process Facility through Best Value Approach

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Edible bird nest industries have existed for more than a century; however, it has been going through a few revolution cycles. As harvesting EBN from the natural habitat in the dark and dim limestone caves to the modern purpose-built swiftlet farms, the quality and quantity of the bird nests have risen to a new level. This success of changing the habitat of swiftlet colonies is revolutionary because the ease of rescuing bird nests from life-threatening experiences to a safe environment has improved. Furthermore, with a synthetic environment, the quality of bird nests has improved with decreased levels of pollution and the colony’s population increased due to better growth along with protection from predators. On the downside, edible bird nest cleaning processes experienced very few changes since the discovery of edible bird nests. The method of cleaning remains unchanged. Several machines have been introduced to replace human labor and the results are either ineffective or undesirable. In this study, existing practices were observed and analyzed by identifying the area of opportunity for improvement. A new proposed method has been implemented to enhance the quality and nutrients of the bird nests. The experimental methodology has been employed to analyzes a set of samples obtained from both cleaning methods. The results show a smaller expansion rate under the current method in processing edible bird nest; hence, the possibility of nutrients preserved has increased by 30% under the new method. The percentage of crude protein concentration in the newly improved method was 50.25% whereas in the traditional method, it was only 31.16%. This clearly indicates the difference of 19.09% nutrient lost between the new improved method and traditional cleaning method.

Keywords: Bird nest cleaning, bird nest processing, edible bird nest, swiftlet, best value approach.

Introduction

Edible bird’s nest (EBN) is a precious functional food and therapeutic herbal medicine that has been used for several hundred years in China. It is known as the “Caviar of the East” (Marcone, 2005) in Chinese communities around the world. EBN mainly comprises a secretion of the salivary gland of several species of Aerodramus genus (formally collocallia) (Gray, 1840) in the Apodidae family, such as Aerodramus fuciphagus and Aerodramus maximus. These birds are found predominantly in Southeast Asia, e.g. Thailand, Vietnam, Indonesia, Malaysia and Phillipines (Marcone, 2005).

The therapeutic effects of EBN, including replenishing lung deficiency and expelling phlegm, were recorded in Chinese literature first published in 1695 (Zhang, 1959). In view of these therapeutic and beauty–rejuvenating applications, EBN is much in demand in the international...
market. The estimated market for EBN in 2004 was about HK$3 billions in Hong Kong alone (Leung, 2004).

Generally, the edible-nest swiftlets are cave dwellers; their nesting areas are usually inaccessible for humans and located in dim (or completely dark) sites in limestone caves. They are widespread in the Indian Ocean, South East Asia, North Australia, and the Pacific Islands (Thomassen et al., 2003) and are predominately discovered in Asian countries, such as Malaysia, Indonesia, Thailand, Vietnam, Philippines, and China, etc. (Marcone, 2005) with Indonesia as the biggest and the Malaysia Borneo provinces of Sarawak and Sabah being the second biggest resource (Hobbs, 2004).

Although the high consumption of EBN poses a perennial threat to the survival of swiftlet and proposals for limitations on EBN trade are constantly being raised, the free EBN trade remains unchanged because swiftlets are currently not listed on the endangered species lists of the Convention on International Trade on Endangered Species of Flora and Fauna (CITES) due to their large population (10 millions). Nevertheless, the countries supplying EBN have promised to protect swiftlets while harvesting the EBN to maintain supplies to an ever-growing market around the world (Animals Committee of CITES, 2000).

Edible bird nest industries have existed for more than a century, from the natural habitat in the dark and dim limestone caves to the modern purpose-built swiftlet farms, the quality and quantity of the bird nests have risen into a brand-new level. This success of changing the habitat of swiftlet colonies is one of revolutionary because it has improved the ease of rescuing bird nests from life threatening experiences to safe environment. In the natural cave environments, swiftlet nests can only be harvested twice a year. This affects the quantity of bird nests as the same bird nests may be reused by the same swiftlet or other. The quality of bird nests may also drop substantially when the environment of nature cave is not clean and other insects or animals such as bats and lizards may further pollute the nests.

With a man-made environment, all the guanos can be cleaned weekly and the nests harvested fortnightly to maintain the quality and quantities of bird nests. At the same time, swiftlet colonies can achieve better growth and longer lifespan with better protection from their predators. Swiftlet farming in Malaysia started late last century and it mushroomed during the last few years with estimate 60,000 to 80,000 farms in Malaysia. It has been identified as one of 16 entry point projects that ‘catalyzes the establishment of market driven, industrial scale and integrated agriculture-related businesses’ under the National Key Economic Areas (NKEA).

However, edible bird nest cleaning process has not changed much and sufficient improvement since the discovery of EBN.

In August 2011, China had ban all bird nest from Malaysia due to an alarming scandal which blew up in Zhejiang when its industry and commerce bureau discovered that the average level of nitrate in 537 “blood nest” samples was 4,400mg/kg, far exceeding the national cap of 70mg/kg. Most of the bird’s nests were claimed to be originated from Malaysia (Tho, 2014). The news was a serious blow to the swiftlet industry in Malaysia, which suffered sharp dip of unprocessed bird nest price by 60% when local prices for grade “A” unprocessed bird’s nests plunged from
RM4,000 per kg in year 2010 to between RM1,200 and RM1,500 per kg in the local market that year (Lee, 2013).

In September 2012, Malaysia and China signed a protocol on bird’s nests entry into China, which touched on the aspects of examination, quarantine, and hygiene. Fifteen Malaysian companies submitted their applications to export their bird’s nests to China in March last year. They were subjected to evaluation by Chinese authorities. Nine gained the conditional pass in June but only eight of them were given the final approval (Tho, 2014). The lift of the ban came as new hope to this long-suffering industry. However, obtaining the final approval from China authorities seems to be a stiff challenge for most of the downstream producers.

During the literature review of bird nest cleaning process, only two papers stated the process of EBN cleaning (Vimala et al, 2012 and Jong et al, 2013). However, both processes involve repetitive spray of water to soften the bird nest for cleaning of feathers as well as molding of bird nest back to its original shape. The detailed process involves five basic steps, which are washing with brushes, softening with water, cleaning with pincer, molding or binding with thread and drying with fan and heating with an incandescent light bulb (Jong et al, 2013).

In the past five years, the retail prices of EBN reduced by 50% from RM 8,000 per kilo to merely RM 4,000 per kilo. This is due to non-standardization of cleaning processes and the lack of proper cleaning guideline. A research on the nutritional value of EBN showed a substantial reduction on fat (0.01% to 0.03%) and ash (3.5% to 6%) contents between the unclean and clean nests. Moreover, cleaned bird nest’s moisture contents increase from 31% to 92% was due to the cleaning process (Hamzah et al, 2013).

It remains a challenge for the actual nutrients contents in bird nests to be preserved during the cleaning process and most of the processing plants in Malaysia fail to meet the standard requirement of HACCP and CNCA of China. As the main concern from the stakeholders of industries was obtaining the permit from CNCA China to export their clean bird nests to China, the non-standardization of their cleaning process jeopardizes their market share and value of their products.

Objectives

The objective of this research is to analyze current cleaning methods, by identifying the areas of opportunity for improvement. By adopting best value approach as comparison with traditional approach, the new proposed cleaning method focuses to minimizing its exposure to possible contamination, and to preserve its original nutrients.

Research Methodology

In search of an improved cleaning method, the best value approach by Kashiwagi is deployed. In the paper, Kashiwagi reiterates that by engaging the expert to plan and manage the entire project from beginning to the end, the risk can be shifted to the vendor, thus providing the best value for the lowest price (Kashiwagi, 2011). By implementing best value approach, the existing processing method is investigated to identify the area of opportunities for further improvements.
With data collection, issues that are not conforming to requirements would be resolved through the newly proposed cleaning process.

In the second step, it is to study both processing methods and comparing through SWOT analysis. A set of clean bird nest sample was obtained and tested to ensure the effectiveness of the new proposed process.

Data Collection

All the information in this research is collected through interview and observation. Data is compared and analyzed from the perspective of economic, functionality, environmental impact and sustainability.

*Current Approach in Establishing the Cleaning Process Facility*

Bird nest processing has been established since last century. However, the approach in establishing the processing facilities remains the same till present. In this paper, the author tends to analyze the current issues and problems encountered to establish a better approach to mitigate the risk and increase the quality output.

In the last decade, the traditional cleaning process was regarded as a trade secret in which the owner of the business will not reveal to any outsider other than their immediate family members. However, the awareness of the consumers toward quality control and demand for better quality has forced the traditional businesses to abandon their well-kept secret, in search of a better approach. Through observation of cleaning processes in the past 10 years, most business owners have been going through the process of piecemeal approaches in establishing the cleaning facilities.

In Malaysia, the history of bird nest cleaning only dates to around 15 years. During infancy period, there were few established experts or trainers. Therefore, any business owners or investors will search for a trustworthy expert by attending the seminar or training. Most business owners will start with the basic skill they acquired through training in a few days. They may have gone through a few rounds of seminar to sharpen their skills until they are ready to train their respective workers.

Through observation, the process can generally be summed up in a few steps (Figure 1). The initial step of searching the right cleaning method may be time consuming and with an uncertain outcome. Owners may also face new problems that may need to modify the cleaning procedure. This will cause the issues of unstable quality control and lacking proper procedure.

With constant change in the cleaning procedure, the planning of facilities becomes ineffective. Overlapping in handling process occurred and these complications may lead to higher risk of contamination and resulting in a compromised quality of the final product. This is the constant pattern of traditional process owners as they modify, or upgrade facility based on customer demands for better quality.
Traditional Cleaning Process

The traditional cleaning process has been implemented for more than half a century. It has been passed on from generation to generation without much improvement. This process is time consuming and without scientific proof or analysis. As shown in figure 2, the raw bird nests harvested from the swiftlet farms or limestone caves go through the process of sorting according to its grade. This is to facilitate the value-added diversity of EBN products. The less feathers or impurities will be preserved for the premium grade bird nests followed by normal grade. Bird nests, which are hard to clean will be categorized as low-grade products such as biscuits or bird nest strips.

After the sorting process, raw bird nests will be soaked in clean water for further cleaning. During the process, most of the dusts or surface impurities will float up; the bird nest starts to absorb the water and expands in size by 20% to 30%, with an increase of five times its original weight. The condition of the nest appears to be soft and sticky. Therefore, it is easier for the workers to pick out the feathers with forceps or tweezers. This process may take 20 to 30 minutes for a skilled worker to do and it depends on the cleanliness of the raw bird nest.

The process of molding requires a set of plaster mold or stainless-steel netting, like the half cups (Figure 3). By placing moist bird nest into the plastic mold, the cleaned bird nest is mold pruned into its original shape upon drying up. The plastic mold also requires some clips or tools to hold the bird nest in place during drying. Most of the bird nests will be dried under low heat cabinet with assistance of a direct fan blowing.
One of the weaknesses of this process is that the molding and drying processes are time consuming. As the bird nests expend during the soaking process, it is hard to reshape back to its original size. The quality will be downgraded, and the nutrients content will be reduced quite substantially.

**Best Value Approach to Establish Cleaning Process Facility**

The new effective approach we propose is to set up a cleaning process with the best value approach (Kashiwagi, 2017). The theory of this method does not depend on the knowledge or expertise of the client but rather the expertise of vendors.

Upon engaging the expert, it is paramount that the expert is fully in charge of the whole project, whereas the client would be out of picture. It is now entrusted to the expert to develop a performance matrix or indicator before setting up the facility. Without the interference from the client, the expert could make immediate decisions to reduce time wastage and increase efficiency.

When the facility is fully functioning, the expert would evaluate the facility with actual operation and engage workers in training at the same time. This would allow the expert to fully analyze the efficiency of the facility with minor adjustments, if required.
**New Improved Cleaning Process**

The new improved cleaning process (Figure 5) was developed through a scientific analysis of bird nest properties and its characteristics. The bird nest is built completely from salivary gland; it is sticky and contains high percentage of water. According to previous research, the moisture content is frequently used as an index of stability and quality of bird nest. (Kok and Thrisingam, 2011). During the drying process, it is slowly hardening into a stable state to hold up the weight of the eggs and the chick.

![Figure 5: New improved cleaning process flow chart.](image)

Moisture control after the sorting process is taken into consideration in the new approach. The raw bird nest is required to brush off any impurities or dusts covering the surface. The brushing process is introduced base on the expert’s input to control the moisture and eliminate contamination through excessive water contact. During this process, the raw bird nest is exposed to small amounts of water and causing the bird nest to turn into a soft and elastic resilient condition. It is placed into the container to allow the bird nest to expand slightly. The process of picking the feathers will be under a stage of semi-dry condition. This is to maintain the nutrients as well as the original shape of the bird nest. Cleaned bird nests will be trimmed away and any excessive edges to be placed into the plastic mold as shown in Figure 3. Due to the controlled expansion and moisture, the drying process does not require any heat. It is placed within a ventilated cabinet until the bird nest dries completely to its original shape. This approach has shortened the time of molding and drying. It also preserves the nutrients and quality of bird nest. The risk of contamination through water or air can be reduced or avoided altogether.

**SWOT Analysis**

Through SWOT analysis, we identified the parameter of cleaning process and key area of improvement. Both cleaning processes can be summarized as in Table 1.
Table 1: SWOT analysis of both cleaning process.

| Strength          | Traditional Cleaning Process | New Improved Cleaning Process |
|-------------------|------------------------------|-------------------------------|
|                   | Easy to train the workers    | Less wastage                  |
|                   | Easy to set up               | Better quality                |
|                   |                              | Less contamination            |
| Weakness          | Higher wastage               | Required more skill           |
|                   | Low quality                  | More steps or processes       |
|                   | Higher chance of contamination | Longer training time          |
| Opportunity       | More area of improvement     | More skill improvement        |
|                   | More saving on the wastage   | Better control on worker mobility |
| Threat            | Workers reluctance to change | Required strict quality control|
|                   | More investment needed to improve the process | New workers may find it difficult to master the skill |

From the analysis, it is realized the reasons behind most of the traditional cleaning process remain unchanged mainly due to the reluctance of existing workers toward finding new ways to improve the current process and the increased cost incurred by the operators.

Several risk factors faced by the traditional cleaning entities were also observed. The owners reiterated that the excessive rectification cost on their equipment and upgrading was beyond their initial resources and labor planning. Despite of constant changes on the facilities, quality control of the processes become complicated was either difficult to maintain or improve. For those who are incapable of meeting market demand or upholding of their quality, they may end up winding down their business or phase out from the industry.

Matrix Indicator - Expansion Test

On both cleaning processes, a set of samples collected at the end of cleaning process. Both edible bird nests were weighed before the experiment. The dry bird nests were then being placed into a glass bottle with warm water for 20 minutes (Figure 6). Again, the bird nests were drained and placed on a scale to record the weight. The statistical data for the comparison of both cleaning processes in term of weight and expansion rate was tabulated in Table 2.

Figure 6: Expansion Test.
Table 2: Expansion Test.

| Edible Bird Nest                      | Original Weight (Gram) | Weight After Soaking (Gram) | Expansion Rate (Ratio) | Percentage of Expansion |
|--------------------------------------|------------------------|-----------------------------|------------------------|-------------------------|
| Raw Bird Nest (Unclean)              | 5.52                   | 45.02                       | 8.2                    | 100%                    |
| Clean bird nest using Traditional Method | 4.73                   | 25.11                       | 5.3                    | 64%                     |
| Clean bird nest using New Improved Method | 4.89                   | 37.73                       | 7.7                    | 94%                     |

Matrix Indicator – Crude Protein Test

According to the paper by Marcone, (2005) it was reported that the composition of EBN from both Malaysia and Indonesia was of 62.0% crude protein, 27.3% carbohydrate, 7.5% moisture, 2.1% inorganic ash and 0.14% lipid. The major portion of the detected nutrient was crude protein and it is also comprising of all the major sialic acid components.

To determine the nutrient content of bird nest to substantiate the argument of nutrients lost through the process of cleaning, crude protein test was conducted to address the effectiveness of the new cleaning method.

1. Biuret Method

Biuret Method was chosen in this study. The sample of clean bird nest was prepared as sample A and B. Biuret Method involved the preparation of solution of bovine serum albumin as standard and Biuret reagent which consisted of copper sulfate pentahydrate CuSO₄·5 H₂O c = 13.0 mmol·l⁻¹, potassium sodium tartrate KNaC₄H₄O₆·4 H₂O c = 32·0 mmol·l⁻¹ and NaOH c = 0.6 mol·l⁻¹. The process of the test involved dilution of 0.5 ml of sample with 3 ml of Biuret reagent. The tubes can set for 30 minutes at room temperature and the absorbance was measured at 540 nm. (Copeland, 1994).

2. Preparation of the standard and sample

Approximately 0.4 gram of protein was measured on the scale with the tube in standing position and was then diluted with 400 ml of distilled water. Protein standard was prepared according to Table 3 below:

Table 3: Preparation of protein standards.

| Mg/ml | Protein Standard | Distilled water |
|-------|------------------|-----------------|
| 2     | 2 ml             | 8 ml            |
| 4     | 4 ml             | 6 ml            |
| 6     | 6 ml             | 4 ml            |
| 8     | 8 ml             | 2 ml            |
| 10    | 10 ml            | -               |
Two sets of samples (Sample A and B) of cleaned bird nest were obtained and prepared with double boil for 45 minutes at 100 °C boiled water. Samples were filtered with filter paper to separate the solid objects. A total of three sets for each sample with 0.2 ml of bird nest and 0.3 ml of distilled water were prepared (Figure 7). Approximately 3 ml of biuret reagent was added into each standard and sample with an interval of 1 minute after which the standard and sample could set for 30 minutes.

3. Preparation of spectrophotometer

Spectrophotometer was prepared with blank distilled water at 540 nm. A cleaned container was used for each protein standard and absorption reading was recorded in Table 4.

4. Result

Table 4: Result of Absorbance.

| Tube | Concentration | Absorbance |
|------|---------------|------------|
| 1    | 2             | 0.08       |
| 2    | 4             | 0.122      |
| 3    | 6             | 0.152      |
| 4    | 8             | 0.185      |
| 5    | 10            | 0.231      |
| Sample A1 | 5.89 | 0.152 |
| Sample A2 | 5.89 | 0.152 |
| Sample A3 | 6.33 | 0.160 |
| Sample B1 | 3.87 | 0.115 |
| Sample B2 | 3.55 | 0.109 |
| Sample B3 | 3.82 | 0.114 |
**Conclusion**

The analysis and expansion experiment showed that the new proposed cleaning method was able to preserve the EBN nutrients, shape, and its original properties. A set of raw bird nests (unclean) had been used as a standard measurement for the test. The results showed that full expansion of raw bird nest was 8.2, clean bird nest (Traditional) was 5.3 and clean bird nest (Improved) was 7.7 times of its initial weight. Therefore, the current or traditional processing method may cause possible contamination through water and loss of nutrients by 36%, and the newly improved method could preserve the nutrients of up to 94%.

The result from the Table 5 showed the percentage of protein concentration in new improved method was 50.25% and traditional method was at 31.16%. It clearly indicates the difference of 19.09% nutrient loss from the traditional cleaning method (Table 6).

**Table 5:** Percentage of Protein Contain in 12mg/ml of processed bird nest.

| Sample                  | Protein (mg/ml) | Percentage |
|-------------------------|-----------------|------------|
| Sample A New Improved Method | 6.03± 1        | 50.25%     |
| Sample B Traditional Method   | 3.74±1         | 31.16%     |

**Table 6:** Comparison result of Expansion test and crude protein test.

| Sample                  | Expansion Rate | Percentage of losses | Percentage of Crude protein contain | Percentage of losses |
|-------------------------|----------------|----------------------|-------------------------------------|----------------------|
| Raw bird nest           | 100%           | Nil                  | 62% *(a)*                           | Nil                  |
| Traditional method      | 64%            | 36%                  | 31.16% (b)                          | 30.84% (a-b)         |
| New improved method     | 94%            | 6%                   | 50.25% (c)                          | 11.75% (a-c)         |

*Note. The values of raw bird nest crude protein referring to (Marcone, 2005)
The best value approach of analyzing current cleaning process and re-engineering the process by engaging an expert from beginning have produced much desirable result. The end results could easily be justified through the fundamental matrix set from the beginning. This study concludes that the best value approach indeed has been adopted for a good performance of the process, and a process recommended for adopting the best value expressively.

**Recommendation**

It is recommended the best value approach for any new investors or business owner. The system can reduce owner’s risk by engaging an expert to plan and execute the entire facility from beginning to the end. Figure 8 (Horstman, 2013) shows the best value approach process, where flowing through three stages could eliminate repetitive process from traditional piecemeal process. The new improved cleaning process could also mitigate the risk from the beginning and the quality of edible bird nest could be improved through well executed design and planning.

![Figure 8: Best value approach (Horstman, 2013)](image)

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