



Quills or Featherings? The Mechanization of Cinnamon Processing

Cinnamon, the dried edible-inner bark of the tree: *Cinnamomum Zeylanicum* Blume, is an essential spice used around the world. The history of the cinnamon trade goes beyond the 10th century. Since then Sri Lanka is the only place where true cinnamon, Ceylon cinnamon, can be found [1]. The annual turnover from Ceylon cinnamon export in 2020 is approximately USD 206 Million which is around 61.5% of the total spice export in Sri Lanka. This contributes to 2% of the total merchandise exports revenue of Sri Lanka.

Out of the thousands of varieties available around the world, only Ceylon Cinnamon has become the iconic brand in the global market. Even though there are new true cinnamon exporters like Madagascar and Seychelles, they are yet to make a significant presence in the cinnamon market. Cassia, a substitutional cinnamon variant, has become the major competitor of the true cinnamon market [1]. China, Vietnam, and Indonesia are the major cassia exporters over the past few decades. Cassia is gradually invading the true cinnamon market using price competition [1]. However, cassia contains a significantly high composition of Coumarin, a chemical compound present in plants, which causes adverse health effects by excessive consumption. This is a major advantage that helps true cinnamon in maintaining its market share.

The traditional cinnamon processing method practised in Sri Lanka is skill labour intensive. It consists of several sequential steps; harvesting,

“

Out of the thousands of varieties available around the world, only Ceylon Cinnamon has become the iconic brand in the global market. Even though there are new true cinnamon exporters like Madagascar and Seychelles, they are yet to make a significant presence in the cinnamon market.”

”

scraping, rubbing, peeling, and quill making of which most are laborious. In the past, the set of skills have been transferred from generation to generation mostly within the same family [1]. However, the younger generation has a lack of interest in the traditional cinnamon industry due to its laborious nature and social recognition [1]. This has caused a labour shortage of around 30,000 peelers. Therefore, the existing peelers are demand 35 – 50% of the sales revenue as their processing charge. This excessive labour cost has caused a higher cost of cinnamon production. With the balance revenue of 50-65%, the landowners have to maintain and fertilise the lands leaving marginal profit margins. This discourages the landowners to improve the cultivation and thus the industry is declining. This could be a major reason that Sri Lanka hasn't had significant growth in cinnamon cultivation in terms of land area and production volumes for the past few decades [2]. These have been detrimental to the Ceylon cinnamon brand and the cheaper alternative, Cassia, is replacing the increasing demand for cinnamon. [1].

Recognised output forms

The output form of the traditional method is the quill, which is usually a 42 inch long hollow tube-like shape (Figure 1). The edible bark is carefully peeled as full cylinders to join them together to form the quill stuffed with strips and pieces of the same bark. This method has been introduced by the Dutch during the colonial period of Sri Lanka around 350 years ago [1]. In that time the quills have been baled together, as a safety measure during the shipping. At present, the ISO has introduced a grading system for true cinnamon that contains four categories as Alba(A), Continental (C), Meaxian(M), and Hamburg(H) for standardisation. The grading system is based on the diameter of the quills. Other output forms include quillings, chips, featherings and powder.

Quality and the market

Despite the grading system, the quality of the cinnamon is governed by threshold values for specific parameters defined by ISO 6539:2014 [3]. The quality of the cinnamon depends on the chemical compound presence. Therefore, there is

no convincing evidence that the grade affects the quality of the cinnamon quill. The grades like Alba (A) have the highest market value and are thus considered to be high in quality whilst others have low value and quality in the international market. The market is driven by the trust that smaller diameter quills contain fewer intrusions as fillings compared to relatively higher diameter quills. However, producing smaller diameter quills require extended processing times and skills making those expensive around 3000 – 3500 Rs/kg [4].

Challenges and potential of mechanisation

It appears that the market is based on trust rather than the output form. Moreover, raw cinnamon in quill form is not being used in the most application of culinary, medicine, and cosmetics. The current quill form the dominant market has been a major barrier to the mechanisation of cinnamon processing as it is difficult to peel to make quills using a machine due to the inherent features of stems. Researchers have attempted to mechanise



Figure 2: Wood prototype of the machine

cinnamon processing to assist or replace the current labour-intensive traditional method of cinnamon processing. However, most of them have been focused on the quill making process to cater for the existing market. A recent mechanisation attempt has presented a concept of a single stroke 360-degree cinnamon peeling device by the Department of Mechanical Engineering, University of Moratuwa in 2021 [5]. The machine consists of three equally spaced stainless steel tensioned wires wrapped around the stem (figure 2 and figure 3). The mechanism assists in peeling cinnamon in the forms of featherings, chips, or quillings rather than quills and eliminates the rubbing step as well as the requirement of the skilled labour in the traditional peeling method. Further, higher process efficiencies can be expected compared to the traditional method for producing chips and featherings. Further research is underway in developing bulk cinnamon processing.

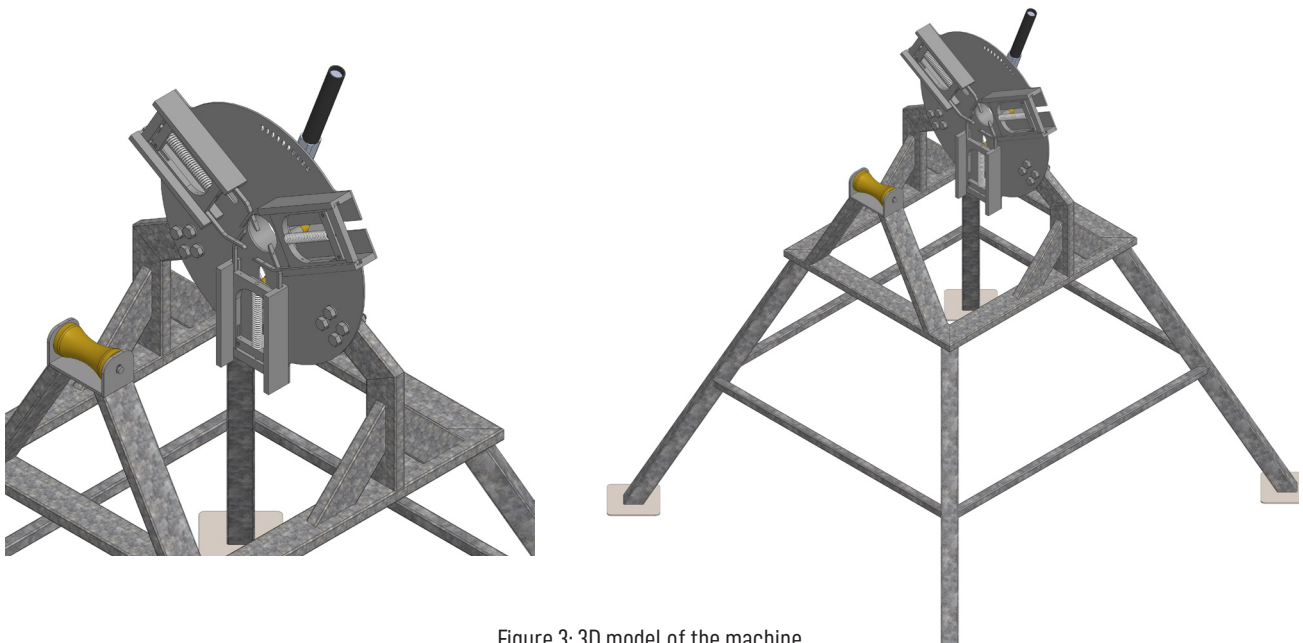


Figure 3: 3D model of the machine

In summary, it is evident that mechanisation is possible given the market for output forms like featherings are established with developed trust across the world. The focus should be more on the alternative value-added forms like chips, featherings, and powder, using bulk processing methods to be price competitive while addressing the skilled labour scarcity. Furthermore, the finished product form can be extended to producing value-added products like cinnamon Tea, pharmaceutical products, and cosmetics products rather than raw cinnamon with the iconic Ceylon Cinnamon brand. This would be the way to drive the future of the Sri Lankan Cinnamon industry towards capturing a greater share of the world cinnamon market with low production costs.

References.

- [1] R. Senaratne and R. Pathirana, *Cinnamon - Botany, Agronomy, Chemistry and Industrial Applications*. 2020 (Springer).
- [2] "FAOSTAT." [Online] <https://www.fao.org/faostat/en/#home> (accessed Nov. 22, 2021).
- [3] "ISO 6539:2014 Cinnamon (*Cinnamomum zeylanicum* Blume) — Specification," 2014. [Online]. Available: <https://www.iso.org/standard/64797.html>.
- [4] Department of Export Agriculture, "Cinnamon – Dept. of Export Agriculture," 2019. <http://www.dea.gov.lk/cinnamon/> (accessed Jan. 02, 2021).
- [5] D. Gunawardhana, V. Primal, M. Nayantra, J. R. Gamage, and H. K. G. Punchihewa, "A single-stroke 360°-arc length peeling mechanism for cinnamon processing," in *MERCon 2021 - 7th International Multidisciplinary Moratuwa Engineering Research Conference, University of Moratuwa. Proceedings*, Jul. 2021, pp. 220–225, doi: 10.1109/MERCon52712.2021.9525650.

Article by

Dimuthu Gunawardhana, Janaka Gamage

Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka.