



PREFERRED PHYSICAL PARAMETERS OF INDUSTRIAL AGARBATTI STICKS

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ABSTRACT:

The incense stick, also known as “*agarbatti*” in India, “*joss stick*” in China, is a thin bamboo stick covered in a substance used exclusively for religious purposes in almost every home in India. Bamboos are significant non-wood forest resources found in the forest and non-forest areas, fast-growing, renewable, versatile, and low-cost natural resources. It belongs to the family Poaceae and is an essential component of many forest ecosystems. Again, it occupies an important place in the people's diverse phases of life and culture. The right choice of parameters of the agarbatti sticks is the primary concern of the different stakeholders of the bamboo sector to maximise the production of incense sticks. The right choice would help maximise the income of the MSME units involved in producing agarbatti sticks. Therefore, the paper evaluates the preferred parameters of the industrially produced incense sticks. The study was carried out in Tripura, one of the North-Eastern states of India, in various bamboo species *viz.*, *Bambusa polymorpha*, *B. vulgaris*, *B. cacherensis*, *B. tulda*, *B. Balcooa*, *M. baccifera*, *Dendrocalamus asper*, and *D.ongispathus* following the likert scale. The most preferred shape of the agarbatti stick was the mechanically produced *round sticks*, while the most preferred color of the sticks is *yellow* and *golden yellow*. Among other parameters, the most preferred are *8 inch* length and *1.3 mm* thickness. It is recommended that the species which can produce the maximum outturn in terms of mechanical production, the preferred thickness, and size should be used as a raw material for the agarbatti industry.

Keywords: Bamboo raw material, Out-turn, Incense Stick, Likert scale, Index score

INTRODUCTION:

Incense or Agarbatti stick is a globally traded product and is used in almost every household worldwide. Incense sticks are long, cylindrical structures, having a bamboo core coated with fragrant materials, which, on burning, fills the atmosphere with fresh air and aroma (Lin et al., 2008). Agarbatti is burnt during religious ceremonies, for spiritual reasons, aromatherapy, and as an insect repellent. (Hyams and Cushner, 2004). Incense sticks are used for many religious purposes, purify the bad air, fill positive energy in the

atmosphere, and eliminate negative energy from our surroundings (Jetter et al., 2002). The production of agarbatti involves bamboo stick production, preparation of incense paste, its application onto the bamboo stick, scenting, and finally packaging (Hazarika et al. 2018). The low labor costs, availability of raw materials has drawn the attention of the whole world towards India, and as a result, India is now one of the largest producer and exporter of incense sticks. (Yadav et al.2020)

The major raw materials used in the agarbatti industry are bamboo (Dutta, 2006). Bamboo

is a perennial fast growing plant, with more than 1600 species, which are widely distributed in the tropical and sub-tropical regions of the world (Vorontsova et al. 2016). In India, there are 125 indigenous and 11 exotic species of bamboos belonging to 23 genera. Bamboo occupies an area of 16 million hectares in India (FSI, 2019). Bamboos grow in at least 37 million hectares worldwide amounting to about one percent of the global forest area (Lobovikov et al. 2007). The scarcity of raw materials due to flowering (Selvan et al 2018); rapid depletion of bamboo resources (Singh et al 1999), and increasing popularity of bamboo in the industrial sector as an alternative to wood (Selvan, 2018) has resulted in depletion of the species which are mainly used by agarbatti industry.

The physical properties and characteristics of bamboo culms have significant effects on their durability and strength which helps to determine the possible bamboo utilization (Guleria et al 2020). Four species of bamboo viz. Barak (*Bambusa balcooa*), Bari (*Bambusa vulgaris*), Mirtinga (*Bambusa tulda*), and Muli (*Melocanna baccifera*) are being used in bamboo-based incense sticks (Jenner and Selvan 2020). However, the most suitable species as a raw material for the agarbatti industry lacks study. Agarbatti sticks that were produced traditionally through hand tools used to be square. But, due to mechanization, the sticks are manufactured in round shapes with varying lengths (7 inches to 12 inches) and thickness (1mm to 1.5 mm). There is no literature or scientific study

available to suggest/indicate the most preferred physical parameters of the agarbatti sticks. The present research demonstrates the preferred physical parameters of the industrial agarbatti sticks.

MATERIALS & METHODS:

1. Study area

The study was carried out in the state of Tripura, India, which is the third-smallest state in north eastern India, having an area of 10,491 km². It lies between 22 °56' and 24 °32' N latitude and 91 °09' and 92 °22' E longitude with an altitude of 12.8m amsl surrounded by Bangladesh in North, South and West and Assam and Mizoram, two Indian states to the East. The state has a bamboo area of 3783 Km² out of the total forest cover of 7726 km² (FSI, 2019).

2. Questionnaire Survey

A questionnaire-based model was used to gather data and subsequently evaluate the preferred length, thickness, color, and shape of the agarbatti sticks. A questionnaire was prepared and tested with 104 interested respondents based on their willingness. The respondents included entrepreneurs, managers, supervisors, workers, and academicians working in the bamboo sector and who have been associated with or having adequate knowledge about the agarbatti making, following the Likert scale. Likert scales are widely used to measure the preferences, opinions, psychic and mental dispositions which is primarily based on the surveys. Certain scales are used for measuring

the attributes of the chosen variables according to the criteria of measurement theory. Respondents were invited to define his/her attitude to the statement by choosing a number of n grades. In this paper, $n=5$ denotes five scales viz., strongly disagree, disagree, neither agree nor disagree (neutral), agree, and strongly agree.

$$X_i^{(\rho)} = \sum_{j=m_\rho}^{m_{\rho+1}-1} X_{ij} \quad \rho=1, \dots, v$$

$$X_i = \sum_{\rho=1}^v X_i^{(\rho)} = \sum_{j=1}^M X_{ij}$$

The above equation implies the response vector of the respondent i in the dimension ρ , respectively, the total response vectors in all M items. Likert scale analysis was used to identify the preferred parameters viz., length, thickness, color, and shape of the agarbatti sticks. The data collected were analysed using MS-Excel.

RESULTS & DISCUSSION:

1. Preferred length of the sticks

The data analyzed revealed that 8 inches stick was the most preferred length of the agarbatti stick by 22 % of the respondents followed by 9 inches stick by 19% of respondents and 12 inches stick by 18% of the respondents with their mean score of 4.5, 4.0 and 3.6, respectively (Table 1). It is standardised by many firms and enterprises that the length of the incense sticks is around 8-12 inches (<https://www.lendingkart.com/business->

[loans/agarbatti-making-business-plan/;https://www.tradeindia.com/fp6312583/Parasmani-Agarbatti-Stick-Length-9-12-inches.html](https://www.tradeindia.com/fp6312583/Parasmani-Agarbatti-Stick-Length-9-12-inches.html);
<https://www.indiamart.com/proddetail/bambooo-round-agarbatti-stick-19285307373.html> .
 Lin et al 2008 in their study on incense stick in Taiwan have mentioned that the average length of incense stick is 39.5 cm (15.6 inches). Preference to longer lengths have been noticed in China, Thailand and Taiwan as compared to Indian requirements.

2. Preferred thickness of the sticks

The respondent data revealed that 29 % of the respondents preferred the 1.3 mm thickness of the agarbatti stick with a mean score of 4.7, followed by 1.2 mm and 1.5 mm thickness responded by 21% and 19 % with their mean score of 3.5, and 3.2, respectively (Table 2). There are very few scientific studies which mention the preferred thickness but thickness of stick is mentioned by many firms and industries which deal with bamboo incense stick which mentions that sizes in trade to be 1.2 to 3.5 mm. (<https://www.indiamart.com/proddetail/agarbatti-polished-bamboo-stick-7451194048.html>;<https://www.krishnamanufacturing.in/incense-stick.html>;
<https://www.indiamart.com/shibam-industries/bamboo-incense-stick.html>). Lin et al 2008 in one study in Taiwan have mentioned that the average diameter of incense stick is 0.4 cm. This clearly shows that the sticks used in India are thinner in diameter (1.2 to 2.0 mm) as compared to the

sticks used in China, Thailand and Taiwan (Lin et al 2008).

3. Preferred shape of the sticks

The data analyzed revealed that round mechanical was the most preferred shape of the agarbatti stick by 25 % of the respondents followed by round manual by 22% of respondents with their mean score of 4.26 and 3.60, respectively. Square manual and mechanical both recorded the same mean score of 3.06 by 18% of the respondents (Table 3). Although this study shows that round mechanical to be the most preferred followed by round manual, it is seen that both round and square incense sticks are in trade by many companies both at national and international level and there are machines to produce both the types of agarbatti sticks (<https://www.anilbamboomachines.com/round-stick-machine-set-for-agarbatti.html>; <https://www.indiamart.com/proddetail/white-raw-agarbatti-sticks-22968609691.html>; <https://www.exportersindia.com/etop-vietnam-hanoi/bamboo-sticks-in-round-and-square-shape-viet-nam-437608.htm>). It was also noticed that some firms prefer square sticks as mixture of incense sticks effectively gets hold the sticks, and thus, offers effective burnability with less fumes (<https://www.agarbattiindia.com/agarbatti-bamboo-stick.html>).

4. Preferred color of the sticks

The respondent data revealed that 24 % and 23 % of the respondents preferred the yellow and golden yellow colour of the agarbatti stick with a mean score of 4.19 and 4.15, followed

by white colour responded by 18% with their mean score of 3.14 (Table 4). It is seen that most of the bamboo sticks in trade are of natural bamboo with colour as white to brown. Some of the firms mention the incense stick colour as varying from white to black as they use synthetic colours. (<https://www.usrenterprises.com/agarbatti-sticks.html>; <https://www.ketanagarbattiworks.com/color-raw-agarbatti.html>; <https://www.shreeharitraders.in/bamboo-stick.html>). But it is visualized that light natural bamboo colour is preferred to the artificially coloured sticks.

CONCLUSION:

On the basis of the results obtained in the present research work, it can be concluded that the most preferred agarbatti sticks are mechanized round in shape with length of 8 inches, thickness of 1.3 mm and having a preferred color of golden yellow and yellow. The variation in length and colour of the sticks exists when bamboo is used as a raw material because of the inter and intraspecific variation in intermodal length and the colour of the culms. More studies are needed to find out the best species in terms of outturn, preferred physical and mechanical properties in demand both at the national level to make the agarbatti sector more profitable.

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- <https://www.shreeharitraders.in/bamboo-stick.html> (Accessed 12/06/2021)

Table1. Ranking of preferred length of agarbatti sticks produced in bamboo stick industries

Preferred length of bamboo sticks (in inches)	Mean	Rank
7	2.4	6
8	4.5	1
9	4.0	2
10	3.2	4
12	3.6	3
No preference	2.6	5

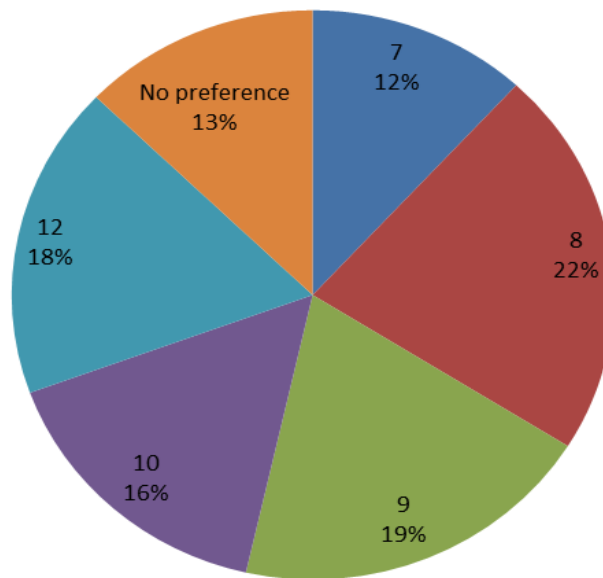


Fig 1. Preferred trend in the length of agarbatti sticks produced in bamboo stick industries

Table 2. Ranking of preferred thickness of agarbatti sticks produced in bamboo stick industries

Preferred thickness of sticks produced (in mm)	Mean	Rank
1	2.3	5
1.2	3.5	2
1.3	4.7	1
1.5	3.2	3
2	2.8	4

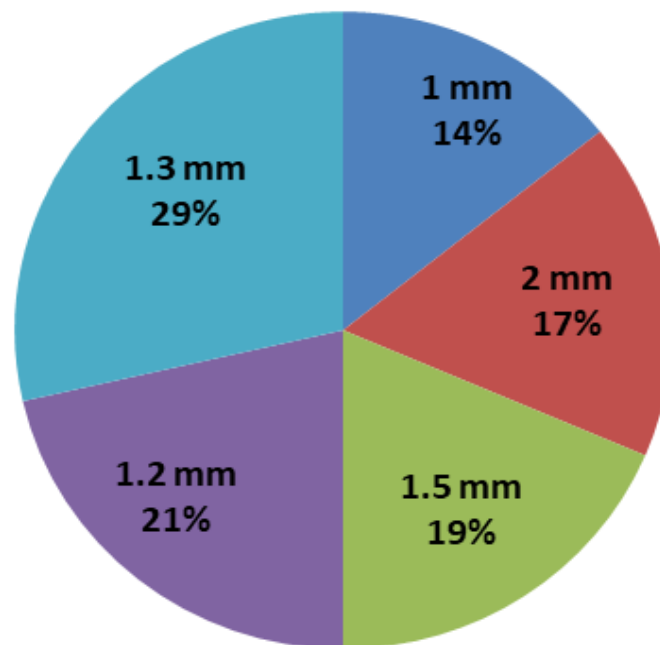


Fig 2. Preferred trend in thickness of agarbatti sticks produced in bamboo stick industries

Table 3. Ranking of preferred shape of agarbatti sticks produced in bamboo stick industries

Preferred shape of the sticks	Mean	Rank
Square manual	3.06	3
Square mechanical	3.06	3
Round manual	3.60	2
Round mechanical	4.26	1
No preference (any method)	2.79	4

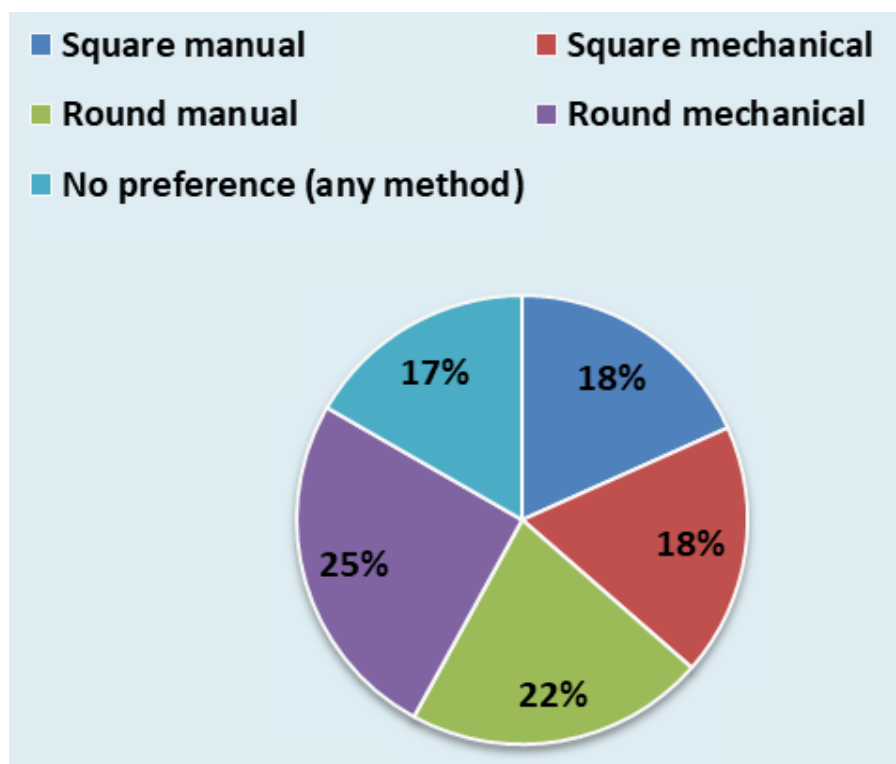


Fig 3. Preferred trend in shape of agarbatti sticks produced in bamboo stick industries

Table 4. Ranking of preferred colour of agarbatti sticks produced in bamboo stick industries

Preferred color of the sticks	Mean	Rank
White	3.14	3
Yellow	4.19	1
Golden yellow	4.15	2
Dark	3.13	4
Any colour	2.93	5

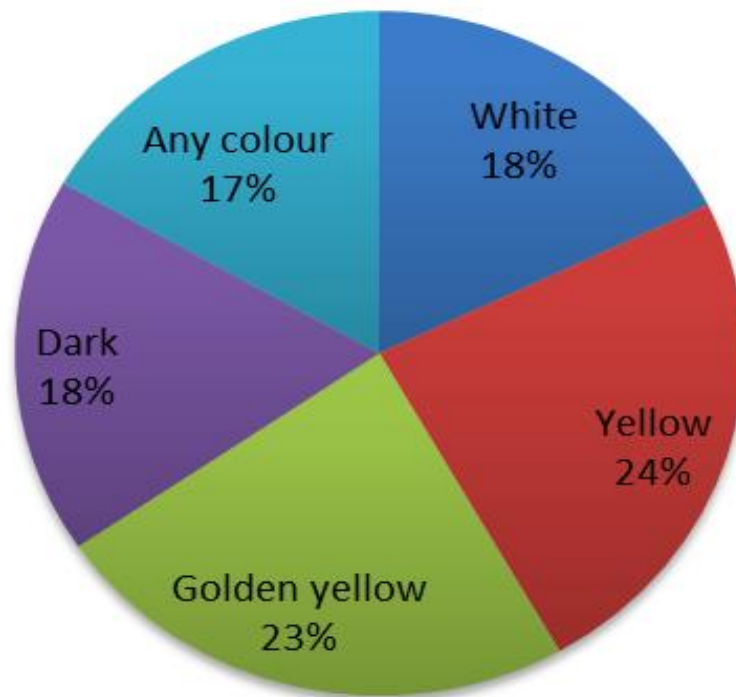


Fig 4. Preferred trend in colour of agarbatti sticks produced in bamboo stick industries