Extraction of Essential Oil: an Appropriate Rural Technology for Minimizing Wastage of Surplus Betel Leaves

by
P. Guha
Scientist Gr.I
Post Harvest Technology Centre,
Agricultural and Food Engineering Department,
Indian Institute of Technology
Kharagpur - 721 302,
INDIA
pguha@agfe.iitkgp.ernet.in

Abstract

Fresh green leaves of betel vine (*Piper betle L.*), locally known as Paan are used for chewing along with many other ingredients, mainly for mouth freshening, digestive and stimulating effects. India is the largest producer of betel leaf in the world producing a crop of about Rs. 9,000 million every year on about 700,000 "*Borozes*" (small huts wherein vines are grown in rural areas). Over 10 % of the production of betel leaves remain surplus and subjected to wastage every year particularly during the rainy season. This calls for the development of an appropriate rural technology for minimizing the wastage.

In view of the above, attempts were made for extraction of essential oil from five prominent varieties of betel leaves with the help of a Betel leaf oil extractor. The results indicate that the average oil content in the Bangla varieties was 1.7 % and in the *Mitha* varieties it was 2.0 % whereas in the *Sanchi* variety it was only 0.8 % on dry weight basis. This oil, which is the major ingredient imparting particular aroma and medicinal properties to the betel leaves, can be preserved for more than three years. The oil has a multidimensional potential use in cottage industry for manufacturing of numerous commercial products like medicine, *Gutkha* (chewable mouth freshener), incense sticks, fragrant and flavouring agent etc. Establishment of rural industry for extraction of essential oil from betel leaves at a very reasonable initial investment of Rs. 10,000-20,000/- along with the suitable "*Borozes*" is envisaged to minimize the wastage of surplus betel leaves besides increasing the agricultural as well as industrial employment opportunities in the betel leaf growing regions of India and other countries.

Introduction

The fresh green leaves of betel vine (*Piper betle L.*) are used for chewing along with many other ingredients like betel nut-chips, slaked lime, catechu, aniseed, coriander seed, pepper mint, cardamom seed, clove, sweeteners and tobacco. Such practice of chewing the fresh green leaves for mouth freshening, digestive and stimulating effects is an age-old practice in many countries of the world including India, Pakistan and Bangladesh. In India alone about 15-20 million peoples consume betel leaf on a regular basis (Guha, 1997) and a crop of about Rs. 9,000 million is produced every year on about 55,000 ha of land (Guha and Jain, 1997). There are about 500,000 *Borozes* (small huts wherein vines are grown in rural areas) in West Bengal (Samanta, 1994) employing about the same number of rural families and a fair estimate indicates that there are about 700,000 *Borozes* in the country including those of the other states. About 66 % of Indian production comes from the state of West Bengal with a 30 % contribution from its Midnapore district (Guha and Jain, 1997). But unfortunately, over 10 % of the gross production remains surplus particularly during the rainy season (Glut season). These leaves are subjected to forced marketing (distress-selling) followed by wastage every year due to improper production strategy, inadequate transportation facilities;

poor post-harvest handling, processing, packaging and storage technology (Guha and Jain, 1997). In the forced marketing stage, these leaves are sold at a throw away price due to its highly perishable nature (Guha, 1997 and 2000). Subsequently in the wastage stage, the unsold betel leaves become a big burden upon the producers for quick and safe disposal and thus, are totally wasted. Therefore, there is an urgent need for research work for minimizing such wastage by development of an appropriate rural technology (post-harvest technology), which may be simple enough for direct adoption by the concerned rural population without undergoing any special training. In view of the above, the present work was planned and carried out to extract essential oil from betel leaves from which manufacturing of relevant commercial products like mouthwash, *paan masala* (Spiced and processed betel leaf), medicine, *Gutkha* (Chewable mouth freshener which is very popular in India), fragrant and flavouring agents can be done at village level cottage industry (Guha, 1997). This may not only minimize the wastage of surplus betel leaves but also improve the employment status in India and other countries and thereby bringing about a big revolution (Guha, 2000) particularly in the rural areas.

Materials and Methods

Fresh betel leaves of five prominent varieties, namely, *Kali Bangla*, *Sada Bangla*, *Ramnagar Mitha*, *Tamluk Mitha* and *Sanchi* were collected from the nearby *Borozes* located in the Radhamohanpur village of Midnapore district of West Bengal and were utilized for oil extraction on the same day. The leaves were rinsed thoroughly with water and blotted dry before recording fresh weight. The petioles were then removed and weighed separately and the leaf blades were minced into 1-cm^2 (approx.) size before placing into a round bottom flask of 20-litre capacity of a Betel leaf oil extractor (Glass and Silver made) developed at IIT, Kharagpur by the author (**Fig. 1**). In one-batch 2.0 kg leaves i.e. 200-400 leaves were used along with about 2.0-litre of water for hydro-distillation. The round bottom flask was heated by heaters with maximum capacity of 3 kWh and cold tap water (~15 °C) was used as cooling agent. The heating continued for about two and half hours and the oil was collected in the oil collection tube (receiver), then transferred to volumetric flasks of appropriate size, corked well and kept in darkness. The essential oil was separated from water by floating over 15 % saline water (w/w) in a separating funnel. The whole extraction process has been illustrated by a flow chart (**Fig. 2**). Comparative organoleptic tests were also carried out with the stored and freshly extracted oil samples for determination of loss of aroma and taste due to storage at an interval of six months up to three years. Photographs were also taken in the field to show the wastage of surplus betel leaves during rainy season (**Figs. 3** and **4**).

Results and Discussion

The photographs taken in the field clearly show that the unsold

Fig. 1 Betel leaf oil extractor

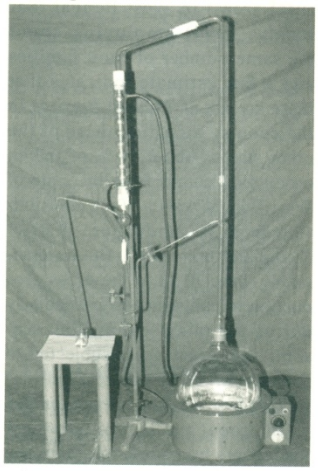
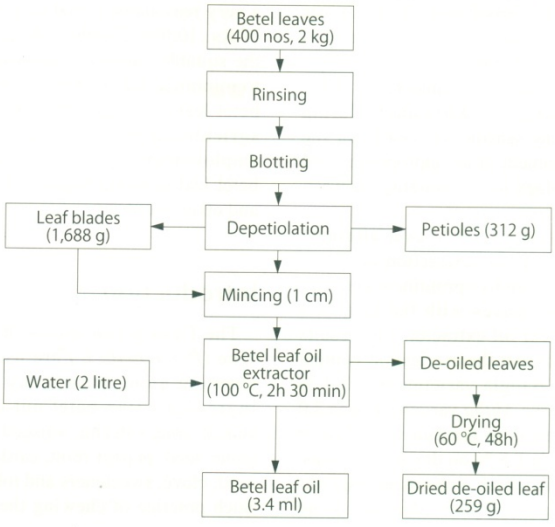


Fig. 2 Process and material flow chart for extraction of betel leaf oil



betel leaves were offered to the bovines (**Fig. 3**) and they refused to eat much due to their pungency and then the leaves were buried in the ground (**Fig. 4**) to avoid health hazards. These evidences clearly point to an alarming situation encompassing excessive production and distress selling which leads to the subsequent total wastage of the leaves (Guha, 1997 and 2000) and (Guha and Jain, 1997). These observations strongly justify the need for an appropriate post-harvest technology suitable for the existing rural conditions. Therefore, to cope up with such a situation, oil extraction trials were carried out which indicated that the average oil content of the two *Bangla* varieties was 1.7 % and of the two *Mitha* varieties it was 2.0 %, whereas in *Sanchi* variety it was only 0.8 % on dry basis (**Table 1**). Thus, the results clearly indicate that the *Mitha* varieties contained the highest percentage of oil and the *Sanchi* variety had the lowest.

The essential oil extracted from leaf blades of all the varieties had a colourless appearance in the beginning that turned gradually into light straw colour and then to dark brown colour with lapse of time. The oil extracted from *Mitha* varieties had a sweet and spicy fragrance while that from the *Bangla* varieties was pungent and spicy. The *Sanchi* variety however, had the most intense spicy and pungent odour. The comparative organoleptic examinations of stored and freshly extracted oil samples indicated that the oil can be preserved easily at room temperature without significant loss of aroma for more than three years and can be used in cottage industry for manufacturing of *Gutkha* (chewable mouth freshener which is very popular in India), mouthwash, *Paan Masala* (spiced and processed betel leaf), medicine, fragrant and flavouring agents, etc. (Guha, 1997).

It may be expected that commercial exploitation of this essential oil may bring about a big revolution (Guha, 2000) as would be evident from its financial implications, particularly in the state of West Bengal where the raw material is produced in excess of demand, invariably, during the rainy seasons. This may be very attractive to the business community concerned with a country like India where investments are invited for capturing the fabulous market consisting of 15-20 million buyers who consume betel leaves on a regular basis (Guha, 1997). The cost of fabrication of a 20-liter size oil extractor is about Rs.20,000/ and that of the 10-litre size is Rs.10,000/, which is well within the affordable limits of the betel leaf growers. Therefore, the farmers themselves, at a rural industry, can take up such oil extraction work. This will help farmers minimize the wastage of surplus betel leaves that are otherwise sold at a throw away price (Guha, 1997 and 2000), fed to the bovines or buried in to the ground. The 20-litre size oil extractor can easily process 200-400 leaves/batch and about 800-1,600 leaves/day, whereas the daily production of the leaves may not normally exceed 500 leaves/Boroz of average size, i.e., 0.02 ha. Therefore, in all accounts a small oil extractor of 20-litre capacity would be sufficient to process the surplus leaves on any day. Further, even if the 10 % surplus leaves of one week are accumulated (i.e. 50 x 7 = 350 leaves) then the same can be processed conveniently within a day. In any case, whenever required, multiple sets of oil extractors may

Table 1 Essential oil content (%) of different varieties of betel leaves*

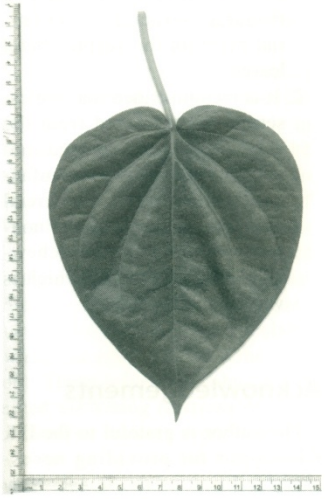
Name of variety	Trials					
	I	II	III	IV	V	Average
Sanchi	0.8	0.8	0.8	0.9	0.8	0.8
Sada bangla	1.7	1.7	1.7	1.8	1.7	1.7
Kali bangla	1.7	1.8	1.7	1.7	1.8	1.7
Ramnagar mitha	2.0	1.9	2.0	2.0	1.9	2.0
Tamluk mitha	2.0	2.0	1.9	2.0	2.0	2.0

*The leaf blades contain about 16 % dry matter

Fig. 3 A cow feeding upon surplus betel leaves

Fig. 4 Graveyard of surplus betel leaves where the leaves are buried into the ground

Fig. 5 Photograph of betel reaf



also be put into use along with a bigger Boroz in order to process the surplus leaves within a day or two. Similarly, a single unit can also be shared by several farmers to make this rural technology more cost effective. Such oil extraction will provide employment opportunities to the family members of the cultivators (Guha, 2000) counting over 500,000 in West Bengal alone (Samanta, 1994) for collection, washing, depetiolation, mincing, and processing of the leaves as well as product development and manufacturing work. This may also provide business opportunities for manufacturing, repairing and servicing the betel leaf oil extractors in addition to the essential oil traders, *Gutkha* manufacturers and others. Further, bigger and metallic units can be installed if sufficient capital is available which would magnify the agricultural as well as industrial employment opportunities besides enhancing wealth generation.

Conclusion and Recommendation

1. It may be concluded from the present study that wastage of betel leaves worth millions of rupees may be minimized through extraction of essential oil from the surplus betel leaves.
2. It is recommended that the essential oil extracted from the betel leaves may be used in a cottage industry for manufacturing of different commercial products, particularly the non-tobacco based *Gutkha* (chewable mouth freshener which is very popular in India).

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