Patchouli in fragrances-incense stick production from patchouli spent charge powder

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Abstract: Incense sticks are popularly known as the fragrance ambassador of India. The burning of incense in religious and social activities has been practiced in India since early times. Patchouli is an aromatic and medicinal plant and is grown for its essential oil. Patchouli essential oil has greater demand and finds extensive application in flavour, perfumery, cosmetic, food and beverage industry and pharmaceutical industries. In our present study the residual essential oil content of patchouli spent charge was studied under various methods, i.e. shade, tray and sun drying, after steam distillation extraction of patchouli essential oil. The residual essential oil content of shade dried spent charge was 0.5% - 0.7%. So, the ground shade dried patchouli spent charge was used in incense sticks manufacture. Ten different types of incense sticks were produced by blending the patchouli spent charge powder at various levels along with other traditional ingredients; and it made us clear that patchouli spent charge powder can replace wood powder up to 5% - 10% level which is currently used at 15% level. Various physical quality parameters of different patchouli spent charge based incense sticks were studied which eventually indicated that incense sticks from spent charge powder were much acceptable at present scenario.

Keywords: patchouli, spent charge powder, wood powder, incense sticks

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1 Introduction

Flavours and fragrances have been part of life since ancient times. In some or other ways we all use perfumery and flavour materials in our daily life. It was thought to have power to heal and protect human from evil. As we are all aware that, from early in the morning to late at night, whatever we use for personal care and hygiene to cosmetics and confectionaries are added with some types of perfume or flavours. These come naturally from many plants and animal sources. Fragrance creation is an art as well as science. In the old days, perfumer was using only natural essential oils as ingredients for perfume creation. It was more often an art. As time passed, the availability of natural essential oils became difficult and the cost of natural oils started rising. These along with the advent of organic chemistry, provided natural and synthetic perfumery materials. At the same time, usage of perfumes in various household products was spread and the requirement of industrial perfumes increased substantially. This helped perfumers with more choices of ingredients with affordable cost. This development forced to understand the chemistry of perfumery ingredients, including the quality aspects and profiles (Raghavan et al., 1995; Ranade and Paranjape, 2000).

Incense sticks are usually made from aromatic plants and essential oils extracted from plants or animal sources. When incinerated, they will produce a very captivating and appealing fragrance (Anonymous, 2007). In ancient times, only naturally fragrant resins or woods like sandalwood and patchouli were used for incense.

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Modern fragrance production allows virtually any scent to be duplicated. It includes green tea, candy cane, blueberry, pumpkin pie and gingerbread incense. The manufacture of incense sticks involves no typical or sophisticated chemicals and the raw materials consist of powdered odoriferous (roots, barks, seeds, woods, leaves, flowers, etc) resins, essential oils and aromatic chemicals. The paste made with the raw materials like charcoal powder, gum along with water, and colour is applied to bamboo stick on which additional perfumes/fragrances or combination of fragrances may be dipped later. The process of manufacture is entirely manual. Families are contracted and workers in these families are mostly women; some child labour input occurs, mainly to assist the family business (Figure 1). It is produced largely in rural sector and has a sizeable export market. The BIS (Bureau of Indian Standards) Committee formulated a standard covering only physical characteristics like fragrance, visual inspection, length, size, burning time, etc., initially with a view to improving it substantially to distinguish an acceptable product from non-acceptable one. The Indian standard for incense sticks was finalized in 1984. BIS code for incense sticks is IS; 13582. The current growth rate of incense stick industry is 20% on year basis (Anonymous, 1992; Bordoloi and Sarmah, 2009).

Figure 1 Labours involved in the production of incense sticks in a cottage industry at Bangalore

Incense sticks are considered as a substance which stimulates the senses to bring physical pleasure and mental tranquillity. Incense sticks making is an art which made its appearance in the southern region of India primarily because of easy availability of sandalwood and jasmine in the area. It is largely concentrated for almost 80% in the southern region. Traditionally, artisans in kingdoms of Mysore, Tiruchirapalli and areas nearby used to make aromatic and fragrance products that had therapeutic and cosmetic properties. The art soon spread among more families as the demand for the products grew. Even today, incense sticks rolling are largely concentrated in the Karnataka, Tamil Nadu, and Andhra Pradesh. Widespread utilization of herbal-based incense sticks for their pleasing fragrances has also been found in the Middle East, European countries and other parts of the world. As per the market survey conducted by the National Council of Applied Economic Research (1990), the total quantity of incense sticks produced in the country in 1990 was 147 billion, valued at around 130645900 US$. The production and market size of the sector are increasing tremendously in India and abroad. The consumers are highly concentrated among the rural pockets (61%) in India (INBAR, 1994; Jenner and Reza, 2008). Incense works on the simple principle of heating together with a combination of two compounds with different boiling points. The volatile compounds (aromatic compounds) having a lower boiling point will evaporate first, thus spreading their fragrance in the atmosphere. While the carrier oil/resins will help the incense mix to burn to ashes (Anonymous, 2011).

The incense sticks industry is fragmented with numerous small players dominating the industrial landscape. The biggest brand in the incense sticks

industry 'Cycle' has only 3% market share. FMCG companies like Hindustan Lever have tried to enter the industry to leverage their large distribution network through the machine-made incense sticks route which appealed on aesthetics but did not rate highly on fragrance. ITC has now entered the industry as a national player, buying from vendors who make handmade products. The incense sticks industry is witnessing a healthy growth of 10% - 12% every year since the last five years or so and in a way is not able to cope with this growth. Twenty-five to thirty percent of the industry is controlled by 20 - 25 large players with the turnover of each player being 4,665,925 – 5,599,110 US$ approximately. The largest player, Cycle has a turnover of 11,198,220 US$ with 75% of the industry being characterised by small players who undertake even perfume dipping and packaging through job workers supplying to distributors (Anonymous, 2012a).

Patchouli (*Pogostemon cablin* Benth.) is a medicinal and aromatic herb, a member of the Lamiaceae family and is notable for its various health beneficiary applications such as: a reducer of appetite, water retention, and inflammation; a cell rejuvenator and antiseptic; an aphrodisiac; an aid in the treatment of acne, eczema, nervousness, depression, and insomnia; a fungicide; an insecticide; an aid in combating menstrual problems; an antirheumatic; a treatment for headaches; and a tranquilizer, sedative and hypotensive (Zhu et al., 2003; Pavela, 2005; Oyen and Dung, 2006; Khare, 2007; Wei and Shibamoto, 2007). The pleasant aroma and versatility of patchouli and its extensive usage in aromatherapy, perfumery, cosmetics, beverages and food industry has increased its market potentiality. Indonesia is the major producer and exporter of its oil, whereas Malaysia, China and Brazil are also large producers. Indian demand for patchouli oil is around 220 tons valued at 6,159,021 US$ while global demand is to the tune of 1,600 tons of oil per annum with a value of 44,792,880 US$. India has considerable scope to enter the world market (Vijayakumar, 2004; Anonymous, 2012b). Very large agarabatti industry can consume spent leaf of patchouli along with twigs which has very low oil content. This can fetch almost 10% - 20% cost of raw materials. This type of materials produced so far has been sold in incense industry fetching 0.22 – 0.24 US$ kg^{-1} (Anonymous, 2008). Only few works have been reported on the processing aspects of patchouli though considerable progress has been made in the cultivation front. Currently, the spent charge (herbage after steam distillation) after distillation of patchouli essential oil is not used except for production of biogas by anaerobic digestion and manure purpose (Borah et al., 2003). There is a potential for utilizing this by-product in incense stick manufacture after drying and pulverizing it into suitable particle size powder. Patchouli has characteristics in common with camphor, cedarwood, vetiver, calamus, oakmoss and orris (Anonis, 2007). The use of medicinal and aromatic plants has never been out of focus throughout history (Baser, 2005). The incense stick industry depends heavily on forest products for their raw materials. This calls for the use of patchouli spent charge powder for incense stick production, as every year hundreds of acres has been deforested for manufacturing of incense sticks all over the world. This would rather helps in conservation of natural forest resource. The powder may replace sawdust powder, a raw material in incense stick production.

2 Materials and methods

2.1 Residual essential oil extraction by hydro-distillation method

The extraction of residual patchouli essential oil from the experimental samples of dried patchouli spent charge after steam distillation studies (convective tray drying, shade drying and sun drying) was done in the laboratory by hydro-distillation technique (AOAC, 1995) using Clevenger's apparatus. This was mainly carried out to make sure whether spent charge still possesses oil content in it, so that it could be advantageously used for further processing of incense sticks production purpose.

2.2 Determination of moisture content for incense sticks ingredients

The moisture content of the ingredients of incense stick mix was determined as per the procedure outlined in AOAC Standards (1995).

2.3 Incense sticks production

The raw materials for making base incense sticks include charcoal powder, '*jigatu*' powder (a gummy material from plant origin that helps to bind ingredients on to the bamboo stick), wood powder (roughly around BS: 40 mesh size ≈355 μm), '*nuruva*' powder and the bamboo sticks (Figure 2). Shade dried patchouli spent charge were taken in three different leaf-to-twig ratios, namely, 70:30, 60:40 and 100:0. The samples were ground to powders of 65 mesh sieve size (350 μm). The patchouli spent charge powder above blended along with wood powder was used at three levels, namely, 5:10, 10:5 and 15:0 (spent charge: wood powder), in the production of incense sticks. Totally ten types of incense stick mixes including the control were tried in the present study for the production of incense sticks and the treatment details are given in Table 1 (Figure 3).

Figure 2 Raw materials of incense sticks

Table 1 Treatment details of patchouli spent charge based incense sticks

Treatments	Patchouli spent charge powder : wood powder			Leaf : Twig ratio of patchouli spent charge powder		
T_1	05	:	10	70	:	30
T_2	10	:	05	70	:	30
T_3	15	:	00	70	:	30
T_4	05	:	10	60	:	40
T_5	10	:	05	60	:	40
T_6	15	:	00	60	:	40
T_7	05	:	10	100	:	00
T_8	10	:	05	100	:	00
T_9	15	:	00	100	:	00
T_{10}(Control)	00	:	15	Not Applicable		

Figure 3 Patchouli based incense sticks

2.4 Quality characteristics of incense sticks

Physical parameters, viz., mean weight, moisture content, diameter, burning test (IS: 13582-1992) was carried out indoors at ambient room conditions. For burning test, three samples of incense sticks from each treatment were randomly selected. Burning length of each stick was made equal using surgical knife. Sticks were placed horizontally over the table and sticks are lit. Time taken for complete burning of individual stick was recorded using stop watch and the mean burning time was calculated. Sensory evaluation (organoleptic evaluation) of the unscented incense sticks was conducted by a panel of fifteen trained judges for appearance, colour, 'fragrance before burning' and 'fragrance after burning'. Samples from each treatment were coded and presented to the panel for evaluation. The ratings assigned by the panel of judges were numerical scores ranging from one to five points as outlined by Amerine et al. (1965).

3 Results and discussion

The residual oil content of patchouli spent charge dried under various drying methods was estimated by hydro-distillation technique using Clevenger's apparatus and the results were presented in Table 2. The residual oil content of dried patchouli spent charge was about 0.2% to 0.7%, higher value being observed in shade dried sample. Interestingly, both sun dried and tray dried spent charge samples had very low residual essential oil

content (<0.5%). So, shade dried samples were utilized for incense stick production after grinding into suitable particle size. The moisture content of various incense stick ingredients was estimated to have integrity in incense stick production, before manufacture of incense sticks and is presented in Table 3. As per the plan, ten types of 'bland' incense sticks were produced by varying the level of raw ingredients of incense mix especially the wood powder component. The finished patchouli spent charge based incense sticks were tested for various quality parameters, viz., test weight, moisture content, diameter and burning time (in triplicates). The parameters were studied in line with IS:13582-1992 code for incense sticks and are presented in Table 4. The experimental data were analyzed by one way ANOVA and CRD was followed for analyzing the data of the present study. The data were analyzed for main and interaction effects at probability level of 5%.

The unscented incense stick samples of ten different treatments were subjected to sensory evaluation (five point hedonic scales) by trained judges to assess the sensory quality. Table 5 shows the average sensory scores obtained by the ten types of incense sticks (panel of fifteen trained judges). It was found that there was no significant difference between the incense sticks of different treatments as far as colour and appearances were concerned. This is because the sticks were made using almost the same type and quantity of ingredients like charcoal powder, sawdust, jigatu, nuruva, etc., and the sticks were rolled by a single person. Partial or full replacement of wood powder with spent charge powder perhaps did not affect these attributes much since, both powders were of plant origin and the replacement level

Table 2 Residual essential oil content in patchouli spent charge

Sl. No.	Drying method	Residual essential oil content in spent charge/%
1	Tray drying	
	@ 50℃	0.2 – 0.3
	@ 60℃	0.2 – 0.3
	@ 70℃	<0.2
2	Shade drying	0.5 – 0.7
3	Sun drying	0.3 – 0.4

Table 3 Moisture content of different ingredients of incense stick

Ingredient	Moisture content/% wb
Patchouli spent charge powder	8.26
Wood powder	9.52
Charcoal powder	9.76
'*Nuruva*' powder	8.39
'*Jigatu*' powder	10
Bamboo sticks	9.59

Table 4 Quality parameters of different incense sticks made using patchouli spent charge powder

Treatments	Parameters			
	Moisture content /% wb	Stick diameter /mm	Test weight /gm	Burning time/min
T_1	9.59	3.0960	1.0118	35.34
T_2	9.24	2.9640	1.0546	37.32
T_3	9.97	3.2700	1.0878	38.29
T_4	10.11	2.8700	1.1298	38.89
T_5	10.14	2.8880	1.1720	36.32
T_6	10.05	2.8100	1.1144	41.57
T_7	9.72	3.0000	1.2190	38.01
T_8	9.87	2.8680	1.1472	42.64
T_9	10.05	2.8460	1.0250	38.68
T_{10}	9.75	2.5540	1.0360	35.78
Mean	9.85	2.9166	1.0998	38.28
F-value	NS	NS	NS	*
SEm ±	0.1501	0.1546	0.0848	1.1231
CD (0.05P)	0.4303	0.4419	0.2424	3.3131
CV (%)	2.1501	11.8542	17.2474	5.0804

Note: * Significant at 5% level; NS - Non significant.

Table 5 Sensory scores of different incense stick for various sensory attributes

Treatment	Quality Parameters				
	Color	Appearance	Fragrance before burning	Fragrance during burning	Overall acceptability
T_1	3.80	3.73	3.73	2.93	3.46
T_2	3.66	3.80	3.60	2.86	3.26
T_3	3.66	3.40	3.26	2.73	3.06
T_4	3.66	3.73	3.86	2.86	3.40
T_5	3.73	3.53	3.46	2.80	3.20
T_6	3.80	3.80	3.33	2.86	3.26
T_7	4.13	4.13	4.06	3.26	3.90
T_8	3.86	3.80	3.70	3.10	3.23
T_9	4.06	4.00	3.56	2.86	3.16
T_{10}	3.86	3.93	3.13	2.80	3.20
Mean	3.82	3.78	3.57	2.91	3.31
F-value	NS	NS	*	NS	*
SEm ±	0.17	0.18	0.19	0.15	0.16
CD (0.05P)	0.48	0.50	0.52	0.44	0.44
CV (%)	17.6	18.81	20.65	21.26	18.94

Note: * Significant at 5% level; NS- Non significant.

was at 15% in the total composition. As far as fragrance before burning was concerned, the incense sticks of treatments that contained relatively higher proportion of spent leaf powder (T_7, T_8 and T_9) were adjudged to be good by the panellists. This is because in spent charge, the leafy matter was found to contain relatively more residual oil compared to twigs that resulted in better fragrance of incense sticks before burning, as in such treatments where proportion of leaf powder was higher.

However, the fragrance during burning was mostly woody similar to the control. This clearly indicated that the normal process of dipping of bland incense sticks in fragrance/perfume solution is necessary. The mean scores given by sensory panel indicated that the treatments T_7 is best in respect of all the tested sensory attributes. The treatment T_8 was on par with T_7, and therefore, it may also be acceptable provided physical quality traits and burning ability were good. Considering all the quality attributes in totality, it may be concluded that incense sticks made from treatments T_7 and T_8 were best among the tested treatments. It implied that for incense stick manufacturing, patchouli spent charge leaf powder can be added to about 5% - 10% level replacing wood powder which is normally present at about 15% level in the ingredient mix.

4 Conclusions

In conclusion, currently the spent charge after distillation of patchouli essential oil is not used except for manure and to a meagre extent biogas production. There is a potential for utilizing this by-product in incense sticks manufacture after drying and pulverizing it into suitable particle size powder. The powder may replace sawdust/wood powder, a raw material in incense sticks production. From the studies conducted above, sensory attributes of different patchouli spent charge based incense sticks indicated that incense sticks were very much acceptable to the consumer. It may be concluded that patchouli spent charge powder can replace wood powder up to about 5% - 10% level of incense masala mix, substituting 2/3 of 15% of wood powder requirement with spent charge powder. This will help to conserve the natural forest resources, since for the same incense stick manufacturing purpose hundreds of acres of land is deforested every year. Also, incense sticks produce smoke which is considered as injurious to health, since it contains woody material. Instead, patchouli based incense sticks may be used, as patchouli has many health benefits.

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