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# Ascertain of volatile oil in selective seed spices from diverse sources

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## ABSTRACT

Seed spices such as cumin, fennel and coriander are high value and low volume case crop for farmers of arid and semi-arid region of Gujarat and Rajasthan. Spices have diverse nature of uses from culinary to medicine ingredient that are salubrious nature to human, even to animals. The spice content play a significant role for their quality evaluation and obtain value addition products. Volatile oil also knows as essential oil a major vital content and value added product from spices. To find out volatile oil content in different sources of seed spice have useful to procure for need base quality requirement. Presently an assessment of volatile oil in selected seed spices *viz*., cumin (*Cuminum cyminum* L.), fennel (*Foenicum vulgare* M.), and coriander (*Coriandrum sativum* L.) were conducted from collectively 923 samples collected from various sources during the two years 2011-12 and 2012-13 harvested crops. Results showed in table 1 are pooled average volatile oil (VO) content (v/w%) in seed spices that were found to be 4.10 $\pm$ 0.825%, 1.69 $\pm$ 0.525%, and 0.46 $\pm$ 0.125% from 326, 337, and 260 samples of cumin, fennel and coriander, respectively. In cumin and fennel seed from agronomic trials showed highest volatile oil 4.79% and 2.02%, whereas processed seed powder showed lowest volatile oil of 3.50% and 1.44%, respectively, in both crops. While in case of coriander, the VO value was 0.48% as highest in breeding trial samples, but at par with rest of collection from APMCs & FLD's, agronomic trials, and pooled average value at 0.46%. Crops of cumin and fennel seed from organic farming were significantly at par with agronomic trialed, whereas breeding- a varietal diverse cumin and fennel seed shows significant lower VO at 3.76% and 1.68% than rest collections of crops, respectively, in pooled value of both years. The volatile oil average values in cumin and fennel were 4.04%, 4.16% and 1.54%, 1.84% of their respective year of 2011-12 and 2012-13, which were within the significant limit but processed sample lead to decreases the content significantly from 4.10 $\pm$ 0.825% to 3.50 $\pm$ 0.59% which is net 17.14 percentage less than that of the pooled average value. It may infer from this assessment of volatile oil in cumin, fennel and coriander seeds that the good agricultural production practices as well as organic farming may increase in content against processed-cleaned.

**Key words:** volatile oil, cumin, fennel, coriander, agricultural practices

Spices are having unique aromatic and flavoring properties due to phytochemical mixture that make then a special ingredient for the culinary as well as salubrious. This special property is due to present of volatile oils (VO) is also known as an essential oils (EO) in it, which are a diverse groups of natural biochemical ingredients in spices and condiment that are important sources of aromatic and flavoring chemicals in food, cosmetic, pharmaceutical and process products. Volatile oils are largely composed of terpenes and aromatic polypropanoid

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compounds derived from the acetate-mevalonic acid and the shikimic acid pathways, respectively (Croteau *et al*., 2000, Alemayehu *et al*., 2016). Essential oil composition and content of plants varies among and within spices, also differ due to genetic and environmental factors that influence genetic expression (Bernath *et al*., 1986).

Essential oils, there can be several reasons why the composition and thus, the EO quality from aromatic plants might differ greatly, which can be due to genetic, physiological and environmental factors as well as processing conditions. *In the genetics,* taxon clone, hybrid, cultivar, population intra specific chemotypes (distinct populations within a species), p*hysiological such as o*ntogenetic developmental changes (vegetative <> generative), plant organ size and morphological differences (root, leaf, flower, seed), *Environmental like c*limate, light hours, temperature, latitude, height above mean see level, origin of spices, continent, agriculture cultivation techniques, fertilizer, irrigation, harvest time, and *pre processing etc.* The essential oil content of plant tissue also varies with developmental stage (Burbott and Loomis, 1967, Lawrence, 2002) and EO can vary by extraction methods, isolation distillation, extraction, maceration, pressing, effleurages, storage effects of aging, ΔT, rH etc. on raw material or EO Adulteration/ Standardization EO blending prior to distillation/ directly into the EO (Guenther, 1972).

The major seed spices produce as a agro commodities in the Gujarat region are cumin, fennel, fenugreek, coriander, ajwain, and dill seed. Cumin, fennel, coriander are major case crops with high value and low volume for farmer of arid and semi-arid region of Gujarat and Rajasthan in India. Cumin, coriander required fewer inputs, cultivated in *rabi* season, whereas fennel is long duration cold weather seed spice crop grow during *kharif* and *rabi* season (Panda, 2010)**.** Quality, quantity as well as productivity base cumin, fennel, coriander were prominent in India that make then to export oriented case crop for country too. The share of seed spices export to total spices is only 18 per cent in terms of quantity from Indian spices and spices products that reaches more than 135 countries in world. During last four years export of total spice are increasing value in million US dollar from 2,212 to 2,633 in the year of 2012-13 to 2016-17 (estimated), cumin as third most export product from country at it increased in rupees from lakh 115,306.61 to 196,320.00 and quantity volume from 85,602 to 119,000 tons during same year's period. The total export of spices has exceeded in terms of both volume and value as compared with the target to 8,70,000 tons, valued Rs.15725.12 crore (US$2419.25million) for the financial year 2016-17 the achievement was 109% in terms of volume and 112% in rupee and 109% dollar terms of value (Anonymous 2017). There is a need for clustering of farmers, formulation of cooperatives for international marketing and development sustainable a value addition in the field of spices, a particularly seed spices to enhance self life through value added derive product such as volatile oil, oleoresin and extractant *etc*. and to general more revenue than the presently, particularly during direct seed's marker price slow down with bumper production. Therefore present study was carried out to evaluate the volatile oil content in different seed spices as a one of the most important parameter for spice quality for grading and value addition. To identify the agronomic effort to have high quality seed having maximum vital ingredients that is volatile oil. The objective of the present studies was to determine VO content in three seed spices samples collected from different sources such as agronomic trails, from markets that is APMCs, processed houses, organic

farming FLD's, breeding trails as well as pool together to ascertain a source of quality crops produce, that will useful for need base procurement for specialized marketing or go to value addition.

## MATERIALS AND METHODS

Samples:

The investigation of the present studies were conducted for the percent volatile oil (VO) present in selective three seed spices, cumin (*Cuminum cyminum,* L.), fennel (*Foenicum vulgare* Mill), and coriander (*Coriandrum sativum* L.). For the estimation of volatile oil, total 923 samples, out of which 326, 337, and 260 of cumin, fennel, and coriander, respectively, were collected from the different sources Front Line Demonstrations (FLD's) and Agricultural Production Marketing Committees (APMC's), process houses, agronomic trials, organic farming trials, breeding trials experimental at center for research on seed spices (CRSS), Sardarkrushinagar Dantiwada Agricultural University (SDAU), Jagudan-382 710, during successive two year of 2011-12 and 2012-13. Each seed spices samples of 200-250 gram were packed in the polyethylene sealed bags and stored in the refrigeration at 4°C temperatures until analysis.

Volatile oil determination

Volatile oil content was evaluated by hydro distillation (HD) technique with Clevenger-type apparatus as per m*ethod* suggested (ASTA, revised 2010). Seed powdered were prepared quickly in grinding mill passing through no. 20 mesh size sieve and avoid undue heating of sample during grinding, mix carefully to avoid stratification (layering), immediately use for analysis, where weight the accurate 50 gm of grinded seed powder and loaded in the round bottom steam generation flak of 1 liter of Clevenger assembly, powder immersed with 500 ml water enough to submerge sample completely in the steam flask. Steam flask heated gently to allow the distillation for 3-4 hours under cool water circulation in Clevenger condenser and allow to separation of two layers in graduated tube of assembly to measure the reading, calculated and express volatile oil % percent (v/w) and standard deviation (SD) using Microsoft excel program format.

## RESULTS AND DISCUSSION

Volatile oil is an essential component of the spices and its content in the seed spices such as cumin, fennel and coriander play a critical role for their quality assessment and to obtain value addition products. Second most important aspects in agricultural research after breeding program of selection of variety is to find out most appropriate agricultural practices on crop of cultivation for maximum yield, productivity and better quality produce. For spices seed quality product is determined based on biochemical constitution properties particularly content of volatile oil present in the final product. The scope of research for quality product during cultivation of crops at various levels such as the improvement of genetic breeding of seeds, the development of high yield and constitute varieties etc at germ plasma level. Second one should be good agricultural practices like geometry, fertilization, protection measures, agronomy and assessment of environmental factors that have significant influences on quality parameters of crop and its products. The processing and post harvest treatment at final level also have functional role in preservation and maintenance of quality of particularly spices seed and its products. Taking into these criteria under consideration, volatile oil of the spices and

spices product play a imperative responsibility to justify its quality and justification of value, therefore determination of volatile oil have been carried out from the various samples of the spices seeds of cumin, fennel and coriander collected from various sources as mention in material and methods.

The results of the volatile oil content in three seed spices, five categories and overall pooled value for the studies of two successive productive year 2011-12 and 2012-13 were shows in the table-1, The pooled samples value of mean volatile oil in per cent and standard deviation (SD) of cumin (326) fennel (337) and coriander (260) were found at 4.10 ± 0.825, 1.69 ± 0.525 and 0.46 ± 0.026%, respectively. Samples analysis from the both the year 2011-12 and 2012-13 crops, resulted values of agronomic practice trials samples of cumin and fennel showed highest volatile oil at 4.77% and 1.94%, 4.80% and 2.10%, respectively, which were significantly highest among all others samples of the same years, followed by organic farming samples had 4.52 ± 0.38% and 1.76 ± 0.18%, 4.70 ± 0.52% and 2.04 ± 0.10% respectively in both years. In case of coriander samples from samples of APMCs,& FLD's, agronomic trials, and breeding trials did not show any significant variation in volatile oil values at 0.48%, 0.47% , and 0.49% in 2011-12, as well as at 0.46%, 0.42%, and 0.46% in year 2012-13, respectively, against average values of 0.44 ± 0.12% and 0.48 ± 0.09% in both respective years.

The volatile oil percent values of the samples of cumin and funnel from CRSS breeding trails had second lowest value 3.64% and 1.66% and 3.87 % and 1.92 %, respectively, than the processed one in both year's crops. Cumin samples from processed category had 3.39% and 3.60% which are lower in year 2011-12 and 2012-13, respectively, in case of fennel had 1.44% as lowest in year 2011-12. Cumin from APMC's & FLD's samples value of 4.04% and 4.00% in the both years, which are at par with average as well as pooled mean values of volatile oil. During both years 2011-12 and 2012-13, organic farming samples had second highest in both crops cumin values as 4.52% and 4.70% and fennel values 1.76% and 2.04%, respectively, which are at par with agronomic trials seed content value of highest. In case of coriander samples average values were found to be at 0.44 ± 0.124 % and 0.48 ± 0.091% in years 2011-12 and 2012-13, respectively, without any significant variability among agricultural trials, APMC's & FLD's, and breeding trials samples.

Samples of cumin and fennel from various sources mentioned in table 1 for volatile oil analysis, pooled value of two consequence productive year 2011-12 and 2012-13 had significant variation among each others. Cumin sample from agronomic trials practice showed highest 4.79% and processed samples have a lowest 3.50%, similarly in fennel agronomic and APMCs & FLD's samples had highest 2.02% and processed have only 1.44%. Pooled mean value of volatile oil of the samples of cumin (236) and fennel (337) and coriander (260) had 4.10%, 1.69% and 0.46%, respectively. As compared with reported by Simon *et al.,* (1984) value of volatile oils found in cumin was essential oil 2.5 to 5 percent on a dry weight basis, whereas seeds of cumin (*Cuminum cyminum* L.) from China was a yield of 3.8%, obtained by steam distillation reported by Rong *et al*., ( 2004). Thus the cumin in the present studies variety GC-4 cultivated at CRSS, SDAU, Jagudan and other North Gujarat and its vicinity regions had 4.10% which higher end by 15-20% volatile oil percent content as compared with international reported values. The Fennel has reported value of volatile oil content in seed varies considerably

with the variety, being the lowest 0.7- 2.0% in fruits of Indian origin and highest (4-6%) in fruits obtained from Eastern Europe as mention by Joy *et al*., (2001). While the fennel (*Foeniculum vulgare* L.) variety GF 11 cultivated at in this studies have similar 1.70 % VO value to the reported values of 0.7 - 2.0%. Coriander seed the essential oil is obtained by the steam distillation of mature dry larger seed contains very low 0.10-0.35% where as the small seed contains 0.8-1.8%. (Dimiri, 1976) while in present study cultivated coriander (*Coriandrum sativum* L.) Gujarat Cori-2 variety has volatile oil at 0.46% which more than larger seed, but lesser than smaller seed one.

The present studies on volatile oil content in three different seed spices incite that the agronomic practice in both cumin and fennel and some extend organic fertilized farming has more volatile oil content than the farmer practice cultivated pooled samples. Such data may helpful fort the selection of farm practice to improve VO content in seed spices and overall value addition for export oriented spices.

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Table 1 Volatile oil (v/w %) in seed spices estimated from different sources of samples collected during year 2011-12 and 2012-13

| Productive period | Year | 2011-12 | | 2012-13 | | Pooled | |
|---|---|---|---|---|---|---|---|
| Sample type | No. | Mean % VO | No. | Mean % VO | No. | Mean % VO | |
| Cumin (*Cuminum cyminum* L) | | | | | | | |
| APMC's & FLD's | 70 | 4.04 ± 0.620$^{b}$ | 5 | 4.00 ± 0.503$^{b}$ | 75 | 4.02 ± 0.562$^{b}$ | |
| Processed | 32 | 3.39 ± 0.596$^{c}$ | 22 | 3.60 ± 0.347$^{c}$ | 54 | 3.50± 0.472$^{c}$ | |
| Agronomic trials | 26 | 4.77 ± 0.592$^{a}$ | 107 | 4.80 ± 0.440$^{a}$ | 133 | 4.79± 0.516$^{a}$ | |
| Organic farming | 12 | 4.52 ± 0.386$^{a}$ | 13 | 4.70 ± 0.520$^{a}$ | 25 | 4.61± 0.453$^{a}$ | |
| Breeding trails. | 19 | 3.64 ± 0.657$^{c}$ | 8 | 3.87 ± 0.659$^{c}$ | 27 | 3.76± 0.408$^{c}$ | |
| Average value | 159 | 4.04 ± 0.851$^{b}$ | 155 | 4.16 ± 0.679$^{b}$ | 314 | 4.10 ± 0.825$^{b}$ | |
| Fennel (*Foeniculum vulgare* M.) | | | | | | | |
| APMC's & FLD's | 00 | -- | 4 | 2.02 ± 0.251$^{a}$ | 4 | 2.02± 0.105$^{a}$ | |
| Processed | 10 | 1.44 ± 0.105$^{c}$ | 0 | -- | 10 | 1.44± 0.192$^{c}$ | |
| Agronomic trials | 10 | 1.94 ± 0.107$^{a}$ | 65 | 2.10 ± 0.176$^{a}$ | 75 | 2.02± 0.191$^{a}$ | |
| Organic farming | 16 | 1.76 ± 0.179$^{a}$ | 41 | 2.04 ± 0.103$^{a}$ | 57 | 1.88± 0.355$^{a}$ | |
| Breeding trails. | 166 | 1.66 ± 0.158$^{b}$ | 24 | 1.92 ± 0.159$^{b}$ | 190 | 1.68± 0.331$^{b}$ | |
| Average value | 202 | 1.54 ± 0.284$^{b}$ | 134 | 1.84 ± 0.278$^{b}$ | 336 | 1.69 ± 0.525$^{b}$ | |
| Coriander (*Coriandrum sativum* L.) | | | | | | | |
| APMC's & FLD's | 08 | 0.48 ± 0.082$^{a}$ | 10 | 0.46 ± 0.035$^{a}$ | 18 | 0.47± 0.059$^{a}$ | |
| Agronomic trials | 20 | 0.47 ± 0.059$^{a}$ | 29 | 0.42 ± 0.059$^{a}$ | 49 | 0.45± 0.059$^{a}$ | |
| Breeding trails. | 180 | 0.49 ± 0.083$^{a}$ | 23 | 0.46 ± 0.072$^{a}$ | 203 | 0.48± 0.123$^{a}$ | |
| Average value | 208 | 0.44 ± 0.124$^{a}$ | 62 | 0.48 ± 0.091$^{a}$ | 270 | 0.46 ± 0.026$^{a}$ | |