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# Chemical Composition of Essential Oils From Released Coriander Variety (Coriandrum sativum L.) Grown in Ethiopia

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**Abstract**
The objective of this study was to determine the chemical composition of two coriander variety (Indium and Dinqnesh) produced in Ethiopia. The essential oil content was obtained by hydro distillation method with Clevenger apparatus. The chemical profiles of two varieties were identified using GC-MS. The essential oil content of the dried seeds was 0.60% for Dinqnesh and 0.50% for Indium varieties, respectively. About thirty four and fifty one different compounds were identified from essential oil of Indium and Dinqnesh varieties, respectively. Linalool was found to be the principal constituent for both varieties. The variety Indium had higher linalool content (76.45%) than Dinqnesh (58.85%). Other major components identified were Geranyl acetate (5.60% for Indium and 4.04% for Dinqnesh variety), γ-terpinene (6.76% for Dinqnesh variety and 2.83% for Indium) and α-pinene (6.15% for Dinqnesh and 4.90% for Indium) were identified. Bicycle [2,2,2] heptan-2one,1,7,7-trimethyl-, (1S) and Benzene, 1-methyl-3-(1-methylethyl) were a compounds found only in Dinqnesh Variety and yielded 6.54% and 1.28%, respectively. With comparing the chemical composition of both variety essential oil constituents to other origin or standard requirements, both varieties meet the potential for nutritional and export standard requirement.
**Keywords:** Coriander, essential oil, chemical composition, quality
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## 1. Introduction

The flavour and aroma of produced from coriander seed is mainly due to its essential oil constituents. Coriander seed oil is found among the 20 major essential oils (Lawrence, 1992) and its commercial need depends on its physical characteristics, chemical constituents and aroma (Smallfield *et al*., 2001). Linalool is the principal volatile compound found in seeds, containing more than 50% of the total essential oil (Ramadan and Morsel, 2003). Coriander is economically important spice, due to its biological active compounds found in it. The accumulation and chemical composition of essential oil in plants are governed by different factors: environmental (Rakic and Johnson, 2002; Sriti *et al*. 2011), genetic (Zheljazkov *et al*., 2008; Ebrahimi *et al.,* 2010) as well as cultivation practices (Zheljazkov *et al*., 2008).

Since the chemical compositions of essential oils are the basis for their exploitation, a more attention has to be paid to the variation in the constituents. Coriander has been cultivated in different agro ecology of Ethiopia. The essential oil compositions of coriander fruit samples from Bale and Gondar regions of Ethiopia is reported by Nigist and Birhanu (1998). So far two coriander varieties namely Indium and Dinqnesh which released by Tepi and Debrezeit Agricultural Research Centers collaboratively; their essential oil compositions is not yet studied. Therefore, this study was conducted to determine the essential oil yield and compositions of the two released varieties of coriander

## 2. Materials and method

### 2.1. Sample collection

The seeds of coriander varieties were collected from Kulumsa Agricultural Research Centre during January, 2018 and were transported to Tepi Agricultural Research Centre for the essential oil extraction.

### 2.2. Sample extraction

Essential oil extraction from the coriander seed was performed by the Hydro-distillation in Clevenger apparatus. 100 g seeds of each powder of coriander varieties with three replicates were set separately in round bottom flask of 2000 ml in which 1000 ml distillate water was added. The process of hydro-distillation lasted for four consecutive hours and oil obtained was stored in a dark glass container until the time of chromatographic separation.

### 2.3. Gas chromatography mass spectrometry (GC-MS) analysis

GC-MS analysis of essential oil composition was identified at Jije analytical testing service laboratory. Essential oil compound identification was depending on comparison of their mass spectra with data of CG-EM (Nist 62 lib.) (Mclafferty and Stauffer, 1989) and retention index of kovats (Adams, 1995). The analysis conditions had a chromatographic system 7890B GC with split/split less mode inlet; equipped with DB-5MS capillary column (30

 

m x 0.25 mm x 0.25 mm) and detector 5977A MS. The GC experimental conditions functioned with inlet temperature of 260ºC with injection volume of 1µl; column flow of carrier gas Helium (1ml/min) and with programmed oven temperature of 40°C hold for 3 minutes, then 4°C/minutes to 90°C hold for 3 minutes by 4ºC/minutes to 170 °C hold for 3 minutes, at 6°C/minutes to 230ºC hold for 4 minutes, 10°C/minutes to 270°C hold for 1 minutes.

## 3. Results and discussion

### 3.1. Essential oil yield (%)

Hydro-distillation of coriander seeds resulted in 0.60% and 0.50% Essential oil for Dinqnesh and Indium varieties, respectively. The result obtained in this study is comparable with many authors report of oil yield between 0.2 and 1.3% among 36 different Coriander accessions from Austria (Dobos and Novak, 2005); between 0.1 to 0.36 % for Iranian accessions (Nejad *et al*., 2011); lees than 1% (Telci *et al*., 2006) and between 0.5 to 2.5% (Mahendra and Bisht, 2011). Contradictorily, Zheljazkova *et al*. (2008) reported the essential oil content 0.8 to 2.2% from different cultivars of coriander native to Atlantic Canada which is greater than the result obtained in this study.

### 3.2. Chemical composition of oil

A total of 51 and 34 compounds were identified from Dinqnesh and Indium varieties, respectively and presented on table 1. The essential oil tested contained high amount of linalool (76.45% for Indium variety and 58.85% for Dinqnesh variety followed by α-pinene (6.15% for Dinqnesh variety and 4.90% for Indium), γ-terpinene (6.76% for Dinqnesh variety and 2.83% for Indium), geraniol (4.04% for Dinqnesh and 1.22% for Indium), geranyl acetate (5.60% for Indium and 4.04% for Dinqnesh variety).

In this study Bicycle[2,2,2] heptan-2one,1,7,7-trimethyl-, (1S) and Benzene, 1-methyl-3-(1-methylethyl) were a compounds found only in Dinqnesh Variety yielded 6.54% and 1.28%, respectively, (Table 1). From a total of 51 compounds identified from Dinqnesh variety; 17 compounds were not found in Indium variety. However, the percentage of linalool in Indium was very high (76.45%) when compared to the linalool percentage of Dinqesh variety (58.85%). Differently from identified compounds Oleic acid is found only in Indium variety. Raal *et al.* (2004) analysed the oil of Coriander seeds from different geographical origins of Europe and the major constituent of the oils were reported as linalool (58.0−80.3%), γ-terpinene (0.3−11.2%), α-pinene (0.2−10.9%), *p*-cymene (0.1−8.1%), camphor (3.0−5.1%) and geranyl acetate (0.2−5.4%). The essential oil content of coriander consists mainly linalool (50 to 60%) and about 20% terpenes (pinenes, γ-terpinene, myrcene, camphene, phellandrenes, α -terpinene, limonene, and cymene) as reported by Telci *et al. (*2006). In this study the other compounds identified in the coriander seed oil are D-limonene (0.73% for Indium and 3.03% for Dinqnesh variety), aR- turmerone (1.05% for Indium and 0.40% for Dinqnesh variety) and indo-borneol (0.43% for Indium and 1.75% for Dinqnesh variety). Bicycle [2, 2, 2] heptan-2one, 1, 7, 7-trimethyl-, (1S) and Benzene, 1-methyl-3-(1-methylethyl) were the major compounds only found in Dinqnesh variety (Table 1).

Table 1. Chemical composition of two varieties essential oils of coriander (coriandrum sativum L.) seeds

| S/n | Name of compounds | Chemical composition (%) | |
|---|---|---|---|
| | | Dinqnesh | Indium |
| 1 | 3-carene | 0.029 | - |
| 2 | Bicyclo[3,1,0]hex-2-ene, 2-methyl-5-(1-methylethyl)- | 0.043 | - |
| 3 | α-pinene | 6.146 | 4.903 |
| 4 | Camphene | 1.073 | 0.211 |
| 5 | Bicyclo[3,1,0]hexane, 4-methyl-1-(1-methylethyl)- | 0.335 | 0.132 |
| 6 | β- pinene | 0.479 | 0.461 |
| 7 | β-myrcene | 0.906 | 0.314 |
| 8 | α-phellandrene | 0.026 | - |
| 9 | α-terpinene | 0.068 | - |
| 10 | Benzene, 1-methyl-3-(1-methylethyl)- | 1.286 | - |
| 11 | D-limonene | 3.034 | 0.723 |
| 12 | Eucalyptol | 0.049 | - |
| 13 | β-cis-Ocimene | 0.033 | 0.026 |
| 14 | γ-terpinene | 6.761 | 2.827 |
| 15 | Cis-linalooloxide | 0.127 | 0.168 |
| 16 | Cyclohexene, 1-methyl-4-(1-methylethylidene) | 0.791 | - |
| 17 | Trans-Linalool oxide (furanoid) | 0.029 | 0.093 |
| 18 | Linalool | 58.855 | 76.452 |
| 19 | Bicycle[2,2,2]heptan-2one, 1,7,7-trimethyl-, (1S) | 6.542 | - |
| 20 | Cyclohexanol, 1-methyl-4-(methylethenyl)- | 0.034 | - |

 

| | | | |
|---|---|---|---|
| 21 | Citronellal | 0.146 | 0.057 |
| 22 | Pinocarvone | 0.046 | - |
| 23 | α-Campholenal | 0.028 | - |
| 24 | Endo-Borneol | 1.763 | 0.429 |
| 25 | Terpinen-4-ol | 0.233 | 0.082 |
| 26 | L-alpha-Terpineol | 0.656 | 0.163 |
| 27 | Bicyclo[3,1,1]hept-3-ene-2-one,4,6,6-trimethyl- | 0.063 | - |
| 28 | 2,6-Octadien-1-ol, 3,7-dimethyl-, (Z)- | 0.032 | - |
| 29 | Citronellol | 0.339 | - |
| 30 | 2,6-Octadienal, 3,7-dimethyl-,(Z)- | 0.038 | - |
| 31 | Geraniol | 4.022 | 1.197 |
| 32 | Citral | 0.048 | 0.027 |
| 33 | Thymol | 0.021 | 0.034 |
| 34 | 1-Naphthalenol, decahydro-4a-methyl- | 0.029 | 0.056 |
| 35 | Myrtenyl acetate | 0.371 | 0.109 |
| 36 | 6-Octen-1-ol, 3,7-dimethyl-, acetate | 0.028 | - |
| 37 | Geranyl acetate | 4.034 | 5.609 |
| 38 | Dodecanal | 0.034 | 0.047 |
| 39 | Caryophyllene | 0.069 | 0.113 |
| 40 | 2- Dodecenal,(E) | 0.14 | 0.547 |
| 41 | Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl- | 0.042 | - |
| 42 | (1S,5S)-2-Methyl-5-((R)-6-methylhept-5-en-2-yl)bicycle[3,1,0]hex-2-ene | 0.036 | 0.058 |
| 43 | Cyclohexane, 3-(1,5-dimethyl-4-hexenyl)-6-methylene-,[S-(R*,S*)]- | 0.038 | 0.113 |
| 44 | (3S,3Ar,3Br,4S,7R,7aR)-4-isopropyl-3,7 dimethyloctahydro-1H-cyclopenta[1,3]cyclopropa[1,2]benzene-3-ol | 0.032 | - |
| 45 | aR-Turmerone | 0.40 | 1.049 |
| 46 | Tumerone | 0.151 | 0.209 |
| 47 | (E)-Tetradec-2-enal | 0.027 | 0.285 |
| 48 | Curlone | 0.165 | 0.285 |
| 49 | Tetradecanoic acid | 0.136 | 0.032 |
| 50 | 2-pentadecanone, 6,10,14-trimethyl- | 0.023 | 0.045 |
| 51 | n-Hexadecanoic acid | 0.164 | 0.119 |
| 52 | Oleic acid | | 0.039 |
| | Total | 100 | 97.014 |

Among the common chemical constituents, the Dinqnesh variety oil contains the highest γ-terpinene (6.67%), Bicycle [2,2,2] heptan-2one, 1,7,7-trimethyl-, (1S) (6.54%), α-pinene (6.15%), Geraniol (4.02%), D-limonene (3.03%), Endo-Borneol (1.76%), Benzene, 1-methyl-3-(1-methylethyl)-(1.28%) and camphene (1.07%) than the Indium variety. However the constituents of oil in Indium variety was higher for linalool (76.45%), Geranyl acetate (5.61%) and aR-Turmerone (1.04) than for Dinqnesh variety. The results obtained showed the compounds variation from other country variety when we compare with author report. This may be due to climate, soil condition and genotype difference.

 

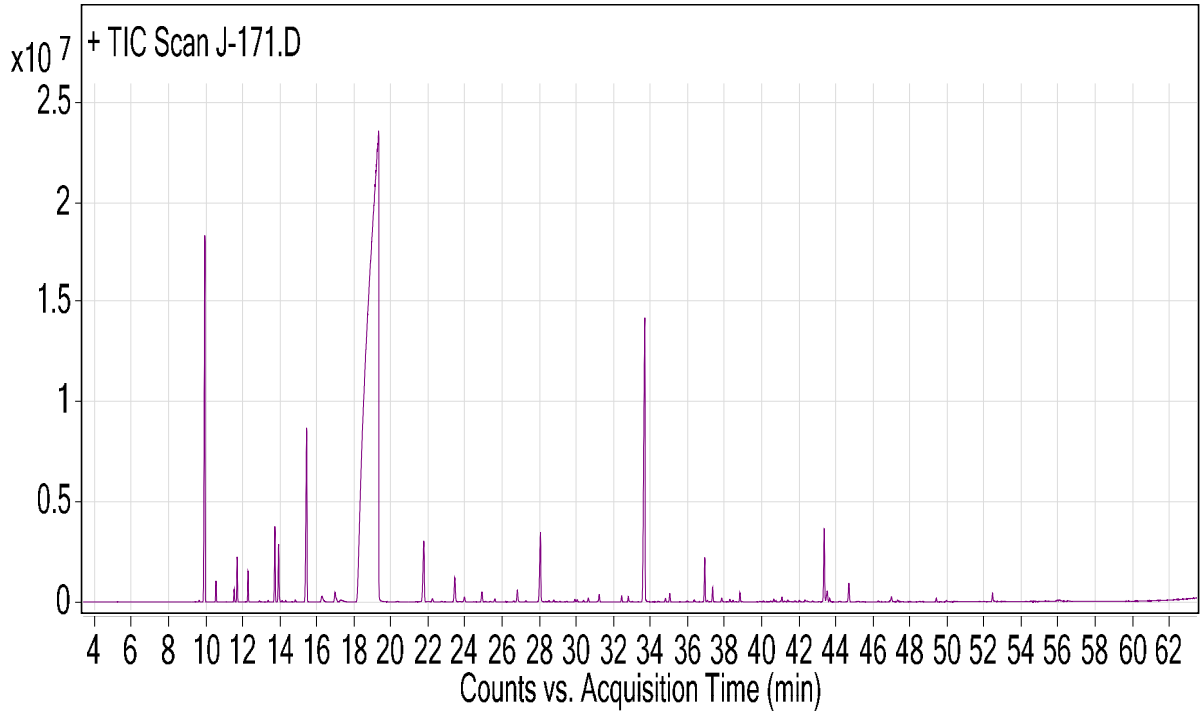


Figure 1. GC chromatogram of indium variety essential oil

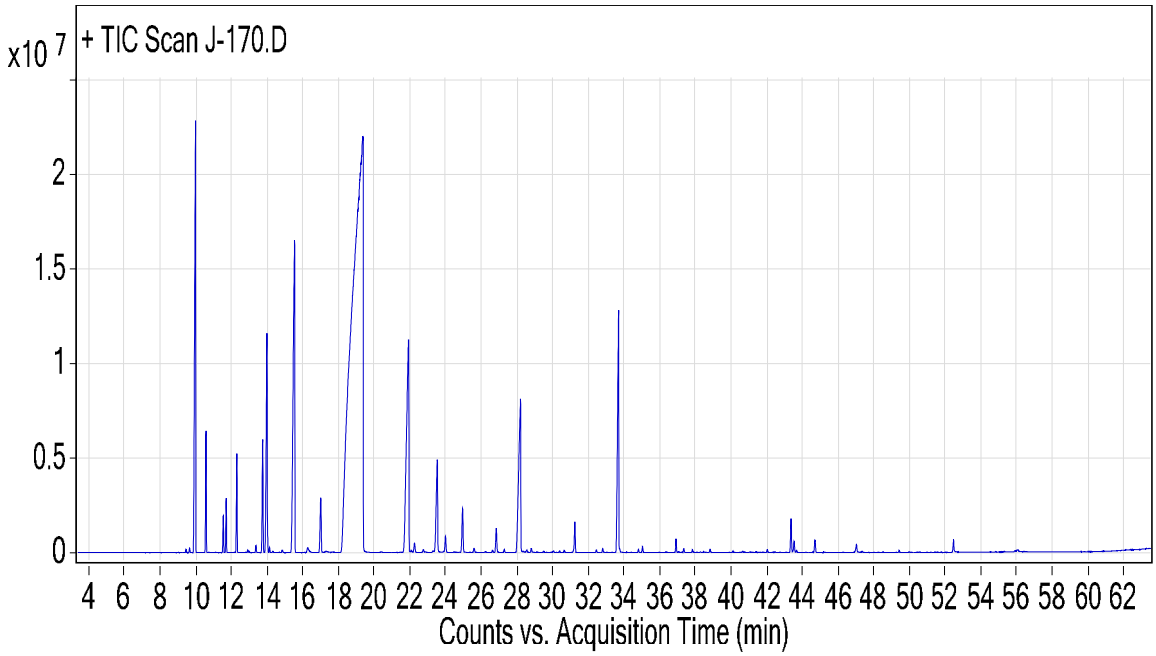


Figure 2. GC chromatogram of Dinqnesh variety essential oil

## 4. Conclusion

Essential oil composition depends on genetic and ecological conditions affecting the plants. The results obtained indicated variation on coriander seed essential oil from two varieties cultivated in the same agro-ecological conditions. In our study Linalool (58.85−76.41%), Geranyl acetate (4.04−5.60%), γ-terpinene (2.83−6.76%) and α-pinene (4.90−6.15%) were found as major components are responsible for the character of fragrance and aroma of the coriander. The results showed the Ethiopian coriander had met the international standard for essential oil and is competitive for export to international market.

## 5. Conflict of interest

The authors would like to declare that this study was carried out mainly for academic research purpose without any conflict of interest.

 

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