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Research Article

Essential oil Percentage of Celery and Parsley and Their Components as Affected by Method Extraction

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Abstract:

Medicinal and aromatic plants often used as natural medicines because of their remedial properties. Product of plant origin has become an exciting area of research in drug discovery and development. Medicinal and aromatic plants mainly exploited for essential oil extraction for many applications in industries. This study aims to evaluate two extraction methods on essential oil percentage and components of celery and parsley seeds. Celery essential oil percentage gave insignificant effect according to the two used methods, meanwhile parsley essential oil percentage appeared significant values, and the main components of the two plants decreased with extracted by evaporator, (limonene of celery and Myristicin of parsley). Limonene was decreased from 71.32% with hydro distillation to 42.04% with evaporator hydro distillation, myristicin was lower from 77.58% to 53.69% according to the previously methods. Monoterpene hydrocarbons decreased in two plants with evaporator hydro distillation, but oxygenated compounds were increased and the decrease was very low in both two plants, meanwhile sesquiterpene hydrocarbons cleared decrease in celery and increase in parsley. According to previously, recommended by application the two methods (hydroditilation of water and evaporator) for essential oil extraction of both of celery and parsley seeds.

Key words: essential oil; celery; parsley

Introduction

Essential oils used in a wide variety of consumer goods such as detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages (hard drinks) and insecticides. The world production and consumption of essential oils and perfumes are increasing very fast. Production technology is an essential element to improve the overall yield and quality of essential oil. The traditional technologies pertaining to essential oil processing are of great significance and are still being used in many parts of the globe. Water distillation, water and steam distillation, steam distillation, are widely used for extraction essential oils.

Regarding hydro distillation, the essential oils industry has developed terminology to distinguish three types: water distillation; water and steam distillation; and direct steam distillation. Originally introduced by Von Rechenberg, these terms become established in the essential oil industry. All three methods are subject to the same theoretical considerations, which deal with distillation of two-phase systems. extraction over distillation is that uniform temperature (usually 50° C) can be maintained during the process, as a result, extracted oils have a more natural odor that is unmatched by distilled oils, which may have undergone chemical alteration by the high temperature. This feature is of considerable importance to the perfume industry; however, the established distillation method is of lower cost than the extraction process, depending on the wood used. This dry distillation is usually conducted in retorts and, if the wood is chipped or coarsely ground and the heat is applied rapidly, the yield often represents about 10% of the wood weight used.

The family Apiaceae is commonly known as the carrot family. It has approximately 2000 to 3000 species; out of these 174 grow in Mediterranean region. Celery has been cultivated for the last 3000 years, notably in pharaonic Egypt, and known in China in the fifth century BC (Chevallier, 1998). Celery has used as a food, and at various times both the whole plant and the seeds have been consumed as a medicine. The characteristic odor of celery essential oil is due to a series of phthalide deriva-ztives (Bjeldanes and Kim, 1977). Sedanolide, sedanonic anhydride, 3-n-butyl phthalide, and other minor phthalides reported to be the major constituents of celery seed oil (Lund, 1978). Celery seed or celery seed extracts used as flavoring agents for preparing herbal combinations sold as dietary supplements, and in antirheumatic formulations. Celery seeds also implicated in arthritic pain relief, for treating rheumatic conditions and gout (Chevallier, 1998; Bjeldanes and Kim, 1977; Satyavati and Raina, 1976). Other reports on the medicinal properties of celery seeds were related to asthma and bronchitis and, when used in combination with other herbs, to reduction of blood pressure (Chevallier, 1998; Satyavati and Raina, 1976).

Parsley *Petroselinum crispum* (Mill.) Nym. syn. *Psativum* Hoffm., family Apiaceae, a medicinal and food plant, is known for its aromatic leaves and roots. The essential oil is present in all parts of the plant. Leaf oil of the finest quality has a flavor that resembles the fresh herb and can only be obtained in low yield. Usually commercial essential oil derived from mature seeds (fruits) and has a distinctly different flavor. It used as a flavoring agent in food products or fragrance in perfumery and cosmetics, as stated in many patents. Antimicrobial, diuretic and weak antioxidant activities of parsley essential oil reported. Edqm, (2014) cited that Myristicin from parsley oil has a potential cancer chemoprotective agent.

Material and Methods:

Plant material:

Seeds of celery, and parsley obtained from local medicinal plant grower used in this study.

Essential oil isolation:

Three replicates from every Seeds of plants under study (100 g for every replicate) subjected to hydro distillation (HD) and hydro-steam distillation (HD-SD) for 3 h using a Clevenger type apparatus (**Clevenger, 1928**). The laboratory-scale hydro distillation apparatus, described in European Pharmacopoeia (EDQM, 2014), contains 500 mL volume round-bottom flask connected to a slightly modified Clevenger-head (Kapás et al., 2011), capillary collector tube with 1.0 mL (0.01 mL scaling). For water and steam distillation, the plant materials placed into a sieve or on a grate atop a distillation vat/pot/still.

The water below heated up causing steam distillation of the material. The steam and water pushed through the plant material where the steam and oils captured and then separated out to produce the essential oil

Gas chromatography-Mass spectrometry

GC-MS analyses were carried out on a Varian 3400 system equipped with a DB-5 fused silica column (30 m x 0.25 mm i.d.); Oven temperature was 40 to 240°C at a rate of 4°C/min, transfer line temperature 260°C, injector temperature 250°C, carrier gas helium with a linear velocity of 31.5 cm/s, split ratio 1/60, flow rate 1.1 ml/min, Ionization energy 70 eV; scan time 1 s ; mass range 40-350 amu. The components of the oils were identified by comparison of their mass-spectra with those of a computer liberary or with authentic compounds and confirmed by comparison of their retention indices either with those of authentic compounds. Kovat's indices[19] were determined by co injection of the sample with a solution containing a homologous series of n-hydrocarbons, in a temperature run identical to that described above.

Results and Discussion:

Effect of Extraction Method on Essential Oil Yield and its Components:

A qualitative and quantitative comparison of the essential oil constituents based on the different distillation methods applied to *Apium graveolenus* and *Petroselinum crispum* (Mill.) plants essential oil presented in Tables 1, 2 and 3.

Plant	Water distillation	Water and steam distillation	LSD at 5%
Celery	1.41a	0.71b	0.07
Parsley	1.113a	1.11b	N.S.

Table 1: Essential oil percentage of Celery and Parsley seeds.

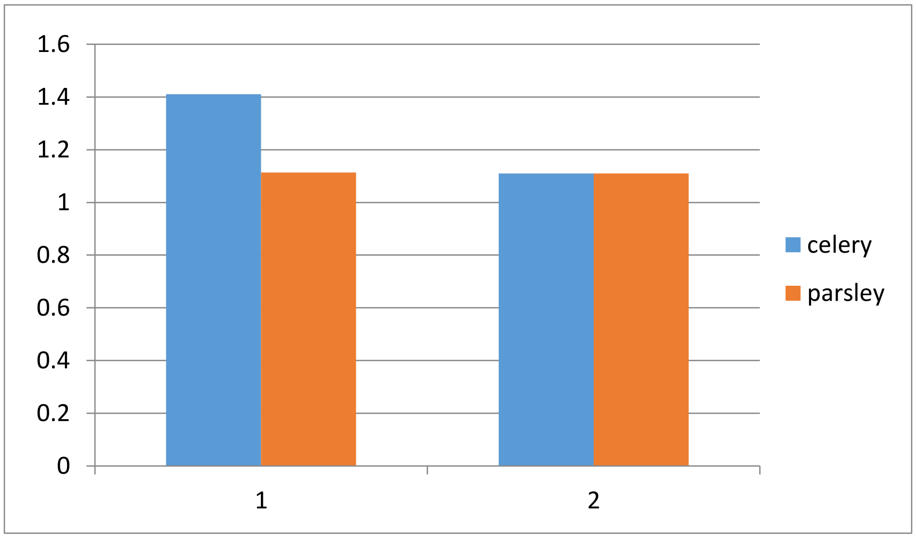

Figure 1: Essential oil percentage of Celery and Parsley seeds.

Looking for Table (1) and figure (1), found that celery essential oil was significantly increased with the two used methods of extraction, water distillation has better amount than water and steam distillation, but increasing of parsley essential oil was insignificant, the tow methods gave the same trend of celery essential oil.

This may be due to the effect that, in steam distillation method, the characteristics of plant material, such as type of plant material, mode of comminuting, degree of temperature, the time of extraction and grade of insulation are much more important in the other distillation methods.

E.Fathi and F.Sefidkon (2012), cited that the highest oil yield of Eucalyptus sargentii was obtained by hydrostillation and the lowest one was with steam distillation, but the highest percentage of 1,8 Cineol the main component of was obtained by steam distillation. A.Rahimi et al (2014), printed that hydro distillation gave the greatest principle components (linalool and linayl acetate) of flower of Citrus aurantium L. essential oil chemical constituents, in comparison with the extraction method of ultrasonic-assisted Head Space (SPME), using GC-MS analyses. Gavahian M. etal (2015), studied extraction of dried herb essential oil of Mentha peprita L. and found that yield of hydro distillation was higher than that of steam distillation. The greatest components (neo iso-Menthol and isomenthone) were decreased with steam distillation extraction. Mohamed E. Ibrahim on leaves of Egyptian Verbena triphylla (2016), using different extraction methods, indicated that maximum oil percentage was obtained with hydro distillation (HD) method compared with that of solvent (SE) extraction. He added that greatest components of chemical constituents were Citral (a+b) and Citronellol, SE gave higher percentage than that obtained by HD.

Jamil et al (2016), treated with Murraya koenigii L. leaves and cited that results cleared that the percentage yield for steam distillation was higher when compared to convention method which is hydro distillation, they added that steam distillation increased caryophyllene than hydro distillation, meanwhile decreased β-phellandrene which were the main components of essential oil composition. Siti etal (2016), cleared that the principle components of Malaysian Citrus (Rutaceae) medicinal plants were limonene and p-pinene in fresh peels and leaves, both of two components were lower with water distillation than with steam distillation.S.C.Ibeh et al (2017), reprinted that 100 grams of botanical leaves samples were used for three different methods or distillation methods. Higher percentage oil yield of Ocimum gratissimum with the used of steam and microwave distillation methods when compared to hydro distillation. Mahfud et al (2017), showed that hydro distillation is more effective when compared to steam distillation for extraction of Bangle essential oil, the qualitative analysis by GC-MS shows that the amount of terpinol, which is the main component of Bangle essential oil is higher in case of hydro distillation when compared to that obtained by steam distillation.

Effect on essential oil constituents of celery and parsley:

According to Table (2), noticed that the main components of celery essential oil is limonene followed by apiol, limonenwe percentage was decreased with steam distillation when compared with that was obtained by hydro distillation and so on monoterpene and sesquitrepene hydrocarbons oxygenated compounds appeared the same trend of monoterpene and sesquiterpene hydrocarbons.

J.Philippe et al. (20002), analyzed celery seed essential oil using GC/MS, they detected forty two constituents, limonene and β-selinene were the major components. Ayman et al. (2011), reprinted that chemical components of celery essential ois fraction by GC/MS technique, they revealed that limonene was the greatest component, followed by and β-pinene. They added that GC/MS of parsley seeds essential oil cleared that β-phellandrene was the main component, followed by myristicin and limonene. Samef et al. (2012), extracted volatile oil from Apuim graveolens seeds, the extraction produced volatile fraction (yield of 1.5% weight of the charge), they referred that limonene was the greatest component followed β-splinene. Morodalizadedeh et al., (2013) illustrated that limonene has the highest amount among the components of Apuim graveolens L. essential oil, followed by β-ocimene and pulegone. Naglaa et al., (2015), found that celery seed essential oil appeared that limonene was the principle component of components fraction analyzed by GC/MS, followed by β-selinene.

Mahmoud (2011), cited that the major components of parsley seeds were myristicin, apiol and phellandrene, identified by GC/MS. bLeila et al., (2014), noticed that myristicin was the main component of parsley essential oil, followed by β-phellandrene and then β-myrecene. Hussein et al., (2016), extracted parsley essential oil and determined concentration of volatile compounds, they illustrated that the major compounds were myristicine, myrcene and β-phellandrene. Jonathen and William (2017), on parsley (Petroselnum crispum Mill) volatile oil compounds, were obtained by hydro distillation and analyzed with GC/MS, and printed that leaf parsley was rich in myristicine, followed by β-phellandrene.

Essential oil compounds	Kovats Index	% Compound	
		A	B
α- Pinene	939	0.76	16.50
Camphene	954	0.75	0.65
β- Pinene	979	0.96	16.85
ρ-Cymene	1026	0.03	5.66
Limonene	1030	77.58	53.69
β- Phellanderene	1042	0.02	1.05
α-Terpinene	1062	0.02	0.13
Linalool	1088	0.03	0.11
Camphor	1143	0.03	0.07
Carvone	1243	0.03	0,06
Eugenol	1401	0.03	0.07
Myristicin	1520	0.07	0.06
Nerodiol	1546	0.04	0.08
Elemicin	1554	0.04	0.06
Apiol	1680	12.00	13.04
Total		99.79	100.00
Monoterpene hydrocarbons		77.78	76.63
Sesquiterpene hydrocarbons		0.78	0.26
Oxygenated compounds		21.23	23.11

A= Essential oil extracted by water distillation.
B= essential oil extracted by evaporator.

Table 2: Essential oil components by GC/ MS analysis of (*Apium graveoluns*) seeds.

Essential oil compounds	Kovats Index	% Compound (A)	(B)
α- Pinene	939	0.06	1.22
Camphene	954	0.02	0.97
β- Pinene	979	10,00	23.27
ρ-Cymene	1026	0.03	5.66
Limonene	1030	0.07	0.06
β- Phellanderene	1042	0.02	1.05
α-Terpinene	1062	0.02	0.13
Linalool	1088	0.03	0.11
1Camphor	1143	0.03	0.07
Carvone	1243	0.03	0,06
Eugenol	1401	0.03	0.07
Myristicin	1520	77.58	53.69
Nerodiol	1546	0.04	0.08
Elemicin	1554	0.04	0.06
Apiol	1680	12.00	13.04
Total		100.00	99.54
Monoterpene hydrocarbons		87.82	85.00
Sesquiterpene hydrocarbons		0.02	1.05
Oxygenated compounds		12.16	13.49

A= Essential oil extracted by water distillation.

B= essential oil extracted by evaporator.

Table 3: Essential oil components by GC/ MS analysis of (*Petrselinum crispum*) seeds.

Conclusion:

Results cleared that hydro distillation method is better than steam distillation, for extraction of both celery and parsley seeds essential oil quantity. Essential oil components appeared a different effect according to the used methods, and oxygenated compounds increased with steam distillation. Essential oil principal components by GC/ MS analysis of both celery and parsley seeds decreased in two plants with steam distillation, that may be due to oxygenate form of the compounds, which were affected by the method, so its recommended by hydro distillation method for extraction the essential oils of celery and parsley seeds.

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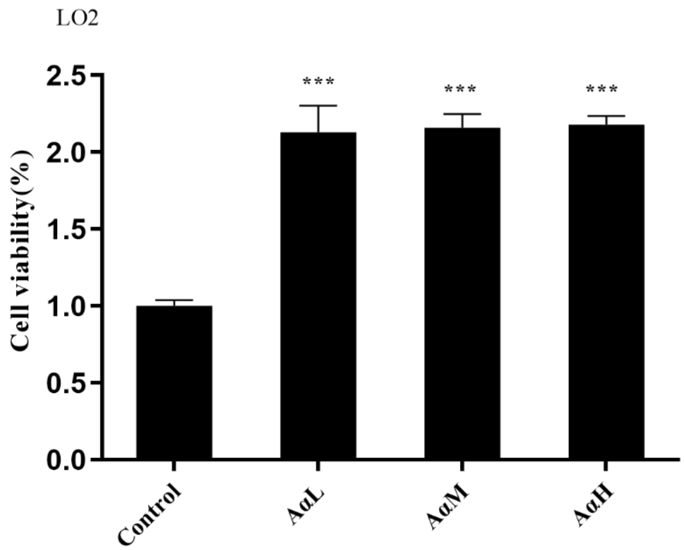
Supplemental material



Supplemental description. (A) The cell viability of LO2 cells was detected by the cck-8 kit. Data are expressed as the mean ± SEM ($n = 10$, *$p < 0.05$, **$P < 0.01$, ***$P < 0.0001$ compared with the control group.

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