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Studies on extraction of essential oils from spices (Cardamom and Cinnamon)

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Abstract
This investigation aims to study physicochemical composition and Extraction technology of Essential oil from Cardamom and Cinnamon. Different physicochemical properties viz., moisture, fat, protein, carbohydrates and ash were evaluated. The Extraction of Essential oil from Cardamom and Cinnamon was carried out by using two methods Viz., solvent extraction and steam distillation methods. It was observed that yield of cardamom essential oil by solvent extraction was high (7.3%) whereas cinnamon had (4.2%) whereas the extraction yield by steam distillation was 2.6% and 1.8% for cardamom and cinnamon respectively. It can be revealed that extraction of essential by solvent extraction method had high extraction yield compared to steam distillation method.

Keywords: Cardamom, cinnamon, essential oil, solvent extraction, steam distillation

Introduction
India is 'The Land of Spices' and the glory of Indian spices are known throughout the world. India commands a formidable position in the world spice trade. Indian spices are popularly known for their flavour and aroma in domestic as well as in the international markets. Out of 109 spices listed by ISO (International Standards Organization), India produces around 75 spices in its various climatic regions (Sajana, 2016) [11].

Spices can be defined as "vegetable products used for flavouring, seasoning and imparting aroma in foods" (FAO, 2005) [5]. Spices' are aromatic substances of a plant origin, obtained from roots, flowers, fruits, seeds, leaves or bark. They form a dried part of a plant, which essentially distinguishes them from 'Herbs', which are obtained from the leaves of herbaceous (non-woody) plants. While spices are generally grown in warm tropical and subtropical climates, herbs originate from temperate climate. Condiments also differ from spices, as they are edible substances (NCDEX, 2012) [9].

Cardamom (*Elettaria cardamomum*) considered as "Queen of Spices" is one of the pleasantly aromatic spices of the *Zingiberaceae* family with evergreen erected thick stem 2 to 4 m tall perennial plant. Cardamom is ranked third most expensive spices after vanilla and saffron. It produces segmented aromatic pods or capsules with 15 to 20 seeds and is known as green or true cardamom (Krishnan *et al.*, 2005; Reyes *et al.*, 2006) [6, 10].

"Cinnamon", the general term for the bark of several *Cinnamomum* spp., has long been used as a food ingredient, because of its sweet and spicy flavour (Shareef, 2011) [12]. Cinnamon (*Cinnamomum cassia* L.) is generally used as spices and recognized as folk herbal medication from number of centuries. Various in vitro and in vivo trials suggest that its phytochemicals have strong antioxidant, antiinflammatory, antimicrobial, antitumor, cholesterol lowering and immunomodulatory effects. The volatile oils from bark, leaves and roots have an array of monoterpene hydrocarbons as cinnamaldehyde, eugenol and camphor in various proportions. The bark portion contains almost 0.4 -2.8% of volatile oils containing cinnamaldehdyde, caryophyllene, cinnamyl acetate, linalool and eugenol (Butt *et al.*, 2013) [4].

Essential oils are volatile secondary metabolites formed by aromatic plants and can generally be recognized by their characteristic odour. Their production is known to occur throughout the plant kingdom. Many epidermal cellular structures are capable of producing essential oils and there is a wide variety of chemical constituents (Martinelli *et al.*, 2017) [7].

Steam distillation is the most commonly used method for extracting essential oils. Many traditional distillers favor this method for distilling most oils as they claim that none of the newer methods produce better quality oils.

Materials and Methods

The present proposed work was carried out in the Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani (Maharashtra).

Materials

The good quality raw material such as dried cardamom and cinnamon bark required for present investigation was procured from local market of Parbhani.

Chemicals and Glassware

Chemicals of analytical grade and glassware required was available in the laboratory, Department of Food Chemistry and Nutrition, College of Food Technology. VNMKV, Parbhani.

Methods

Physical properties of spices

The physical properties such as colour, flavour, shape, length, height, percent seed were determined. The length, width and height measured using digital vernier calliper scale.

Proximate composition of Spices

Spices such as Cardamom and Cinnamon were analysed for proximate composition including moisture, fat, protein, total carbohydrate, ash and mineral content were determined as per the method given by AOAC, (2005) [1].

Extraction of Essential oils

Extraction of essential oils from cardamom and cinnamon was carried out by using two different methods viz., solvent extraction and steam distillation. The extraction on essential oil was carried as per the method given by Singh and Ahmad, (2015) [13].

Steam distillation extraction

The grounded powder (150 g) and 500mL distilled water was mixed in round bottomed flask and heated for 5.0 hr to yield essential oil. The collected extract was separated by using separating funnel holding for 10 min in order to separate essential oil.

Solvent Extraction

The coarse powdered sample was extracted with petroleum ether was kept in soxhlet apparatus bottom flask in 1:2 w/v, ratio for 24 hrs. The collected extract was concentrated in hot air oven at 40°C. The essential oil obtained was weighed and kept at 4°C until further analysis.

Results and discussion

Proximate composition of spices

The data pertaining to the proximate composition of spices such as cardamom and cinnamon with respect to moisture, fat, crude protein, carbohydrates and ash content were determined and results obtained are depicted in table 1.

Table 1: Proximate composition of Cardamom

Chemical properties	Mean value (%)
Moisture	19.2±0.2
Fat	2.4±0.1
Protein	10.6±0.2
Carbohydrates	68.2±0.3
Ash	5.3±0.2

*Each value is the average of three determinations

Data presented in the table 1 showed the chemical properties of cardamom and found that moisture content of cardamom pods was found to be 19.2 percent, fat percent, crude protein was 10.6 percent, carbohydrates 68.2 percent and ash 5.3 percent. The results are in accordance with ASTA, (1977) [2] and NIN, (2016) [8].

Table 2: Proximate composition of Cinnamon bark

Chemical properties	Mean value (%)
Moisture	10.75±0.3
Fat	2.3±0.1
Protein	3.4±0.2
Carbohydrates	78.9±0.5
Ash	3.15±0.1

*Each value is the average of three determinations

Data given in the above table 2 indicated that cinnamon contained highest carbohydrate 78.9 percent whereas the fat content was 2.3 percent, protein 3.4 percent and Ash 3.15 percent. Similar results are given by USDA, (1977) [14].

Mineral composition of spices

The various mineral properties of cardamom and cinnamon including calcium, phosphorus, sodium, potassium and iron were investigated and results are accordingly presented in table 3.

Table 3: Mineral composition of spices

Minerals (mg/100g)	Spices	
	Cardamom	Cinnamon
Calcium	92.7	299.1
Phosphorus	183.0	57.0
Sodium	17.0	23.0
Potassium	124.2	127.0
Iron	12.8	8.3

*Each value is the average of three determinations

The data regarding various minerals of cardamom and cinnamon indicated in table 3. revealed that highest calcium content found in cinnamon was 299.1 mg/100g whereas in cardamom 92.7 mg100g. It was observed that iron content in cardamom and cinnamon was 12.8 and 8.3 mg/100g respectively. Results indicated that phosphorus in cardamom and cinnamon was found to be 183.0 and 57.0 mg/100g respectively.

Extraction of essential oils from cardamom and cinnamon

Data pertaining to extraction of essential oil from spices such as cardamom seeds and cinnamon bark was carried out by two methods viz., steam distillation and solvent extraction respectively and extraction yield of essential oil was calculated and results are illustrated in table 4.

Table 4: Extraction yield of essential oil

Extraction methods	Extraction yield (%)	
	Cardamom	Cinnamon
Steam distillation	2.6	1.8
Solvent extraction	7.3	4.2

*Each value is the average of three determinations

It was observed from the above table 4 that extraction yield of essential oil by solvent extraction method was found to be highest compared to steam distillation method. It was revealed from the results that yield of cardamom essential oil by solvent extraction method was 7.3 percent whereas yield of

cinnamon essential oil was 4.2 percent. The yield of essential oil by steam distillation method indicated for cardamom and cinnamon were 2.6 and 1.8 percent respectively. It can be revealed that extraction of essential oils by solvent extraction method had high extraction efficiency as compared to steam distillation method.

Conclusion

Overall it can be concluded that Extraction of essential oil from spices can be done by using solvent extraction and steam distillation method. The solvent extraction method showed better efficiency of extraction compared to steam distillation method for essential oil extraction.

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