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## Spectroscopic Study of Some Medicinal Oils and Their Binary Mixtures

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### Abstract

In the present paper the UV-Vis spectroscopy of four medicinal oils viz. cinnamon oil, clove oil, lemongrass oil, orange oil and their binary mixtures have been investigated. The absorption curves of these samples show almost similar type of curves but they have different magnitude of absorption. For absorption measurements were done with the help of a UV-Vis spectrophotometer (model name) in the wavelength range 200nm to 900nm. The possible reasons for different magnitude of absorption have been discussed in the paper.

**Keywords:** Cinnamon Oil, Clove Oil, Lemongrass Oil, Orange Oil, UV Absorption.

### 1. Introduction

The germicidal effects of UV light have been known since the late eighteenth century (1 - 11). The electromagnetic waves in UV region are shorter than those in the visible region and have bactericidal effects and also inactivate enzymes. The ultraviolet (UV) region of the electromagnetic spectrum ranges from 100 to 400 nm. Germicidal effect is maximum in the range of 250 and 270 nm and its effect decreases as the wavelength increases until it is non-existent (13).

Many researchers have investigated the spectroscopic studies of many oils and fats, viz. Cristina Popovici et al. reported absorption of fresh grape seeds oil and fresh sun flower oil, S.P. Emmanouilidou reported method for detection of adulteration by spectroscopic study, N.S.Elsark reported similar studies on soybean seed oil, Ersilia Alexa et al. have also reported FTIR spectroscopy for adulteration identification in some oils, K. Anil Kumar and K.

Viswanathan reported UV transmission through 6 edible oils and cod liver oil and chicken oil.

## **2. Experimental Details**

In the present study four medicinal oils viz; cinnamon oil, clove oil, orange oil and lemongrass oil have been investigated. The oils were purchased from local market of Lucknow and were used without further purification.

### **2.1 Orange Oil**

Orange oil is an essential oil extracted from glands inside the kind of an organic fruit (Orange). It's major constituents are (<90%) d-limonene, so it is used in place of pure d-limonene (5). Limonene gives the familiar aroma of citrus fruits and is also used in perfume and household cleaners. The constituents of orange oil vary for several reasons but limonene is always a major constituent.

### **2.2 Lemongrass Oil**

Its' common name is cymbopogon citratus, which is (sweat grass). It is a commercially important aromatic grass of family poacea. Leaves of the grass have high citral content in the essential oils with a lemon-like aroma (6). It is also an important medicinal herb, as it is considered carminative, insect repellent, herbal tea and anti cancerous (7). This oil is also used for spasmolytic, analgesic, anti-inflammatory, antipyretic, diuretic and tranquilization (6, 8). It also boosts the parasympathetic nervous system, it helps in toning the muscles and tissues, relieves muscle pains by making the muscle more supple. It also has anti fungal properties (9). The composition of volatile constituents of lemon grass oil has already been reported (10, 11). The lemon grass oil is characterized by its high content of citral (12, 13). Citral is a mixture of two stereo-isomeric monoterpene aldehydes geranial (trans citral called citral a) and neral (cis citral called citral b). Chemical composition of citral is (C<sub>10</sub>H<sub>16</sub>O). India is a major producer of this oil. It has high demand in perfumery, flowers and pharmaceutical industry.

### **2.3 Clove Oil**

Clove oil is an important aromatic spice, which belongs to the family myrtaceae. Clove is cultivated in India, Madagascar, Sri Lanka and Malaysia (14, 15). Allmost all part of the clove plant are used in food processing, pharmaceutical industries, perfumery and cosmetics (16). It is also used for treatment of several deseases such as disorder of digestive systems (17). It also has many biological actioivities such as anti-bacterial, anti-fungal, insecticidal and anti-oxidant properties besides it has anti-phlogistic and anti-vomitting properties (18-

21). Its analgesic effect has been reported by many researchers (15, 22, 23). It also has cytotoxic and anti cancerogenic effects (24, 25). From phytochemical analysis it has been reported that eugenol is the main component of clove oil (26, 27).

#### **2.4 Cinnamon Oil**

Cinnamon is a small evergreen tree and belongs to the Lauraceae family. It grows in southern part of India, China, Burma and Indonesia (28-31). Cinnamon oil is extracted from different parts of the plant such as bark, leaves, roots and fruit of cinnamon separately. The colour of cinnamon oil is pale yellow with pleasant, spicy odor (32). The bark and leaf oils are more important than oil from other part of cinnamon, it is used as flavour ingredient, cosmetics and pharmaceutical preparations (30, 31). In medicine it is used to cure colds, diarrhea, fight bad breath, digestive system and toothache (29, 32). It also has good anti-oxidant, anti-ulcer, anti-microbial, anti-diabetic and anti-inflammatory properties (29). The main chemical constituents of cinnamon oil are cinnamaldehyde and eugenol (2).

#### **2.5 Experimental Details**

Commercially available varieties of these oils were used in this study without further purification. A dual beam of UV spectrophotometer was used for study of the absorption characteristics of selected medicinal oils. In this instrument there are two beams from a single source of light, one goes through the samples whose absorption we want to measure and another directly to detector. The difference in amount of light from the two beams gives the absorption or transmission characteristics of the samples placed on the path of beam.

All the samples investigated i. e. pure and binary mixtures, have been designated as 1, 2, 3, 4 and 5, where sample 1 is pure oil (A), sample 2 is (75% oil A+ 25% oil B), sample 3 is (50% oil A+ 50% oil B), sample 4 is (25% oil A+ 75% oil B), and sample 5 is 100% pure oil (B). Similar binary mixtures for other medicinal oils were also investigated.

### **3. Results and Discussions**

Figure (1) shows the variation of absorption with wavelength (in nm) of cinnamon oil, clove oil, orange oil and lemongrass oil in pure form. Figures 2, 3,4, and 5 are representing the variation of absorption with wavelength at room temperature in cinnamon oil and clove oil, clove oil, and orange oil, lemongrass oil and cinnamon oil, orange oil and lemongrass oil, orange oil, and cinnamon oil, and their mixtures in different proportion.

From figure (1) it is observed that, in visible region the absorption of lemongrass oil is relatively higher than the other oils and the orange oil has least absorption. Pure lemongrass

oil has greater absorption than the pure cinnamon oil, clove oil, and orange oil in pure form. This may be because lemon grass oil has more unsaturated fatty acids and have more number of pi-electrons than all the other three oils. From figure (1) it is also clear that the absorption of Cinnamon oil has least value. Kumar, A. K., reported that mustard oil and neem oil show more absorption because these two oils contain about 82% of unsaturated fatty acids which have more number of pi- electrons than other oils (12).

Figure (2) shows the UV absorption of cinnamon oil, Clove oil and their binary mixtures. The highest UV absorption is of mixture with 50% clove oil and 50% cinnamon oil. The reason is same as discussed in the variation of absorption with wavelength for four oils. Figure (3) shows the variation of UV absorption in Clove oil and orange oil and their binary mixtures with frequency. From figure (3) it is observed that the UV absorption of binary mixture in Clove oil and Orange oil in the ratio 50% each has highest value. Figure (4) shows the UV absorption of Lemongrass oil, cinnamon oil and their binary mixtures. In this case the UV absorption in binary mixtures in the ratio (75% lemongrass oil +25% cinnamon oil) has greater value, because this ratio may have more unsaturated fatty acids and have more number of pi-electrons than the other binary mixtures of Lemongrass oil, cinnamon oil. Similar variation was also observed in figures (5 and 6) for the binary mixtures of orange oil and lemongrass oil, orange oil and cinnamon oils respectively.

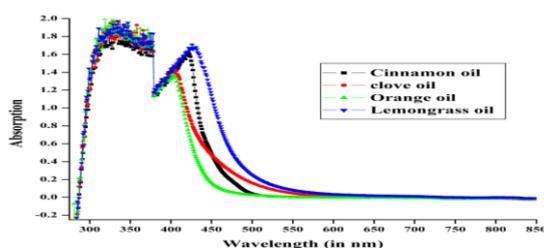


Fig.1: Variation of absorption with wavelength (in nm) of cinnamon oil, clove oil, orange oil and lemongrass oil.

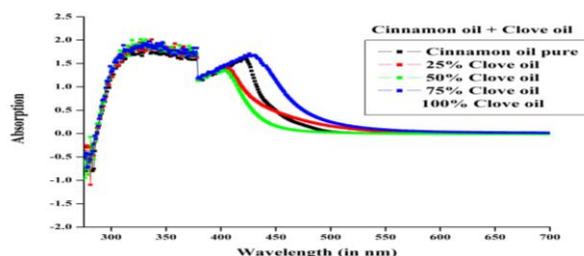


Fig.2: Variation of absorption with frequency (in nm) of cinnamon oil, clove oil and their mixture in different proportion.

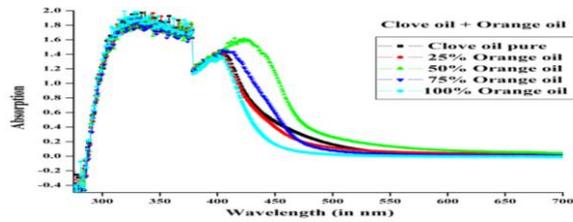


Fig.3: Variation of absorption with frequency (in nm) of clove oil, orange oil, and their mixtures in different proportion.

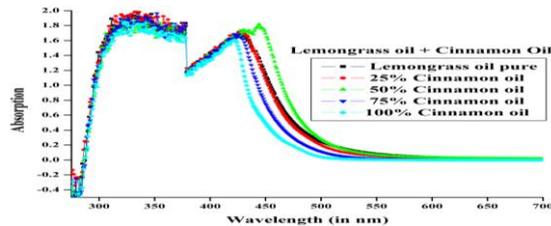


Fig.4: Variation of absorption with frequency (in nm) of lemongrass oil, cinnamon oil, and their mixtures in different proportion.

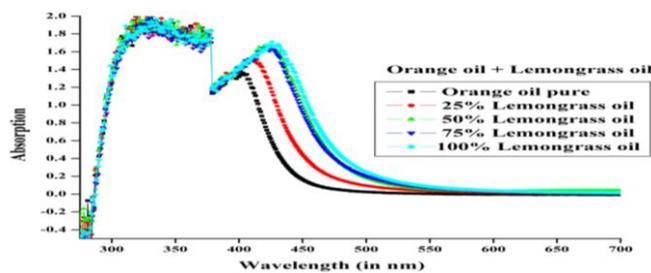


Fig.5: Variation of absorption with frequency (in nm) of orange oil, lemongrass oil, and their mixtures in different proportion.

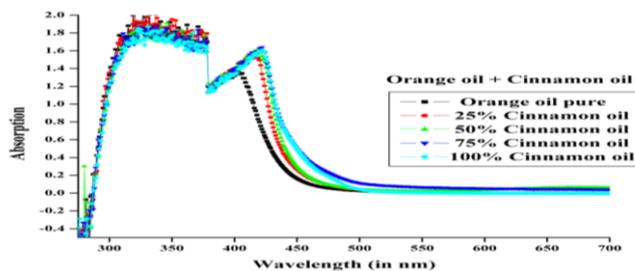


Fig.6: Variation of absorption with frequency (in nm) of orange oil, cinnamon oil, and their mixtures in different proportion.

#### 4. Conclusions

It can be concluded that the medicinal oils in general exhibit significant variations in their composition, consequently, it is impossible to define unique values for chemical and physical

constants for any oils and it is usually necessary to combine several empirical constants to predict the chemical and physical properties of medicinal oils.

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