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PERSPECTIVE ON PHYTOCHEMICAL AND BIOCHEMICAL COMPOUNDS OF SELECTED INDIAN MEDICINAL PLANTS

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ABSTRACT:

Throughout history, human civilizations have moved around plants which have influenced a lot to the humanity. Plants have the ability to produce diverse variety of phytochemical and biochemical compounds which can be used to perform different biological functions. Many of these phytochemicals have beneficial effects on long-term health when consumed by the humans and can effectively used to treat human diseases. The importance of medicinal plants becomes more patent at the present time in developing countries. In India, it is estimated that 80% of people depends on plants to cure themselves, of these about 60% population of humans use medicinal plants habitually to fight certain ailments and nearly 40% people use such plants in pharmaceutical industries. The current research paper deals with the various phytochemical and biochemical analysis of 14 medicinal oil plants of Indian origin such as *Ajowan*, Almond, Basil, Capsicum, Cardamom, Clove, Camphor, Coriander, Eucalyptus, Lemon Grass, *Neem*, Peppermint, Sandalwood, and Turpentine. Plant species selection was based on their immense therapeutics applications both in industrial and domestic sectors. The analysis of these plat oils were carried out using standard methods and protocols. Research analysis revealed that Saponification Value (SV), Acid Value (AV) and percentage of Free Fatty Acids (FA) were higher in Coriander, *Neem*, Cardamom and *Ajowan*, followed by moderate amount in Basil, Almond, Capsicum and Peppermint, whereas lower quantity was observed in Lemon Grass, Clove, Sandalwood, Camphor, Turpentine and Eucalyptus.

KEY WORD: *Medicinal plant oils, Phytochemical characteristics, Biochemical analysis,*

Saponification value, Iodine value, Acid value, Free fatty acids.

INTRODUCTION:

Since ancient time, people are exploring the plant species in search of new drugs, which has resulted in exploitation of large number of medicinal plants with curative properties to treat various ailments. With greedy run of man from '*Jadibutti* (Elixir)' to '*Aushadh* (Medicine)', the search for medicinal plant species by human beings has reached to the extreme level, where new perspectives are budding-up day by day to be used in therapeutics. In traditional system of medicines, plants with medicinal properties have been used widely and successfully in curing different obnoxious diseases in humans. World Health Organization (WHO) reported that practitioners of traditional systems (*Vaidyas* / *Hakims*) treat almost 80% of patients with profuse use of medicines and/or drugs in India. Nearly, 80% of the world human population relies on traditional medicines as primary health care system for better hygiene; which involves an extensive use of plant extracts. The present paper discusses the perfunctory study of oils of 14 Indian medicinal plants such as *Ajowan*, Almond, Basil, Capsicum, Cardamom, Clove, Camphor, Coriander, Eucalyptus, Lemon Grass, *Neem*, Peppermint, Sandalwood, and Turpentine. The plant oils were chosen on the basis of their wide use in therapeutics at domestic and industrial levels (Soap industry, Perfumeries, Food products, Pharmaceuticals, etc.). All the studied plants are used to cure various symptoms such as anxiolytic effects, analgesic, aphrodisiac, anti-spasmodic carminative, depurative, digestive, fungicidal, and stimulant properties.

MATERIALS AND METHODS:

The selected plant oils (mentioned elsewhere in paper) were procured from respective oil industry. Different biochemical tests such as Saponification Value (SV), Iodine Value (IV), Acid Value (AV), and Percentage of Free Fatty Acids (%FA) were determined as per standard methods and protocols prescribed by (Pearson, 1962; AOAC, 1975; Thimmaiah, 2006). The studied biochemical parameters are described here under in detail.

Determination of Saponification Value (SV)

To determine the Saponification Value (SV) of studied plant-oils, 0.5 gm of sample was dissolved in 12.5 ml of 0.5N Alcoholic KOH Solution. The mixture was incubated in boiling water bath for 30 minutes, which was then be cooled at room temperature, and titrated with 0.5N HCL with 1% Phenolphthalein indicator. Besides, a blank was also run to have precise comparison among duplicates, and the mean

results were considered. The same protocol (Blank and Mean) was followed for all the other biochemical tests.

Saponification Value (SV) (mg KOH) = A x 28.06 / W

Where, A= Amount of HCL (ml) (Blank-Titer)

W = Weight of Sample (gm)

Determination of Iodine Value (IV)

0.1 gm of sample was dissolved in 10 ml of chloroform, to which 12.5 ml of Hanus Iodide Solution was added, and kept in dark for 30 minutes. Later, 15 ml of KI solution was added. The mixture was titrated with 0.1N $Na_2S_2O_3$ Solution using 1% Starch Solution (Indicator).

Iodine Value (IV) = [(A x N x 0.1269 x 100) / W] gm I_2 / 100 gm of Oil

Where, A = Amount of $Na_2S_2O_3$ (Blank-Titer), N = Normality of $Na_2S_2O_3$,

W = Weight of Sample (gm)

Determination of Acid Value (AV)

For determination of Acid Value (AV), 0.1 gm of sample was dissolved in 10 ml of Neutral Solvent. The mixture was titrated with 0.1N KOH Solution after an addition of few (2-3) drops of 1% Phenolphthalein Indicator.

Acid Value (mg KOH / gm) = (A x 0.1 x 56.1) / W

Where, A = Titer Value (ml), 0.1 = Normality of KOH

W = Weight of Sample (gm)

Determination of Free Fatty Acids (%FA)

Percentage Free Fatty Acids (%FA) was determined using following equation:

%FA = K x Acid Value (AV)

Where, K = Constant (0.503).

RESULTS AND DISCUSSION:

For the present study, different types of biochemical tests were carried out in 14 selected plant-oils (*Ajowan*, Almond, Basil, Capsicum, Cardamom, Clove, Camphor, Coriander, Eucalyptus, Lemon Grass, *Neem*, Peppermint, Sandalwood, and Turpentine) to determine the degree of concentrations of various biochemical contents. The laboratory tests such as Saponification Value (SV), Iodine Value (IV), Acid Value (AV) and Percentage of Free Fatty Acids (%FA) were carried out. The values of biochemical contents observed in plant-oils are exhibited in **Table 1**. The Mean values (SV = 237.64, IV = 30.72, AV = 17.07, %FA = 8.58), and Standard Deviation (S.D.) (SV = 188.26, IV = 15.97, AV = 29.96, %FA = 15.07)

are derived for studied plant-oils, which clearly reflects the ascending concentration gradient among plant-oils [(Mean) = SV > IV > AV > %FA); (S.D.) = SV > AV > IV > %FA).

Saponification Value (SV)

The SV in plant oils ranged from 28.06 to 547.17. The lowest SV was reported in Camphor (28.06), followed by Sandalwood (70.15), Lemon Grass (72.95), and Clove (84.18). On the other hand, the moderate values of saponification were observed in oils of Peppermint (178.58), followed by Basil (336.72), Capsicum (336.72), Ajowan (364.78), and Ajowan (364.78), whereas the highest SV was recorded in Neem (465.80), followed by Cardamom (477) and Coriander (547.17). Surprisingly the values of saponification in oils of Eucalyptus and Turpentine were recorded null **(Figure 1)**.

Iodine Value (IV)

Figure 2 exhibited the variable contents of iodine in plant-oils, ranged from 8.83 to 58.37. The study reveals that Lemon Grass, Turpentine, basil, Need and Cardamom possessed the highest iodine content (58.37, 53.29, 50.76, 43.14, and 43.41, respectively), followed by modest iodine contents in Clove (34.26), Ajowan (27.91) and Peppermint (26.64). Drastically, the plant-oils (Sandalwood, Camphor, Eucalyptus, Coriander, Capsicum, and Almond) showed least iodine contents (19.03 each, 15.22 each, 13.95, and 8.83, respectively). The relatively low iodine contents in plant-oils might due to the presence of few unsaturated bond and low susceptibility to oxidative rancidity. Most of the plant-oils with higher values of phyto-chemical and biochemical compounds are at greater risk of rancidity. Because of this characteristic, lower valued oils can be kept for longer period of time without rancidity and use (Eka, 1980).

Acid Value (AV)

Acid value is very important for the determination of edible application (Biochemical methods by Sadashivam, 2005). The obtained data of Acid value manifests that Neem and Coriander and oils are categorized as High Ranged Oils (HRO) having acid value of 47.68 and 117.81 respectively. The Moderate Ranged Oils (MRO) (6.17 to 9.53) are Eucalyptus (6.17), Capsicum (6.73), Clove (7.85), Camphor (9.53) and Sandalwood (9.53). On the other hand, the oils categorized as Low Ranged Oils (LRO) (2.80 to 5.61) are Turpentine (2.80), Basil (3.92), Lemon Grass (4.48), Ajowan (5.61), Almond (5.61), Cardamom (5.61) and Peppermint (5.61) **(Figure 3)**. On owing of the higher ranged values, Neem and Coriander oils cannot be used topologically, instead they can be used for medicinal purposes at greater extent. Contrastingly, MRO can be used as edible materials (Capsicum and Clove). In addition,

the benefit of LRO is that they can be used both in topological applications as well for edible purpose, such as Basil, Lemon Grass, Ajowan, Almond, Cardamom and Peppermint in ascending inclination (Amoo *et al.*, 2004). As a whole, Neem and Coriander oils possess higher values of saponification and acidity, so they are highly susceptible towards rancidity. Because of their higher rancidity, if applied topologically they may produce some untoward ailments such as skin-rashes, psoriasis, blisters, etc. owing to increased number of carbon atoms (Cox and Pearson, 1962).

Percentage of Free Fatty Acids (% FA)

As per **Figure 4**, the maximum amount of free fatty acids is present in oils of Coriander (59.25) and Neem (23.98), followed by occurrence of moderate quantity ranged from within 3.10 to 4.79 represented by Eucalyptus (3.10), Capsicum (3.38), Clove (3.94), Camphor and Sandalwood (4.79 each), (4.79). Besides, oils of Turpentine (1.40), Basil (1.97), Lemon Grass (2.25), Ajowan, Almond, Cardamom and Peppermint (2.82 each) were found to contain the low amount of fatty acids. The lower the value of free fatty acids, better the quality of oil (Verpoorte, 1998). The findings of the present study display that plant-oils of Coriander and Neem possess better quality than that of Eucalyptus, Capsicum, Clove, Camphor and Sandalwood. The latter group of plant-oils owns good quality to be used in commodities. Surprisingly, the oils of Turpentine, Basil, Lemon Grass, Ajowan, Almond, Cardamom and Peppermint could be used as common oils as reflected by low quantity of free fatty acids. On account of their low-ranged values, these oils are of high-quality and can be used widely for therapeutic uses (Prakash and Gupta, 2005). The lemon grass oil possessed lower value of saponification test, acid test and free fatty acid test. And almond oil possessed lower iodine value, acid value and free fatty acid value. So both these oil are of good potential to use therapeutically. They are non drying oil, and less susceptible towards rancidity. Against this, Neem oil possessed higher value of all four tests, cardamom possessed higher saponification and iodine value and coriander oil possessed higher value of acid value test and free fatty acid test .All this higher ranged valued oil are of low potential for medical application especially at industrial level (Sandhya, *et al.*, 2006)

Turpentine, basil, lemon grass, ajowan, almond, cardamom, peppermint oil has been categorized of lower ranged oil for acid value test, the values are within range of 2.80 to 5.61, while neem and coriander oil possessed higher ranged value which is 47.68 and 117.81 respectively. Because of the higher ranged value neem and coriander oil can not apply edibly while using for medicinal purpose. The benefit if lower ranged oil is that they can apply edibly also. Moderate ranged oil can also be used edibly up to some extend.

The data of free fatty acid value showed that the Turpentine, basil, lemon grass, ajowan, almond, cardamom, peppermint oil are of lower ranged oil, possessed the value within range of 1.40 to 2.82 and neem and coriander oil are of higher ranged oil having value 23.98 and 59.25 respectively. The lower the value of free fatty acids, the batter the quality of oil. So all the lower ranged oils are of batter quality, and moderate value ranged oil are of good quality for use. The data showed that turpentine, basil, lemon grass, ajowan, almond, cardamom, and peppermint oil are common oil showed lower ranged value of acid value test and % free fatty acid value test. Because of their lower ranged value they are of good quality and also can be apply edibly, so can be use widely for therapeutic purpose. The lemon grass oil possessed lower value of saponification test, acid test and free fatty acid test. And almond oil possessed lower iodine value, acid value and free fatty acid value. So both these oil are of good potential to use therapeutically. They are non drying oil, and less susceptible towards rancidity. Against this, neem oil possessed higher value of all four tests, cardamom possessed higher saponification and iodine value and coriander oil possessed higher value of acid value test and free fatty acid test. All these higher ranged valued oil are of low potential for medical application especially at industrial level.

CONCLUSION:

Most of the plants with the high ranged oil such as *Neem* and Coriander cannot be used topologically as these oils shows high risk of rancidity which if applied topologically may produce some untoward ailments such as skin-rashes, psoriasis, blisters but instead these oils can be used for medicinal purpose and also can be intake as a edible materials (Capsicum and Clove). In addition to it, low range oil such as Basil, Lemon Grass, *Ajowan*, Almond, Cardamom and Peppermint can be used both as topologically for edible use. Apart from these oils with low value of free fatty acid are considered to be better quality of oil for use.

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Table 1. Values of Biochemical Tests of Plant Oils

Oils	SV	IV	AV	% FA
Ajowan	364.78	27.91	5.61	2.82
Almond	364.78	8.83	5.61	2.82
Basil	336.72	50.76	3.92	1.97
Capsicum	336.72	13.95	6.73	3.38
Cardamom	477.00	43.14	5.61	2.82
Clove	84.18	34.26	7.85	3.94
Camphor	28.06	19.03	9.53	4.79
Coriander	547.17	15.22	117.81	59.25
Eucalyptus	0.00	15.22	6.17	3.10
Lemon Grass	72.95	58.37	4.48	2.25
Neem	465.80	44.41	47.68	23.98
Peppermint	178.58	26.64	5.61	2.82
Sandalwood	70.15	19.03	9.53	4.79
Turpentine	0.00	53.29	2.80	1.40
MEAN	237.64	30.72	17.07	8.58
S.D.	188.26	15.97	29.965	15.07

*** SV: Saponification Value, IV: Iodine Value,**
AV: Acid Value, %FA: Percentage Free Fatty Acids

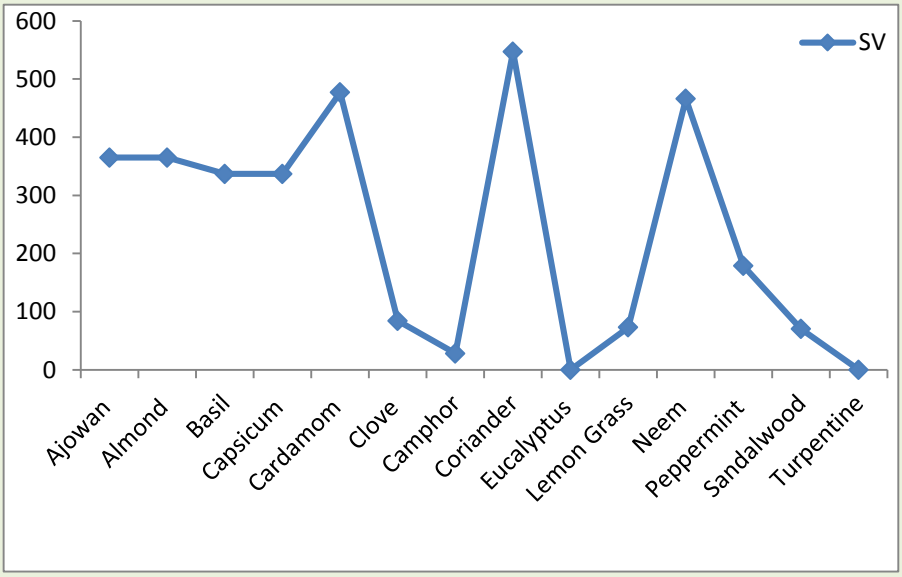

Figure 1. Saponification Value (SV) of Plant Oils

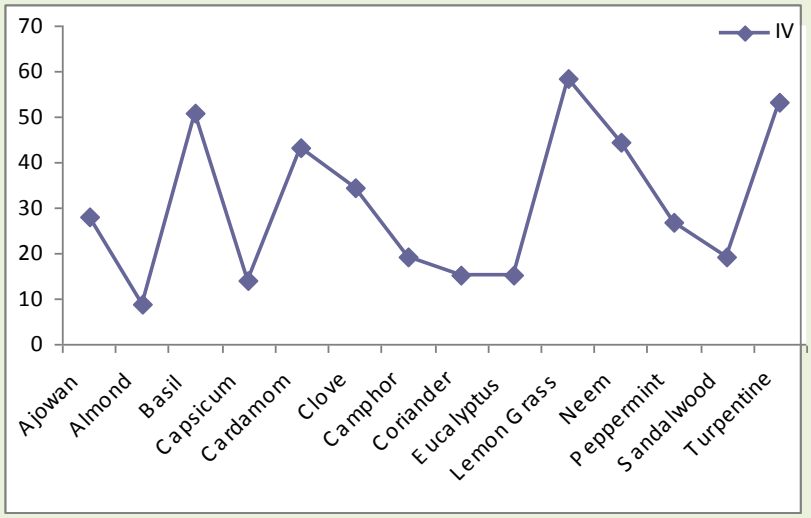

Figure 2. Iodine Value (IV) in Plant Oils

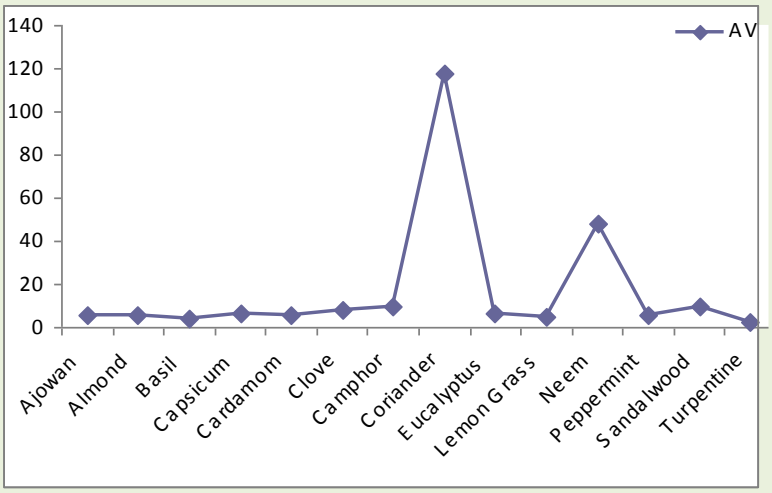

Figure 3. Acid Value (AV) in Plant Oils

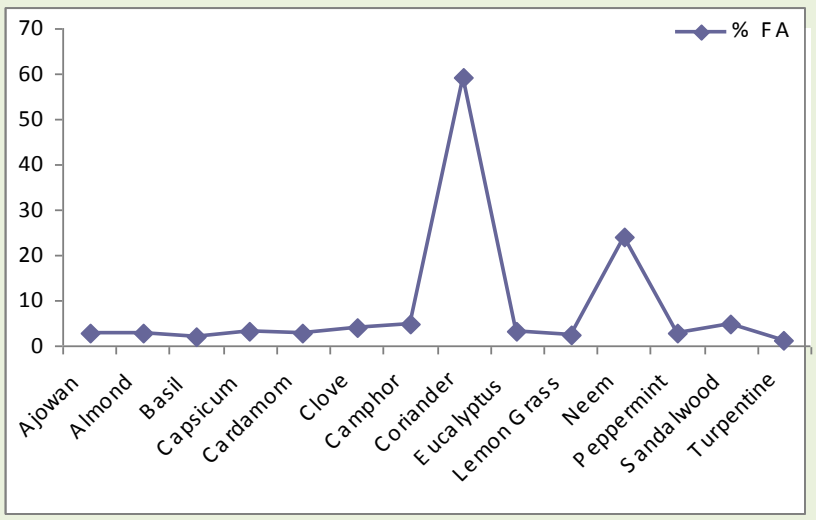

Figure 4. Percentage of Free Fatty Acids (FA) in Plant Oils