SYNTHESIS CHARACTERIZATION AND COMPARATIVE STUDIES OF TURMERIC OLEORESIN DERIVED FROM SELECTED TURMERIC PLANTS

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ABSTRACT
This paper reports an investigation of the extraction of Oleoresin present in the crude plant extracts of four selected turmeric plants i.e. BSR-01, BSR-02, CL-101, CL-219. Oleoresin is one of the most significant organic oil content that are extracted from the turmeric rhizomes. It is naturally occurring mixtures of an oil and a resin and is added to food items as a spice and coloring agents. Turmeric oil is widely used in pharmaceutical and biological applications. This investigation was carried out to determine and compare the quantitative amounts of oleoresin that are present in four different varieties of turmeric. The extraction of the oil content from turmeric was attempted by using a simple column extraction method with alcohol and acetone as a solvent. We have been achieved the isolation process of oleoresin from turmeric in the easy manner with high recovery and also we found that oleoresin rich turmeric variety from this investigation.

Key words: Turmeric rhizomes, Curcuma longa L, Curcuminoids, Oleoresin, Column method.

INTRODUCTION
Turmeric is known as golden spice of India which comes from the root of turmeric plant (Curcuma longa L). Turmeric is of Zingiberaceae family, Zingiberaceae - A family of tropical monocotyledonous plants. It has the chemical structure (1,7-bis (4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione) and has a long history of traditional ayurvedic usage [1-2]. There are various benefits and uses of turmeric powder from food to medicines. The roots, or rhizomes and bulbs, are used in medicine and food. Turmeric is widely cultivated for its rhizomes which are used as a bright yellow-orange culinary spice. In turmeric, curcumin and oleoresin are the two main components which are most important factors for the significance of turmeric [3-4]. Some of the therapeutically active compounds extracted from the rhizomes of Curcuma longa are called curcuminoids. Curcuminoids are inherent compounds of the species Curcuma longa and are responsible for the antioxidant activity of the turmeric. In addition to the curcuminoids, there are essential oils(oleoresin) containing monocyclic monoterpenes, sesquiterpene (bisabolanes and germacranes), arabinogalactans (ukonan) and ar-turmerone [5-6].

Turmeric is generally used in various food industries as a food color. It is mainly used in dairy products, beverages, cereal, confectionary, ice cream, bakery, and savory products. Turmeric is added at higher levels to sausages, pickles, relishes, sauces, dry mixes, and fish due to its original usage as a spice. Turmeric powder can be used for encapsulation and preparing highly beneficial turmeric health tablets. From many years awareness of turmeric and its use as medicine is continuously increasing. Turmeric's main ingredient is curcumin which exhibit a wide range of medicinal activities. Turmeric is used for heartburn (dyspepsia), stomach pain, diarrhea, intestinal gas, stomach bloating, loss of appetite, jaundice, liver problems and gallbladder disorders. It is also used for headaches, bronchitis, colds, lung infections, fibromyalgia, leprosy, fever, menstrual problems, and cancer. Other uses include depression, Alzheimer’s disease, water retention, worms and kidney problems [7-12].

Turmeric oleoresin is the organic extract of turmeric, a ground powder from the root of the curcuma plant, naturally occurring mixtures of an oil and a resin and is added to food items as a spice and coloring agent. Turmeric oil is widely used in pharmaceutical applications for its antioxidant, antimutagenic, anti-carcinogenic, anti-
bacterial and insect repellent properties. Turmeric oleoresins are deep brownish-orange viscous oily fluids, pasty semisolids or hard amorphous solids. The main composition of oleoresin is curcumin and turmeric oil. The selection of a turmeric oleoresin of a particular composition is based on the intended use in food. In general, all turmeric oleoresins contain colouring matter and most contain flavouring matter but some oleoresins are processed to remove aromatic compounds.

Commercial products include oleoresins and formulations in which oleoresin is diluted in carrier solvents and which may contain emulsifiers and antioxidants. Purified extracts of turmeric containing more than 90% total colouring matter are subject to specifications for curcumin. Turmeric oleoresins are sold on the basis of colour value or curcumin. As a food colorant, it can be used in meat, farm products, sugar products, aquatic products and so on [13-19].

According to literature the reported oleoresin content percentage has been varied with different commercially available turmeric samples. The dry rhizomes yield 5.8 % essential oil and fresh ones yield 0.24 % oil containing zingiberine [20-21]. Recently we reported the synthesis of curcumin from selected commercial turmeric plants to find out the curcumin rich turmeric variety [22]. In continuation with our research work in the present investigation we were focused on isolation of oleoresin with high recovery by using different solvents like ethanol and acetone in simple column extraction method to find the enriched oleoresin present in the selected turmeric varieties available in India.

MATERIALS AND METHODS

The experiment was carried out by column extraction method to extract the oleoresin from turmeric. Turmeric samples of four varieties such as CL-101, CL-219, BSR-01, BSR-02 were obtained from Coimbatore, Salem, Erode and Madhurai respectively. The solvents used 95% ethanol and acetone was purchased from E.Merck (India) Ltd. All reagents were of analytical grade and used as received.

SYNTHESIS OF OLEORESIN

Processing care

Around one kilogram of fresh turmeric rhizomes from each plot (comprising 30% mother rhizomes and 70% primary and secondary rhizomes) were boiled in pure water for an hour till the rhizomes became soft and emitted a typical turmeric odour. After boiling, the rhizomes were dried under sun light to attain the required 8% moisture content. The recovery of dry turmeric rhizomes then cleaned, crushed and powdered [23].

Plant extraction

In the present work, oleoresin was quantitatively extracted in column extraction method by using 95% ethanol as a solvent. The dried turmeric powder below 300 mesh (IS-2446, 1963) were taken at the rate of 5.0 g was loaded in glass columns blocked with non-absorbent cotton. Ethanol (15 ml) was allowed to percolate down into the glass column and kept in and the contact was maintained for overnight. Soluble extracts were then drained off into a pre-weighed 100 ml beaker. Again 100 ml of alcohol was used to wash the residue and all the extracts were pooled which was then evaporated to near dryness and the final weight recorded. The same procedure was followed to isolate oleoresin by using acetone as a solvent. After drying the extract weights were noted.

Characterization

The UV-Visible absorption spectra of the samples were measured on a Shimadzu UV-Vis V-530A spectrophotometer in the range of 425nm. Elemental analyses were carried out with Elementar Vario EL III series used to collect the micro analytical data (C, H and N) and compared with the calculated theoretical values.

RESULTS AND DISCUSSION

UV-Vis studies of oleoresin

UV-Vis spectroscopy technique is one of the most convenient method for characterization of curcumin compound. The presence of curcuminoid is confirmed by UV-Vis spectrum analysis as follows. The UV-Vis spectra of turmeric oleoresin (curcuminoid) is given in figure 1. Curcumin exhibits strong broad absorption peak at around 425 nm. The exhibited absorption maxima at around 425 nm can be due either to an n - π* transition or to a combination of π - π* and n - π* transitions which belongs to curcuminoid compound present in turmeric oleoresin (oil).

Elemental analysis

The analytical data of curcumin was obtained as in the table 2. The molecular formula of curcumin C_{15}H_{18}O_{6}. There is no disagreement between the theoretical and experimental values. This results also confirms the presence of curcuminoid in turmeric oil.

Estimation of Oleoresin content

In this work four types of turmeric varieties CL-101, CL-219, BSR-01, BSR-02 were used to determine the content of oleoresin. The extracted oleoresin is calculated by using the following formula and expressed as percent (ASTA, 1983). The results obtained were tabulated (table 2).

\[
\text{Oleoresin content (%) } = \frac{W_2 - W_1}{W_1} \times 100
\]

(On dry weight basis)

Where, \( W_1 \) = Weight of empty beaker

\( W_2 \) = Weight of beaker with turmeric oleoresin content
From the results it can be observed that oleoresin content was varied with different turmeric varieties. Several studies have shown that soil factors, including nutrients and level of acidity as well as the genus diversity, may affect the content of oleoresin in turmeric plants. From the table results we found that the yield of oleoresin was significantly higher when using ethanol solvent. But in the case of acetone solvent, the yields were not obtained effectively among the four different plants. The oleoresin percentage has been estimated to be between 3.50-9.01% in the presence of ethanol solvent and 2.24-6.03% in the presence of acetone solvent. The overall result is summarized in figure 2(a-b). The appreciable yield was obtained from BSR-01 turmeric variety in both ethanol (9.01%) and acetone (6.03%) solvent medium. At the same time CL-219 variety yields less amount of oleoresin in both solvents medium. Moreover CL-101 turmeric also shown good yield with ethanol solvent and moderate result with acetone. Finally these results have been clearly proposed that oleoresin synthesis carried out by using ethanol solvent significantly yields better results than acetone solvent.

Table 1. Elemental analysis data of oleoresin (curcuminoid)

<table>
<thead>
<tr>
<th>Curcumin</th>
<th>Experimental value</th>
<th>Theoretical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_21H_20O_6</td>
<td>69.01 C 5.32 N</td>
<td>68.47 C 5.47 N</td>
</tr>
</tbody>
</table>

Table 2. Turmeric varieties and its oleoresin amount

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variety of Turmeric</th>
<th>Weight taken (g)</th>
<th>Weight (W_2-W_1)</th>
<th>Oleoresin yield (%)</th>
<th>Weight taken (g)</th>
<th>Weight (W_2-W_1)</th>
<th>Oleoresin yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CL-101</td>
<td>5.002</td>
<td>0.712</td>
<td>7.12</td>
<td>5.005</td>
<td>0.535</td>
<td>5.35</td>
</tr>
<tr>
<td>2</td>
<td>CL-219</td>
<td>5.004</td>
<td>0.350</td>
<td>3.50</td>
<td>5.010</td>
<td>0.224</td>
<td>2.24</td>
</tr>
<tr>
<td>3</td>
<td>BSR-01</td>
<td>5.005</td>
<td>0.901</td>
<td>9.01</td>
<td>5.005</td>
<td>0.603</td>
<td>6.03</td>
</tr>
<tr>
<td>4</td>
<td>BSR-02</td>
<td>5.000</td>
<td>0.545</td>
<td>5.45</td>
<td>5.004</td>
<td>0.463</td>
<td>4.63</td>
</tr>
</tbody>
</table>

Fig 1. UV-Vis spectrum of curcuminoid (turmeric oil)

Fig 2a. Oleoresin yields with ethanol

Fig 2b. Oleoresin yields with acetone
CONCLUSION

From this investigation we have shown the synthesis process of oleoresin by easy manner to obtain high recovery. The four commercially available turmeric varieties CL-101, CL-219, BSR-01, BSR-02 were taken to column extraction technique by using 95% ethanol and acetone solvents. On the basis of the data, BSR-01 and CL-101 shown good results in the presence of 95% ethanol solvent and also extraction from ethanol medium produced a better result of oleoresin over all turmeric varieties with respect to the amount of curcuminoid compounds that it contains. BSR-01 turmeric yields 9.01% and CL-101 yields 7.12% of oleoresin which are higher percentage of oleoresin obtained from 95% ethanol solvent. This is significantly appreciable result when compared to the results obtained in the presence of acetone solvent. This information proves to be convenient and practical for manufacturers in terms of the ease with which to obtain the higher yield of oleoresin from turmeric extracts.

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