# Investigation of Costus Root Oil Composition

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A study was undertaken to collect plants occurring wild in the forest for their chemical examination so that possibilities of their domestication and utilisation as a quality product in the organised sector could be visualised. In this context, the roots of *Saussurea lappa* collected from Chamoli district of state of Uttaranchal, India were subjected to extraction for their essential oil and its composition. It was observed the cold percolation with diethyl ether optimal quantity of oil. The analysis of oil obtained by cold percolation revealed that there was one chemical component, dehydrocostus lactone, which is thermolabile and decomposes fast during hydro-distillation. This particular component was isolated and its structure was determined with IR Spectroscopy and NMR. Essential oil obtained from costus root is not only important in medicine, but it has potential to the utilised in perfumery industry.

**Key Words: Costus, Dehydrocostus lactone, Essential oil, *Saussurea lappa***

Costus (*Saussurea lappa*) plant is a tall, sturdy, herbaceous, perennial up to 2 metre high. It is found in North Western Himalayas. Since ancient times, the oil of costus root has been used against several kinds of diseases. In action, it is anodyne, antiarthritic, antiseptic, aphrodisiac, astringent, carminative, diaphoretic, deodorant, disinfectant, diuretic, emmenagogue, expectorant, febrifuge, spasmodic, stimulant, tonic etc. (Chauhan, 1999). Dehydrocostus lactone, a sesqui-terpene, is an important compound found in the roots of this plant. This inhibits the expression of inducible nitric oxide synthase and TNF-alpha in LPS- activated macrophages. Thus dehydrocostus lactone may be a petential compound for the development of new drugs to treat endotoxemial accompanied by the over production of NO and TNF-alpha (Lee *et al.*, 1999). Large quantities of costus root are exported from Kashmir to China and Japan for use in temples and to Europe for oil distillation purpose (Gulati, 1982). Costus resinoid essential oil is in great demand as a fixative in perfumery industry.

## Materials and Methods

The roots of costus (*Saussurea lappa*) were collected from Chamoli district of Uttar Pradesh in North India. The powdered roots (25 g) mixed with 10gm silica gel (to increase surface area for better extraction) were extracted (cold percolation) with diethyl either, petroleum ether, benzene and methanol (350 ml each) consecutively (the previous solvent was completely removed before using next solvent) in a glass percolator (ID 3 cm) with a flow rate of 0.6 ml per minute. The extracts were cool concentrated and yield of oleoresins were recorded. Diethyl ether extract oleoresin was subjected to Thin Layer Chromatography (TLC). The solvent for TLC chamber was used as mixture of toluene and ethyl acetate in 93:7 proportion for detecting the number of compounds. The oil was separated from this oleoresin by chilling method and hydro distillation separately, which was subjected to GLC (Model-Perkin Elmer Auto System equipped with capillary column) for comparative composition. A third method using Super Critical Fluid Extraction (SCFE) technique was also used for the oil extraction (Gas $CO_2$, pressure 70 bar, T10°C). A single compound was also isolated through preparative TLC technique from the ether extracted oil, which was further analysed on FTIR and NMR (FTIR- model Nicolet Impact-400, No. of scan-32, Resolution-4, Apodization-happ-genzel, detector-DTGS polyethylen, beam splitter-KBr). NMR (model-Em 360L, Frequency-60 MHz, magnetic field strength 1.4 tesla, sample revolution-42 rps) for its identification.

## Results and Discussion

The yield of oleoresin obtained with cold percolation with diethylether was recorded as 6.68%. The yield obtained by subsequent extraction of the sample with petroleum ether, benzene and methanol (Table 1) indicates that a total of 22.87% oleoresin was obtained from the sample, highest being with the methanol extract (15.95%).

The oil obtained from cold diethylether percolation was brownish yellow with a peculiar iong lasting odour. The TLC of the oil resolved various compounds. The oils obtained from cold percolation and hydro-distillation were tested on GLC separately for

**Table 1. Fraction (cold percolation) yield of oleoresin and oil with various solvents**

| Fraction | Solvent | Yield of oleoresin | | Oil yield (%) |
|---|---|---|---|---|
| | | (g) | (%) | |
| Ist fraction (350 ml) | Diethyl ether | 1.6716 | 6.68 | 1.16 |
| II fraction (350 ml) | Petroleum ether | 0.0133 | 0.05 | 0.04 |
| III fraction (350 ml) | Benzene | 0.0475 | 0.19 | 0.10 |
| IV fraction (350 ml) | Methanol | 309871 | 15.95 | 0.25 |
| SCFE) (diethyl ether fraction | – | – | – | 4.23 |

comparison. It was found that some peaks were missing in the oil obtained from hydro-distillation (Figs. 1 and 2), which indicated the presence of some thermolabile compound in the oil.

The essential oil was put on two different TLC plates, one preparative and the other analytical (solvent toluene: ethyl acetate, 93:7) and major spots were observed in the UV light. One plate was sprayed with dragan droff

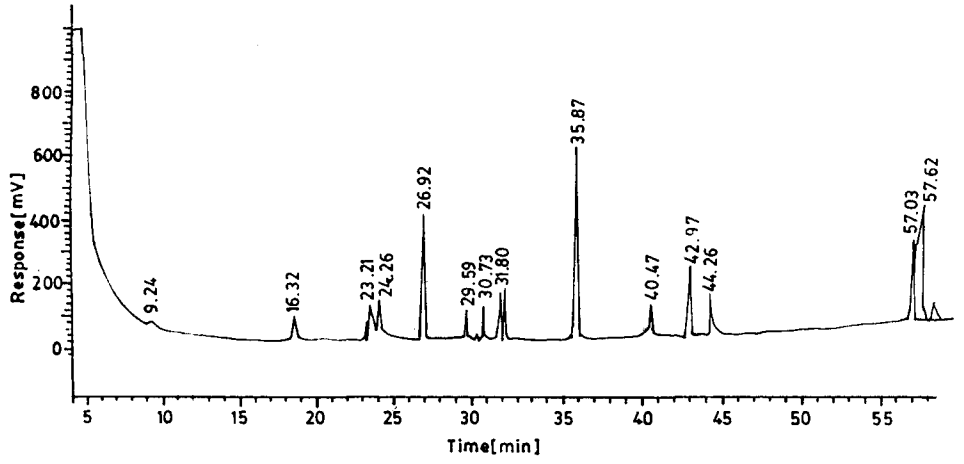


*Fig. 1 Gc Graph of cold percolated oil*

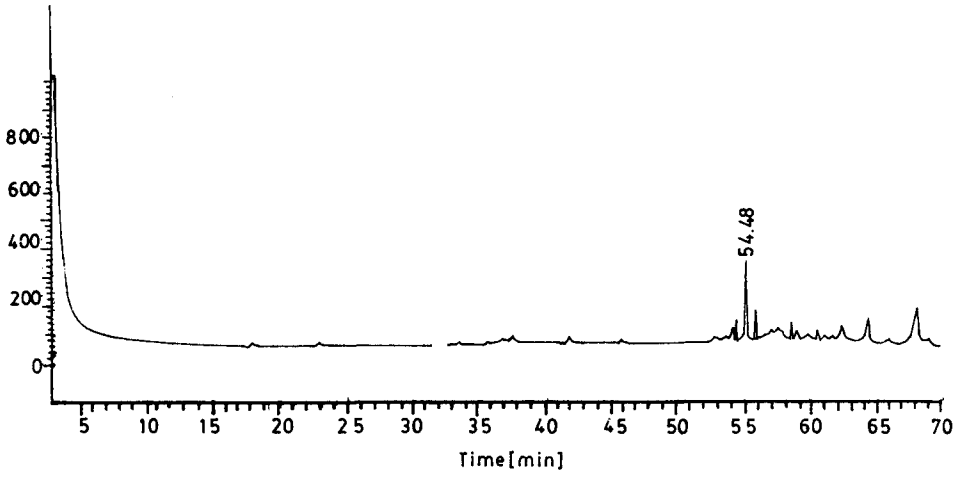


*Fig. 2 Gc Graph of cold percolated oil (after heating)*

reagent. On analytical plate the lower most portion (Rf value 0.03) gave a violet colour indicating the presence of an alkaloid. Subsequently $H_2SO_4$ was sprayed on the plate. Charring at some places indicated the presence of other compounds. The second preparative plate was also examined in UV light. A cluster of few spots was observed between Rf 0.3 to 0.5. Above this cluster a single spot was seen at Rf 0.81. The spot material on plate was scraped separately. On physical examination it was found the spot at Rf 0.81 has a pleasant smell resembling to the natural smell of its parent root material. This was filtered and purified and subjected to IR and NMR, which confirmed the compound as dehydrocostus lactone, which was first time isolated by Ukita (1939). Structure interpreted from FTIR (Fig. 3) and NMR (Fig. 4) is given in Fig. 5 as also reported by Mathur *et al.*, (1965). The characteristic peculiar smell of the oil was mainly due to this compound as the remaining part of the preparative TLC was also isolated, which had no smell.

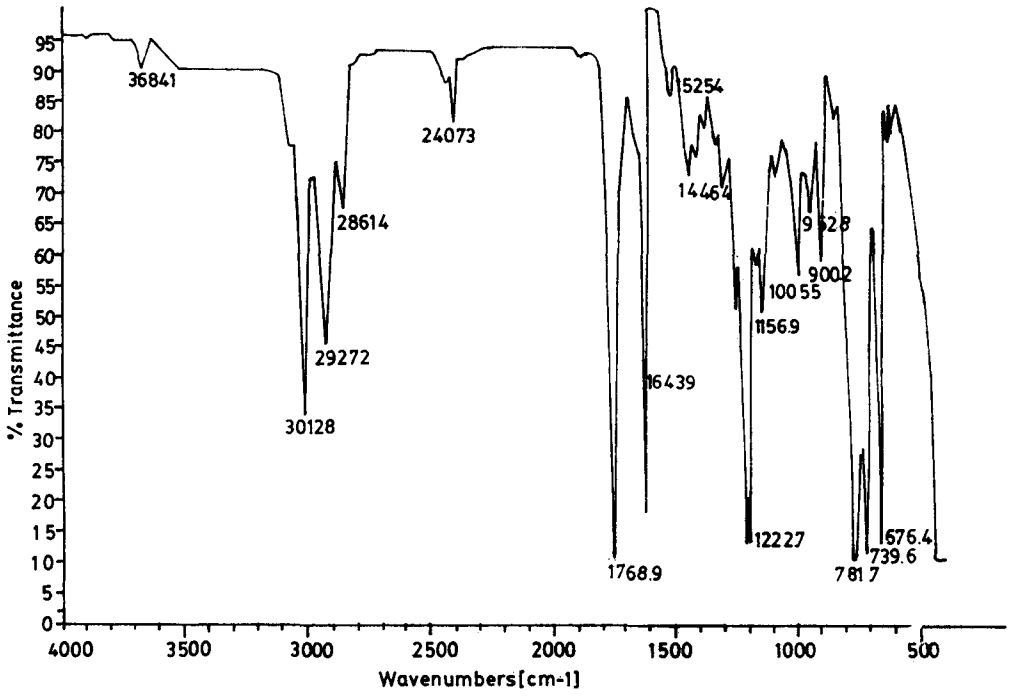


*Fig. 3 FTIR spectra of dehydrocostus lactone*

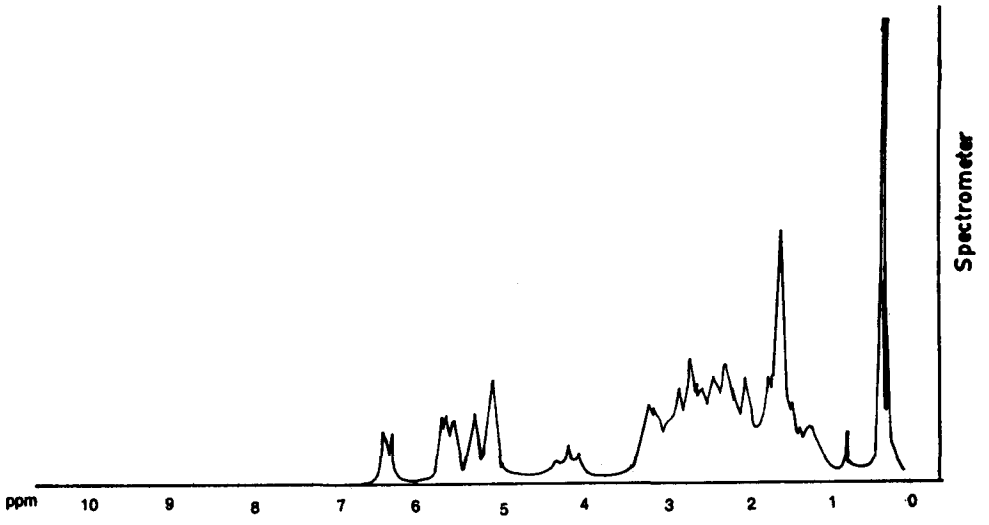


*Fig. 4 NMR spectra of dehydrocostus lactone*

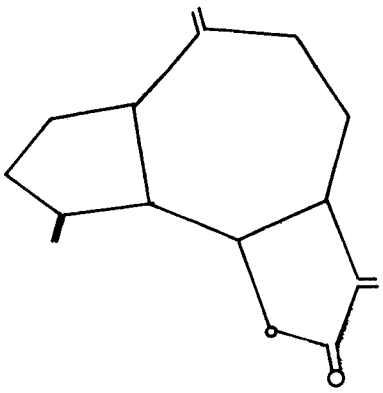

*Fig. 5 Spectra of dehydrocostus lactone*

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