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A correlation study of curcuminoid levels and nature of soils in India

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Abstract

Curcuminoids refer to three main chemical substances, namely curcumin, demethoxycurcumin, and bis-demethoxycurcumin. These are used as natural coloring agents in some food products and have been reported to exhibit several biological activities in animal and human clinical studies. Due to its beneficial effects to human health, several analytical methods have been continuously proposed and developed by scientist to analyze them in plant sources, food, and in pharmaceutical products. This article highlights the impact of soil nature on percentage of Curcuminoid in curcumin.

Introduction:

Turmeric is the boiled, dried, cleaned and polished rhizomes of Curcuma longa. The plant is a herbaceous perennial, 60-90 cm high, with a short stem and tufted leaf. There are 7 to 12 leaves, the leaf sheaths forms the pseudo stem. The lamina is green above and pale green below and has a length of 30-40 cm and width 8-12 cm. Inflorescence is a central spike of 10-15 cm length. 1-4 flowers are born in axil of the bract opening one at a time. About 30 flowers are produced in a spike. Seeds are produced in capsules and there will be one to numerous sunken capsules in an inflorescence. It is a native of India. Apart from India, it is cultivated in Pakistan, Malaysia, Myanmar, Vietnam, Thailand, Philippines, Japan, Korea, China, Sri Lanka, Nepal, East & West Africa, South Pacific Islands, Malagasy, Caribbean Islands and Central America. In India, it is cultivated in the States of Andhra Pradesh, Maharashtra, Orissa, Tamil Nadu, Karnataka and Kerala.

Image.1 Turmeric roots

Turmeric is a tropical crop cultivated from sea level to 1200 meter MSL. It grows in light black, black clayey loams and red soils in irrigated and rainfed conditions. The crop cannot stand water logging or alkalinity.

Image.2 Harvesting of Trumeric crop

Turmeric is used to flavour and to colour foodstuffs. It is a principal ingredient in curry powder. Turmeric oleoresin is used in brine pickles and to some extent in mayonnaise and relish formulations, non-alcoholic beverages, gelatins, butter and cheese etc. The colour curcumin extracted from turmeric is used as a colourant. Turmeric is also used as a dye in textile industry. It is used in the preparation of medicinal oils, ointments and poultice. It is stomachic, carminative, tonic, blood purifier and an antiseptic. It is used in cosmetics. The aqueous extracts has biopesticidal properties.

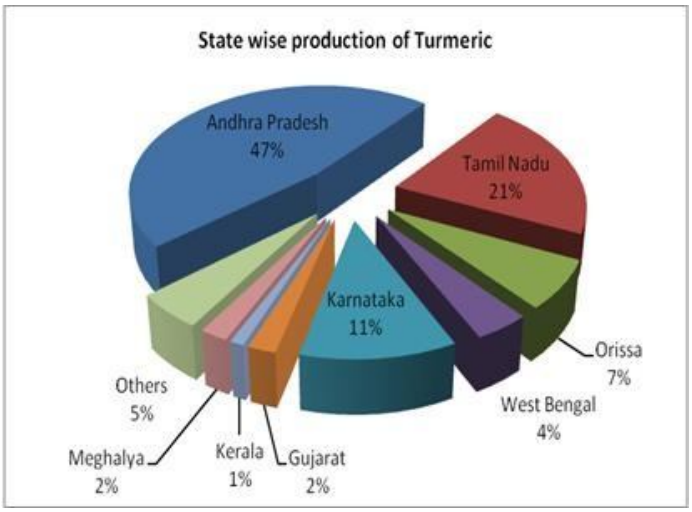


Image.3 Production of Turmeric state wise

Materials and Methods:

For this research study 18 turmeric (Suvarna variety) samples are collected from throughout India. The percentage of Curcuminoid is quantified by using HPLC method.

Mobile phase preparation for Analysis of Curcuminoid:

The mobile phase previously optimized consisted of acetonitrile and 0.1% OPA in the ratio of 50:50 v/v. Both the solvents were filtered through 0.2 µm Pall Ultipor N $_{66}$membrane. The isocratic elution was carried out with the flow rate of 1 ml/min at ambient temperature and a wavelength of 425 nm was used for detection.

Instrument details and optimization:

A Series HPLC system PEAK LC 7000 isocratic HPLC with PEAK 7000 delivery system. Rheodyne manual sample injector with switch (77251), Analytical column Chromosil C18. 150 mm ×4.6mm, Electronic balance-DENVER (SI234), manual Rheodyne injector with a 20 µl loop was used for the injection of sample. PEAK LC software was used. UV 2301 Spectrophotometer was used to determine the wavelength of maximum absorbance.

Any solvent remaining in the system from the previous analysis was washed out by passing Methanol: Water (50:50) for 10 min at 1 ml/min flow rate with purge valve open. After closing the purge valve, 100% methanol was passed for 30 min through column for proper column washing. After this step, for column conditioning and base line stability, Acetonitrile:OPA (0.1%) mobile phase in the ratio of 50:50 v/v was passed through HPLC system for 1 h at 1 ml/min flow rate. The total injection volume was set to 5 µl.

Standard solution preparation:

Standard curcuminoid 50 mg was accurately weighed and transferred to a 50 ml volumetric flask and the volume was made with methanol. Solutions of 50, 100, 150, 200, 250 and 300 µg/ml were made by transferring the aliquot from stock solution and the volume was made with methanol in each case. Further standard solutions were prepared freshly each day by appropriate dilution of stock solution with methanol for intraday as well as interday analysis. The solution was filtered through a 0.2 µm Ultipor N $_{66}$ membrane syringe filter, before injecting it into the chromatographi system.

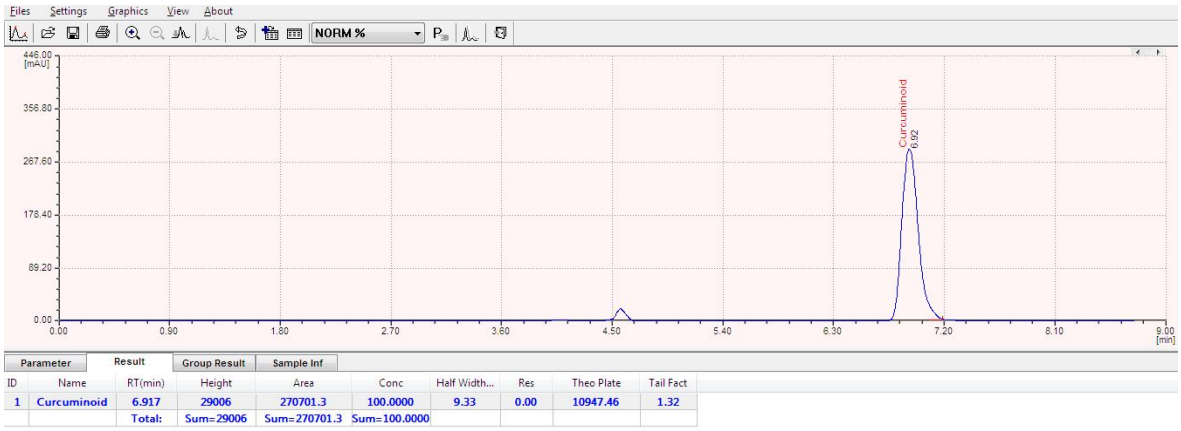


Image.4 Standard HPLC Chromatogram of Curcuminoid

Validation of the method:

Validation of the analytical method was done according to the ICH guidelines. The method was validated for linearity, precision, accuracy, LOD and LOQ. The linearity of measurement was evaluated by analysing different concentrations (50-300 µg/ml) of the standard solutions. Calibration curve was constructed for curcuminoids by plotting average peak area against concentration and regression equation. The correlation coefficient and the slope of the peak were also computed. All the samples were analysed in triplicate. LOD and LOQ of the developed method were determined by injecting progressively low concentrations of the standard solutions using the developed RP-HPLC method. The LOD is the smallest concentration of the analyte that gives a measurable response (signal to noise ratio of 3). The LOQ is the smallest concentration of the analyte, which gives response that can be accurately quantified (signal to noise ratio of 10).

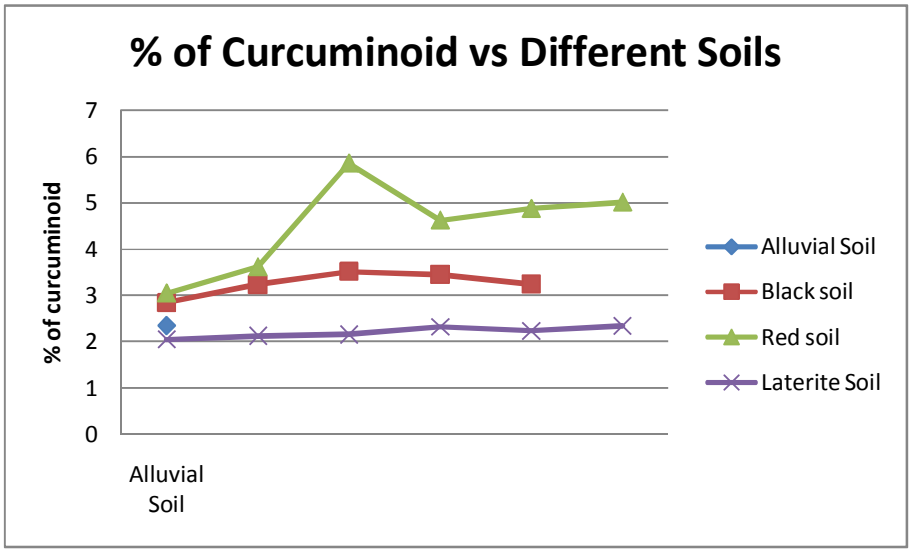
S.NO	Type of soil	Sample collected from	Percentage of curcuminoid
1	Alluvial Soil	Northern Gujarat	2.35±0.56
2	Black Soil	Maharashtra	2.85±0.3
3	Black Soils	Chhattisgarh,	3.24±0.25
4	Black Soil	Andhra Pradesh	3.52±1.24
5	Black Soil	Madhya Pradesh	3.46±0.61
6	Black Soil	Tamil Nadu	3.25±0.55
7	Red Soil	Tamil Nadu	3.05±0.27
8	Red Soil	Chhattisgarh	3.62±0.86
9	Red Soil	Andhra Pradesh	5.86±0.33
10	Red Soil	Karnataka	4.63±0.25
11	Red Soil	Maharashtra	4.88±0.34
12	Red Soil	Orissa.	5.02±0.71

13	Laterite Soil	Kerala,	2.05±0.28
14	Laterite Soil	Tamil Nadu	2.13±0.06
15	Laterite Soil	Maharashtra,	2.16±0.17
16	Laterite Soil	Chhattisgarh	2.32±0.29
17	Laterite Soil	Orissa	2.24±0.34
18	Laterite Soil	Assam	2.34±0.36

Table.1 percentage of curcuminoid in different samples collected from different nature of soils

Discussion:

From table.1 The red soil turmeric samples have maximum percentage of Curcuminoid than other soils. Local exporters are mixing normal turmeric powder with high percentage of Curcuminoid contained turmeric powder based on their requirements while exporting. In the visakapattanam agency turmeric samples found high levels Curcuminoid.



Graph.1 Comparison Curcuminoid percentage

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