# Detection and Estimation of Lead in Curcuma Longa Bulbs (Turmeric) by Atomic Absorption Spectrophotometry

AZHAR M. SYED, M.QADIRUDDIN AND ATAULLAH KHAN
*PCSIR Laboratories, Karachi-39, Pakistan.*

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**Summary:** Lead has been detected and estimated in turmeric by Atomic Absorption Spectrophotometry. The solutions for analysis were prepared by sulphated-ash method and the absorptions were measured against standard solutions of lead in a concentration of 20 ug/ml. The pure sample of curcuma longa bulbs were analysed for lead contents in the inner portion (matrix) and outer portion (cuticle) of the roots. The so called adulterated samples in which lead contents are very high were purchased from the market.

## Introduction

Lead is known to be a cumulative poison which is slowly and incompletely absorbed from the gastrointestinal tract but excreted even more slowly [1]. Due to this reason lead poisoning is usually chronic. Lead is not an essential constituent of any living organism. If a person is exposed to lead poisoning, the lead is stored in the tissues, espeically in the bones.

The symptoms of acute poisoning are intense thirst, a metallic taste in the mouth, a burning abdominal pain, vomiting, diarrhoea, black stools, oliguria and coma. In young children, it is indicated by anorexia, constipation, headache, weakness, the development of a blue line on the gums, and anaemia [2].

Lead in food is controlled by the lead in Food Regulations, 1961 which restricts the amount of lead in food to 2 ppm with the exception of certain foods and drinks tabulated in the Regulations for which limits ranging from 0.2 to 50 p.p.m. are stated.

In India and Pakistan, the use of Curcuma longa bulbs (turmeric) in spices is very common. The presence of lead in turmeric is well known and is supposed to occur due to two reasons.

i. The actual presence of lead in the roots is either due to uptake of lead from the soil and water; or

ii. due to external treatment of turmeric for colouring and polishing by lead chromate.

Qin et al. [4] have detected various trace elements in Chinese herbal medicinal plants by the Energy Dispersive X-ray methods. They have also reported the presence of lead in Curcuma longa bulbs.

The contaminated turmeric powder by $PbCrO_4$ has been analysed for lead by Hartman and Divakar [5]. The basis of test was the production of blue perchromic acid. This colour was more stable at 0°C than at room temperature.

Praminik [6] estimated lead due to Pb $CrO_4$ in turmeric by the detection of Cr by weight and estimating the corresponding amount of lead with respect to their combining weights.

Kulkurani et al. [7] have detected lead in whole and ground turmeric by the production of colour and estimating by spectrophotometry.

Ila et al. [8] have used the non-destructive instrumental neutron activation analysis for the detection and estimation of lead in turmeric powder.

The present work deals with the detection and estimation of lead in pure and treated turmeric by $PbCrO_4$. The powdered samples have also been tested. The analysis has been carried out by the preparation of sulphated-ash and determining lead in the dil. nitric acid solution using Atomic Absorption Spectrophotometry.

## Experimental

*Reagents*

1. Sulphuric acid concentrated (lead free)

2. Nitric acid concentrated (lead free)

*Apparatus*

1. Pyrex glass apparatus hot alkali/acid washed before use.

2. Muffle furnace with controlled temperature.

3. Atomic Absorption Spectrophotometer Perkin Elmer Model 107.

*Metnod*

1.0 gm of the well mixed representative sample is taken in a platinum crucible and 1 ml conc. $H_2SO_4$ is added. The crucible is heated slowly on a bunsen burner till the sample is charred and excess of $H_2SO_4$ is evaporated. It is then placed in a muffle furnace at 450°C for several hours till all the carbon is removed. After the removal of carbon, the crucible is cooled and residue is dissolved in 2 ml Conc. $HNO_3$ and 25 ml distilled water. The solution is filtered and volume made up to 100 ml. Lead is then extracted from the above prepared solution under the usual conditions of volume and pH using dithizone as the complexing agent. After extraction the complex is treated with 50 ml of 1% $HNO_3$ to recover lead for Atomic Absorption Spectrophotometry, using the lead hollow cathode lamp and the following instrumental conditions.

Absorption line 283.3 nm, acetylene 2.4 litres/minute, air 22.5 litres/minutes, slit 0.2 mm, 4 inch simple slot burner; lamp Current 5 milli amps, digital display adjusted to give 20.0 absorption for a standard lead solution fo 20 ug/ml. The instrument determines lead to a level of 0.2 ppm.

## Results and Discussion

Table-1 shows the analysis for lead in pure samples of curcuma longa bulbs (turmeric) obtained from N.W.F.P area of Pakistan and imported sample from Bangla-Desh. In order to find out the distribution of lead with in the roots, the inside matrix and the cuticle were separately analysed by atomic absorption spectrophotometry. The matrix showed the presence of 1.2 ppm of lead where as the cuticle contained 2.8 ppm in the turmeric from N.W.F.P. The samples from Bangla-Desh gave almost similar results (Table-1). Crudgington et al. [9] have analysed a large number of root vegetables and have shown that there is not significant increase in lead content as a result of up-take from the soil rich in lead.

Tabel-I: Lead content of Curcuma longa bulbs

| Origin | Appearance | Sample Portion | No.of Samples | Lead PPM Mean values |
|---|---|---|---|---|
| Hazara and Bannu (N.W.F.P) | Dull brown thin and elongated in shape. | Matrix | 3 | 1.2 |
| | " " | Cuticle | 3 | 2.8 |
| Bangla-Desh | Dull brown short and thick in shape | Matrix | 3 | 1.3 |
| | " " | Cuticle | 3 | 2.6 |

Table-II: Lead content in adulterated samples of turmeric

| | | | | |
|---|---|---|---|---|
| Karachi market (unpacked) | Turmeric whole bright yellow and polished | Matrix | 1 | 410 |
| | " " | Cuticle | 1 | 3700 |
| Karachi market (unpacked) | Dark yellow Turmeric powder | Powder | 3 | 290 |
| Karachi market (packed by a Food process-ing Industry) | Light yellow Turmeric powder | powder | 3 | 30 |

An other possibility of the presence of lead in turmeric is due to Pb $CrO_4$ contamination. Tabel-II shows the analyses for lead in the polished and coloured samples of turmeric in the form of whole and powdered samples. In the whole bright yellow polished samples, the contents of lead in the matrix were 410 p.p.m., whereas in the cuticle it was very high (3700 p.p.m.) This is certainly very much alarming and actualy require strict quality control. These samples were purchased unpacked from the open market and were positively treated by excess of Pb $CrO_4$.

Table-II, also shows the analyis of lead in prepacked samples of powdered turmeric and the lead contents in those were about 30 ppm.

In continuation to the above study in which there seems to be a wide variation of lead contents in turmeric, it was desired to check some of the pickles in which turmeric is used in

Table-III: Lead content in pickles prepared with turmeric

| Source | Appearance | Sample Portion | No. Of Samples | Lead P.P.M. Mean Value |
|---|---|---|---|---|
| Karachi market (unpakced) | Yellowish red in colour | Material mixed and aggregated portion taken for analysis | 2 | 130 |
| Karachi market (packed by Food Processing Industry) | Light red in colour portion taken for analysis | Material mixed and aggregated | 3 | 3.7 |

appreciable amount. About five samples of unpacked and packed by food processing industries were analysed for their lead contents (Table-III). The unpacked samples purchased from the open market showed an average of 130 ppm lead.

The packed samples obtained from some of the food proceesing industries gave the lead contents to an average of 3.7 ppm

It is concluded that there is definitely a need for strict quality control of turmeric and its products. It is also aimed that in future, a proper survey of turmeric grown in different regions of Pakistan could be carried out for the determination and estimation of lead in the roots and the soil of that area.

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**References**

1. E.W.Rice and D.S.Flectcher, Standard Methods of clinical chemistry, Vol. V, Acadamic Press, New York, (1965).
2. Martindale, "The Extra Pharmacopoeia", 26th Ed. The Pharmaceutical Press London, (1973), pp. 479 (a), 215 (b).
3. Lead in Food Regulations, S.I. (1961) No. 1931, H.M.S.O. London, (1961).
4. Junfa Qin, Dehna Ye; Yun Wang, *Jixiao Ma, Xuesheng Bao Zhongcaoyao, 14(II), 492 (1983).*
5. C.P.Hartman; H.G. Divakar, *J.Inst.Chem.Culcutta, 43 (pt.4) (1971).*
6. N.K.Praminik *J.Inst.Chem.Calcutta 45 (pt.1) 3 (1973).*
7. B.M.Kulkurni; L.O. Chourasia; K.N.G. Nair, *T.V. Mathew. Res.Ind. 20(4), 210 (1975).*
8. P.Ila; P.Jagan, *J.Radional.Chem. 57(1), 205 (1980).*
9. D.R.Crudgington, J.Markland and J.V. Vallance, *J.Assoc.Pub.Analysts, II, 120 (1973).*