Dynamics of Curcumin content in *Curcuma caesia* Roxb. rhizomes with different storage conditions and durations

Victor Thingujam and Saswat Nayak

**Abstract**

The present study demonstrates the dynamics of Curcumin content in *Curcuma caesia* Roxb. rhizomes with different storage conditions and durations. The rhizomes were stored and analysed for Curcumin content in the laboratory of College of Forestry under Orissa University of Agriculture and Technology, Bhubaneswar. The results revealed that the Curcumin content (4.43 g/100 g) before storing the dried rhizome powders under different storage conditions and durations increased in all storage conditions when stored upto 90 days. Dried rhizome powder stored in closed polythene bags kept in dark showed maximum Curcumin content (7.63 g/100 g) in case of 90 days storage whereas the minimum content (4.43 g/100 g) was recorded before storing the rhizome powder under different conditions. The present study can give us a more insight on the variation in Curcumin content under different storage conditions and durations.

**Keywords:** *Curcuma caesia*, rhizomes, Curcumin, storage, durations

**Introduction**

*Curcuma* Linn. is a large genus belonging to the family Zingiberaceae. It comprises of about 70 species of rhizomatous herbs distributed mostly in Southeast Asia as wild or cultivated plants. *Curcuma* species have great importance for its medicinal values and among which *Curcuma caesia* Roxb., a plant native to Northeast and Central India is one of the important species used by various tribal communities from long before. It is commonly known as Kali haldi because of the fact that its rhizome is used in Kali puja in West Bengal. The rhizomes of this plant has high economic value for its medicinal properties. The rhizome extracts are used in the treatment of smooth muscle relaxant activity, haemorrhoids, leprosy, asthma, cancer, epilepsy, fever, wound, vomiting, menstrual disorder, anthelmintic, aphrodisiac, inflammation, gonorrhoeal discharges, etc (Kuttan et al., 1987 [4]; Holt et al, 2005 [2]; Shimouchi et al, 2009 [8]; Chandran et al, 2012 [3]; Nilani et al, 2009 [6]; Mehla et al, 2010 [5]). It has also been reported that the rhizome of the species has considerable amount of Curcumin (0.137 %). Curcumin is commonly used as an edible dye besides other medicinal properties like combatting cancer stem cells as well as multidrug resistant cancer, reduces inflammation & joint pain, inhibits the formation of LDL cholesterol, minimizes the blood clots, protects against Alzheimer’s disease and helps in detoxification of heavy metals. The active principles of medicinal and aromatic plants undergo changes with time in post-harvest period so it needs proper storage conditions to avoid degradation of the compound and to maximise its yield. Hence, it was thought imperative to undertake the current study on this plant because of the importance of the active ingredient i.e. Curcumin and to identify proper storage condition to minimise its degradation over time.

**Materials and Methods**

**Experimental details**

The experiment was carried out at the Research field of College of Forestry under Orissa University of Agriculture and Technology, Bermunda, Bhubaneswar and laboratory of College of Forestry, O.U.A.T, Bhubaneswar during 2016-17. The storage experiment was laid out in Factorial Completely Randomised Design (FCRD) with three (3) replications. The experiment consisted of sixteen (16) treatment combinations comprising of four (4) storage conditions viz; i) closed container kept in light ii) open container kept in light iii) closed container kept in dark
and iv) open container kept in dark and four (4) storage durations viz: i) 0 day ii) 30 days of storage iii) 60 days of storage and iv) 90 days of storage.

Sample preparation
Immediately after collection, the rhizomes were separated from the aerial parts and washed with deionized water to remove all soil particles and then shade dried for a week. The shade dried rhizomes were then oven dried at 50°C for 6 hrs and cut into small pieces and finally crushed to fine powders. Dried powdered rhizomes, 3 g each were stored in each polythene bags for storage under different conditions and durations. Extraction was carried out after the period of storage under each conditions by refluxing each sample with methanol for 1 hr and Curcumin content was estimated by UV-VIS spectrophotometer method at 425 nm.

Statistical Analysis
Statistical conclusions were drawn by factorial CRD analysis of the database. All statistical computations were done through SPSSV.19.0.

Results and Discussions
In case of Curcuma caesia Roxb., Curcumin is one of the active principle which is unstable in nature (Schieffer, 2002) [7]. Mean Curcumin content before storage of rhizome powder of Curcuma caesia Roxb (4.43 g/100 g) increased over all storage conditions upto 90 days (7.10 g/100 g) which may be due to the higher rate of biosynthesis of Curcumin in fine powders. The biosynthesis of Curcumin or conversions of other related compounds into Curcumin may be favourable in the stored conditions i.e. air, room temperature, sunlight and humidity for some time period.

Due to higher rate of bio-synthesis of Curcumin and conversion of other related compounds to Curcumin than its degradation under closed dark condition, mean Curcumin content over all storage durations were found to be maximum (6.66 g/100 g) in closed container kept in dark. This might be due to very limited amount of air present in the closed polythene and the storing temperature in dark conditions favouring the faster rate of biosynthesis of Curcumin than its degradation.

Curcumin content after 30 days of storage increased in all storage conditions, however, it starts decreasing till 90 days of storage in all storage conditions except closed container kept in dark where it increased continuously. In the first 30 days of storage, in all storage conditions the available air, moisture content and temperature of storage may be sufficient enough for activation of enzymes favouring higher rate of biosynthesis of compounds than its degradation. However, from 30 days of storage onwards till 90 days, the decrease of Curcumin content in open container kept in light, closed container kept in light and also in open container kept in dark may be due to more rate of degradation of Curcumin than biosynthesis which was influenced by both light and the minimum amount of air required for the purpose. Schieffer (2002) [7] also reported that Curcumin is unstable and degrades in the presence of light.

Curcumin content was recorded maximum after 90 days of storage in closed polythene bag kept in dark (7.63 g/100 g) which constantly increased from the Curcumin content of the rhizome before storage (4.43 g/100 g). The result is in conformity with Ganpati et al. (2011) [3], Curcumin content of rhizomes of Curcuma longa increased with storage period till 30 months of storage and then declined. The minimum Curcumin content was observed during packaging of powdered rhizome which increased in post-harvest period due to bio-accumulation and synthesis of Curcumin.

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Table 1: Effects of Storage Conditions and Storage Durations on Mean Curcumin Content (g/100 g) of Curcuma caesia Roxb. (Rhizomes)

<table>
<thead>
<tr>
<th>Storage Conditions</th>
<th>Storage Durations</th>
<th>0 day</th>
<th>30 days</th>
<th>60 days</th>
<th>90 days</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Curcumin content</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(g/100 g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>open container kept in light</td>
<td>4.43</td>
<td>7.35</td>
<td>6.90</td>
<td>6.87</td>
<td>6.39</td>
<td></td>
</tr>
<tr>
<td>open container kept in dark</td>
<td>4.43</td>
<td>6.70</td>
<td>6.45</td>
<td>6.98</td>
<td>6.14</td>
<td></td>
</tr>
<tr>
<td>closed container kept in light</td>
<td>4.43</td>
<td>7.52</td>
<td>7.22</td>
<td>6.91</td>
<td>6.52</td>
<td></td>
</tr>
<tr>
<td>closed container kept in dark</td>
<td>4.43</td>
<td>7.23</td>
<td>7.34</td>
<td>7.63</td>
<td>6.66</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.43</td>
<td>7.20</td>
<td>6.98</td>
<td>7.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistical at par values are represented by the small alphabets (a, b, c)

<table>
<thead>
<tr>
<th>C.D. (5%)</th>
<th>SE(d)</th>
<th>SE(m)</th>
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<tr>
<td>Storage Conditions</td>
<td>0.21</td>
<td>0.07</td>
</tr>
<tr>
<td>Storage Durations</td>
<td>0.21</td>
<td>0.07</td>
</tr>
<tr>
<td>Storage Conditions x Storage Durations</td>
<td>0.43</td>
<td>0.15</td>
</tr>
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</table>
Conclusion
The pharmaceutically important active principles undergo changes in their concentrations during storage which necessitates the harvested material to be carefully dried under controlled conditions and storage in suitable containers under appropriate conditions so as to minimize losses of the active constituents in the post-harvest period till the final processing. The rhizomes of *Curcuma caesia* Roxb require proper storage after harvesting in order to minimize the loss of Curcumin during post-harvest period. The dried Rhizome powder stored in closed polythene bag kept in dark for 90 days contains maximum Curcumin (7.63 g/100 g) and was constantly increasing from the time of storage (4.43 g/100 g). Thus, it can be concluded that powdered rhizomes of *Curcuma caesia* Roxb. stored in closed polythene bag kept in dark condition resulted in minimum degradation of Curcumin.

References