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Post Harvest Deterioration of Plumbagin in *Plumbago Rosea* Roots

[*]C. Beena[1], M.T. Kanakamany[1] and P.V. Sindhu[1]

ABSTRACT: *The roots of Plumbago rosea Linn. (Synonym. P. indica Linn.) from the family Plumbaginaceae, commonly known as Chitrak in India, are medicinally important. Plumbago root is an essential component in many ayurvedic formulations like chitrakati vati, chitrakati churna, chitraka harithaki etc. Plumbagin (5-hydroxy-2-methyl-1,4-napthoquinone), chemically a naphthaquinone, is the major therapeutically active chemical component present in the roots of plumbago. Post-harvest physiological deterioration (PPD) being a major bottleneck in the long term storage of raw drug materials, proper method of storage and timely utilization of it in medical formulations before the decline of its active ingredient, gains importance in maintaining the good quality and efficacy of formulations. Hence a study was undertaken to assess the post harvest deterioration of the plumbagin in raw drug root samples when kept under different storage conditions continuously for a period of two years. The samples were stored in six different conditions (Treatments) viz., open storage (control), in transparent plastic container, in nontransparent plastic container, in brown paper cover, in polyethylene bags-200 gauge and in poly propelene woven bags. The two year study revealed that storage of Plumbago rosea roots inside closed plastic containers either transparent or non transparent, is recommended as best among the different storage conditions tested which retained about 67 % of active ingredient plumbagin even after two years. If stored in open or inside brown paper covers, the samples will be spoiled within a span of 4 to 6 months due to moisture absorption and fungal attack.*

Keywords: *Plumbago rosea, plumbagin, post harvest deterioration, storage.*

INTRODUCTION

Plumbago rosea Linn. (Synonym. *P. indica* Linn.*)* is the very effective digestive and carminative herbal drug of Ayurveda. It is a shrubby perennial herb native to South Asia, is widely cultivated throughout India and Sri Lanka. The plant belongs to the family *Plumbaginaceae* and is locally known as Chitrak in Hindi and Leadwort in English. It helps to improve digestion and strength. Chitrak roots are used in the treatment of dyspepsia, bronchitis, elephantiasis, chronic intermittent fever, amenorrhoea, anaemia, skin diseases and also used as an abortifacient in ayurvedic system. Plumbago root is an essential component in many ayurvedic formulations like chitrakati vati, chitrakati churna, chitraka harithaki etc. Plumbagin (5-hydroxy-2-methyl-1, 4-napthoquinone), chemically a naphthaquinone, is the major therapeutically active chemical component present in the roots of plumbago[1,2]. Studies have proved its antitumor, antimicrobial, anticancer, antifertility, antileishmanial as well as anti allergic properties also[3-7]. Post-harvest physiological deterioration (PPD) is the major problem in the long term storage of raw drug materials, proper method of storage and effective, timely utilization of it in medical formulations. Quality and efficacy of formulations depend upon the active ingredient present in the raw drugs used. Moreover Plumbago roots are also being utilized for commercial extraction of the chemical plumbagin in pure form. Hence the study was undertaken to assess the post harvest deterioration of the plumbagin content in raw drug root samples when kept under different storage conditions continuously for a period of two years. The objective was to identify the the optimum storage condition for *Plumbago rosea* which can retain maximum plumbagin in roots and also to assess the degree of reduction in plumbagin content during storage.The results revealed helps in standardization of post harvest storage of *p. rosea* roots as raw drug.

[1] All India Coordinated Research Project on Medicinal , Aromatic Plants & Betelvine, College of Horticulture, Kerala Agricultural University, KAU.P.O., Vellanikkara, Thrissur - 680656, Kerala, India.
[*] Corresponding author, *E- mail : beenac2@gmail.com*

Table 1
Change in *P. rosea* root plumbagin content (%) during storage

Months after storage	*T1 (In open)*	*T2 (In brown cover)*	*T3 (In polyethylene cover)*	*T4 (In transparent plastic bottle)*	*T5 (In nontransparent plastic bottle)*	*T6 (In PP woven bags)*
0 MAS	0.858[a]	0.855[a]	0.856[a]	0.856[a]	0.856[a]	0.857[a]
6 MAS	0.823[b]	0.810[b]	0.816[b]	0.830[b]	0.820[b]	0.820[b]
12 MAS	Samples damaged	0.680[c]	0.720[c]	0.726[c]	0.659[c]	
18 MAS	by fungal attack	0.510[d]	0.688[d]	0.690[d]	0.518[d]	
24 MAS		0.443[e]	0.573[e]	0.575[e]	0.450[e]	
Loss of plumbagin (%)		48.2	33.06	32.82	47.4	
Plumbagin retained (%)		51.8	66.94	67.18	52.6	
Rank		II	1	1	II	

MATERIALS AND METHODS

The study was carried out at All India Coordianted Research Project on Medicinal and Aromatic Plants and Betelvine, College of Horticulture, Kerala Agricultural University, Vellanikkara. Roots of *Plumbago rosea* were harvested at maturity i.e. at 18 months after planting, from the crop raised in the station field. The harvested roots were cleaned ,dried under shade for one week, cut into pieces, pooled and 500g pooled root samples were stored for a period of 24 months. The samples were analysed for initial plumbagin content and kept for storage under six conditions (Treatments T_1 to T_6) as specified below (Fig. 1). All the samples were left at room temperature.

T_1. Open - under ambient condition (Control)
T_2. In Brown paper covers
T_3. In Polyethylene bags (200 gauge)
T_4. In transparent plastic bottles (PET)
T_5. In non transparent plastic bottles
T_6. In Polypropelene woven storage bags (Mesh 10*10, GSM-73)

Samples were drawn at 6 month intervals *i.e.* at the end of 6, 12 ,18 and 24 months after storage (MAS) and observations were recorded on plumbagin content, fungal contamination and insect infestation if any, starting from December 2012 up to two years.

Plumbagin estimation was done following the standard methodology using spectrophotometric method as reported by Shalini *et al* in 2010 [8]. Data were subjected to analysis of variance using the statistical package MSTAT-C [9]. Comparison among treatment means was done with Duncan's Multiple Range Test (DMRT).

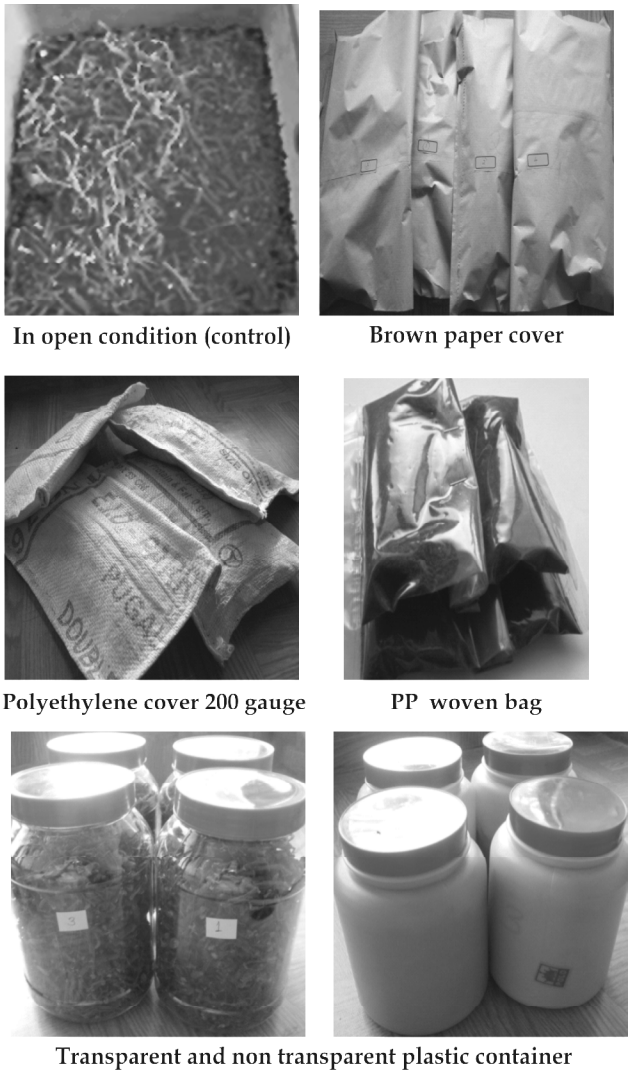

Figure 1: Storage conditions

RESULTS AND DISCUSSION

The initial plumbagin content of samples was around 0.86% on an average in dry weight basis and moisture

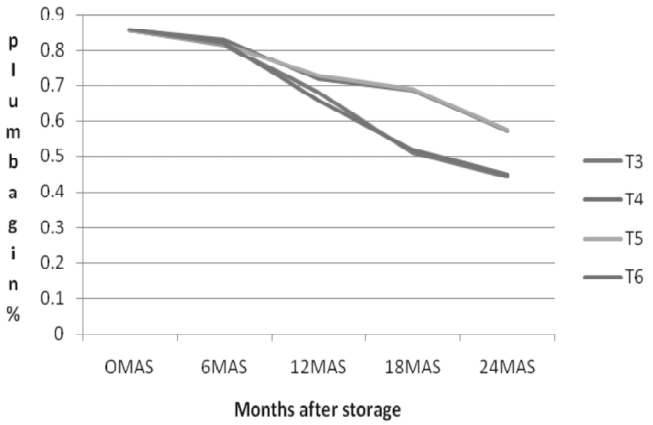

Figure 2: Loss of plumbagin over 24 months

content was 9.8%. Analysis of the observations recorded over a period of 24 months after storage revealed significant reduction in the root plumbagin content under all storage conditions starting from six month onwards as compared to initial plumbagin content (Table 1 and Figure 2). Samples stored inside transparent or non transparent closed plastic bottles (T4 and T5) proved to be the best with less loss of plumbagin (33.06% and 32.82% loss of plumbagin respectively) compared to other treatments. Samples stored in PP woven bags or in polyethylene covers (T6 and T3) proved to be the second best in retaining plumbagin after 24 months of storage. The loss of plumbagin noted after 24 MAS in T3 and T6 were 48.2% and 47.4% respectively. No fungal contamination or insect attack was noted in these samples so far. Samples stored in open as well as in brown paper covers (T1 and T2) accumulated moisture very soon and was completely spoiled within a span of 8 month of storage by fungal attack. Significant reduction in plumbagin started after 6 months of storage.

Study on storage of roots of *P. rosea* also indicated that plumbagin is unstable, undergoes chemical changes on long term storage. The plumbagin content was found to decrease gradually from the fresh sample till the end of 24 months. The HPTLC study on seasonal variations and storage of *Plumbago zeylanica* as discussed by Saraswathy *et al* [10] revealed that there was a continuous decrease in absorbance value of plumbagin at 265nm in case of stored sample as compared to fresh sample *P.zeylanica*.

No insect attack was noted in any of the stored samples . Even in spoiled samples no insects found proving insect deterrent quality of plumbago roots. The results obtained strongly recommend to store the raw drug root samples of plumbago inside closed plastic containers. It can be stored even up to 2 years inside closed plastic containers still retaining 67 % plumbagin.

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