Standardization of processing and storage techniques of *Celastrus paniculatus* Willd. (Malkangni) seeds for livelihood improvement

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Received: 12.02.2020   Revised: 19.03.2020    Accepted: 31.03.2020

Abstract

The present study dealt to standardize the post harvesting practices (drying, processing, suitable containers, storage duration) of *Celastrus paniculatus* seeds in terms of oil content which revealed the sun drying better in comparison to shade and oven drying to maintain quality of seeds. It is also recommended to wash the seeds in water before storage to remove the outer pulpy layer on the seeds which allows the infestation of saw-toothed grain beetle (*Oryzaephilus surnemensis* Linn.). Moreover, high density polythene (HDPE) bags, 4-5°C and duration of six months were found optimum for storage of Malkangni seeds in term of oil content.

Key words: *Celastrus paniculatus*, seeds, processing, storage containers, duration, oil content

Introduction

Processing and storage of medicinal produce play an important role in determining its quality. Bioactive constituents showed a rapid hydrolytic decomposition during storage. The magnitude of such degradation is significantly influenced by nature of collection, drying temperature treatments, processing and storage conditions (Karlund et al., 2014; Kalt et al., 1999; Ansari, 2011; Kokate, 2004). Improper drying and storage may make the materials susceptible towards the attack of mites, nematode worms, insects/moths, and beetles which can also destroy herbal drugs during storage (Kamboj, 2012). As per WHO guidelines, the medicinal plant produce must be stored under specified conditions in order to avoid contamination, deterioration and to enhance long term storage. *Celastrus paniculatus* Willd. is commonly known as Malkangni or Jyotishmati (family: Celastraceae) and is a threatened medicinal plant with woody climber reaching up to a height of 10 m. It is found throughout India up to an altitude of 1200 m, mainly in deciduous forests. Seeds of this species are of medicinal importance and are utilized in treatment of rheumatism, gout, neurological disorder and to improve memory (Nadkarni, 1976). Seed oil is reported to possess sedative and anticonvulsant properties (Gatinode et al., 1957). It is beneficial to psychiatric patients (Hakim, 1964) and in increasing the intelligence quotient of mentally retarded children (Nalini et al., 1986). It is also useful in treating abdominal disorders, beriberi and sores. It is one of the high trade sourced medicinal plant species from tropical forests whose estimated annual trade is approximately 200 – 500 metric tons (Anonymous, 2020). The price of seeds varies from Rs. 200 - 350 per kg in various markets. The seeds of Malkangni are one of the commercially important NTFPs of central Indian region and are collected by the rural and tribal communities for earning their livelihood. Fruits of Malkangni are collected and processed by the dependent communities in unscientific manner due to absence of standardized post harvesting practices. The objective of the present study is to standardize the processing and storage techniques for seeds of *C. paniculatus* for better management and livelihood improvement.

Material and Methods

Collection of fruits of Malkangni: Mature fruits of Malkangni were collected from the forest areas of Chhindwara district of Madhya Pradesh in the months of November and brought to the laboratory for further processing.

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Processing of fruits of Malkangni: Seeds of Malkangni were separated from its fruits by removing petals manually or by rubbing lightly on the surface of jute bag/ rough surface. Seeds were washed in water to remove the outer pulpy layer on the seeds and dried in shade, sun and hot air at 40°C for 24 hrs. Time of drying was kept constant to observe the effect. Seeds dried by all methods were evaluated separately for oil content.

Determination of moisture content: Moisture content in samples was determined by loss of water in terms of percent w/w using the formula:

\[
\text{Moisture content} = \frac{\text{Fresh Weight} - \text{Dry weight}}{\text{Fresh Weight}} \times 100
\]

Storage of dried seeds of Malkangni in different containers: Dried seeds of Malkangni were stored separately in different containers i.e. HDPE bags, Woven sacks, Gunny bags, Markin cloth, Tin, Glass and Plastic containers in three replicates at room temperature. Unpacked samples kept in open environment were taken as control. Seeds of Malkangni were stored in different containers in the month of December and evaluated for the oil content. Seeds stored in HDPE bags were also kept at 4-5°C to examine the effect on oil content. The experiments were also repeated in the successive year.

Evaluation of oil content in Malkangni seeds stored in different containers: Seeds of Malkangni stored in different containers were evaluated for its oil content by Soxhlet apparatus at quarterly intervals for one year. 10 gm of Malkangni seeds taken from a container were powdered. Powdered sample was extracted for oil with petroleum ether (60 - 80°C) using soxhlet apparatus. The filtrate was concentrated using water bath and the yield (v/w) of the oil was calculated (Jadhav and Patwardhan, 2003).

Statistical analysis
The data were statistically analyzed. Experiments were carried out in triplicate and results expressed as Mean ± SD (n=3). ANOVA was applied to check the results as significant and non – significant.

Results and Discussion
Effect of three different drying methods on oil content in Malkangni seeds is given in Table 1. Drying of seeds in shade, sun and hot air oven (40°C) for 24 hrs reduced the moisture level up to 18.12%, 15.4% and 14.31% respectively. Results showed that the Malkangni seeds dried in sun contained maximum oil content (64%) content. Washing of Malkagni seeds in water before storage is required to remove the outer pulpy layer on the seeds which leads their deterioration due to infestation of saw-toothed grain beetle (*Oryzaephilus surinemensis* Linn.) (Figure 1 and 2). Sun dried seeds of Malkangni stored in different containers were evaluated for oil content at quarterly intervals in the year 2014 and its successive year 2015 (Table 2 and 3). Table 4 showed the oil content evaluated in seeds stored in HDPE bags kept at 4-5°C in all quarters of both the years. The initial oil content in seeds at the time of storage was found as 64.61% and 64.8% in the years 2014 and 2015 respectively.

| Table 1. Oil content in Malkangni seeds dried by different methods |
|---------------------------------------------------------------|
|                  | Shade drying | Sun drying | Hot air drying at 40°C | SE± | CD at 5 % |
|------------------|---------------|------------|------------------------|-----|-----------|
| *Celastrus*      |               |            |                        |     |           |
| *paniculatus*   | Time          | 24         | 24                     |     |           |
|                  | Moisture %    | 18.12      | 15.4                   |     | 0.890 N/A |
|                  | Oil %         | 60%        | 64%                    |     | 0.424 1.495 |
|                  |               |            |                        |     |           |
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Figure 1. Processing of Malkangni (*Celastrus paniculatus*) fruits

Figure 2. Infestation of Malkangni seeds with Saw-toothed grain beetle (*Oryzaephilus surinamensis* Linn.)

Table 2. Oil content in Malkangni seeds stored in different containers in the year 2014

| Containers          | Oil content (%) |          |          |          |
|---------------------|-----------------|----------|----------|----------|
|                     | March, 2014     | June, 2014| September, 2014 | December, 2014 |
| HDPE bags           | 61.87           | 54.80    | 54.37    | 53.53    |
| Plastic             | 63.30           | 55.53    | 54.45    | 53.26    |
| Glass               | 63.80           | 55.30    | 55.13    | 54.07    |
| HDPE bags (4-5° C)  | 64.60           | 64.35    | 61.59    | 59.37    |
| Steel               | 62.97           | 55.25    | 54.82    | 52.33    |
| Tin                 | 62.81           | 52.26    | 51.53    | 49.40    |
| Gunny bags          | 59.40           | 51.07    | 50.20    | 48.16    |
| Woven sacks         | 62.13           | 51.60    | 50.47    | 48.15    |
| Markin bags         | 55.36           | 50.30    | 48.25    | 47.67    |
| Open (control)      | 58.37           | 48.80    | 42.11    | 41.12    |
| CD at 5 %           | 0.908           | 0.785    | 1.092    | 0.685    |
| SE±                 | 0.306           | 0.264    | 0.368    | 0.230    |
Table 3. Oil content in Malkangni seeds stored in different containers in the year 2015

| Containers       | Oil content (%) |            |            |            |
|------------------|-----------------|------------|------------|------------|
|                  | March, 2015     | June, 2015 | September, 2015 | December, 2015 |
| HDPE bags        | 61.95           | 55.0       | 54.40      | 53.80      |
| Plastic          | 63.46           | 55.6       | 54.20      | 53.20      |
| Glass            | 63.87           | 55.3       | 55.13      | 54.05      |
| HDPE bags (4-5° C) | 64.77         | 64.3       | 61.57      | 59.47      |
| Steel            | 62.90           | 55.3       | 54.80      | 52.33      |
| Tin              | 62.83           | 52.3       | 52.00      | 49.25      |
| Gunny bags       | 59.21           | 51.4       | 50.44      | 48.27      |
| Woven sacks      | 62.00           | 51.5       | 50.43      | 48.04      |
| Markin bags      | 55.52           | 50.0       | 48.13      | 47.76      |
| Open (control)   | 58.36           | 48.6       | 42.17      | 41.18      |
| CD at 5 %        | 0.607           | 0.946      | 0.744      | 0.532      |
| SE±              | 0.204           | 0.318      | 0.251      | 0.179      |

Table 4. Oil content in Malkangni seeds stored in HDPE bags (4-5° C)

| Quarters         | Oil content (%) | SE± |
|------------------|-----------------|-----|
| March 2014       | 64.60           | 0.145 |
| June 2014        | 64.35           | 0.177 |
| September 2014   | 61.59           | 0.318 |
| December 2014    | 59.37           | 0.291 |
| March 2015       | 64.77           | 0.348 |
| June 2015        | 64.3            | 0.236 |
| September 2015   | 61.57           | 0.218 |
| December 2015    | 59.47           | 0.219 |
| CD at 5 %        |                 | 0.764 |

Table 2 and 3 indicated the maximum oil content in seeds stored in HDPE bags kept at 4-5° C and minimum oil content in seeds stored in Markin bags in both the years 2014 and 2015. It was observed that the initial oil content was retained up to 2nd quarter in the seeds stored in HDPE bags kept at 4-5°C in both the years while in case of seeds stored in other containers, there was continuously decrease in the oil content. The trend of decrease of oil content in different containers can be seen in Figure 3 and 4. HDPE bags was found the best containers to keep Malkangni seeds at 4-5°C for 6 months. The trend in oil content in seeds of Malkangni seeds stored in HDPE bags kept at 4-5°C in different quarters of both years can be seen in Figure 5.
Figure 3. Oil content in Malkangni seeds stored in different containers (year 2014)

Figure 4. Oil content in Malkangni seeds stored in different containers (year 2015)

Figure 5. Oil content in Malkangni seeds stored in HDPE bags at 4-5°C (years 2014 and 2015)
Analysis of variance indicated significant (P < 0.05) variation in the oil content of seeds stored in different containers within the quarters as well as between the quarters in both the successive years. Similarly, significant (P < 0.05) variation was also observed in oil content of Malkangni seeds stored in HDPE bags kept at 4-5°C after initial two quarters. The present study discovered the sun drying better in comparison to other drying methods. It may be due to the fact that in winter season due to low temperature, the drying of raw materials is slow and inefficient. Such conditions promote mould growth which results in deterioration of raw materials (Singh, 2008). Tanko et al., (2005) reported that natural drying promotes the removal of water from the material due to exposure to sun and desiccating effect of air currents. Another study revealed that natural air-drying is easy to control and rarely damages the crop (Downs and Compton, 1955). Downs and Compton (1955) also stated that the weather conditions limit the use of natural drying and it is a popular method especially in those areas where maturity and harvesting of the medicinal plants coincides with the beginning of the dry season, and their phytochemicals are not photosensitive. The proper storage of medicinal plants is of utmost importance to maintain their quality, efficacy and oil content. The present investigation revealed that seeds stored in HDPE bags kept at 4-5°C contained maximum oil content followed by plastic and glass containers while minimum oil content was noted in the seeds stored in markin, gunny, woven bags and openly keeping. The reason for minimum content in markin, gunny, woven bags and openly keeping may be due to the more moisture absorbing capacity of these bags which leads the reduction in the oil content. The study is also supported by Sinh (1999) who reported packing wise bio-deterioration of phytococonstituents that was found high in paper and cloth packings. Highest microbial load was found in gunny bags since gunny bags are made of jute fibers which are of botanical origin cellulytic compounds and are hygroscopic in nature. Minimum load was recorded in polythene packing because polythene did not permit the growth of micro-organisms and found much more effective in controlling the loss of the phytoconstituents. Masand et al., (2014) reported that there are no guidelines for proper storage of herbal raw materials till date. It is only the proper handling, packaging and storage of herbs which can preserve the safety, efficacy and quality of herbs. Thillaivanan and Samraj (2014) reported that the physical factors such as air (oxygen), humidity, light, and temperature can bring about deterioration of plant materials directly or indirectly.

**Conclusion**

It can be concluded from the study that Malkangni seeds should be washed in water and dried in sun for 24 hrs. before the storage. Moreover, high density polythene (HDPE) bags, 4-5°C temperature and duration of six months were found optimum for storage of Malkangni seeds in term of oil content. These findings can be utilized by the traders and other dependent communities for the proper storage of the seeds for fetching better price in the market and thus, will help in their livelihood improvement.

**Acknowledgement**

Author pays his gratefulness to the Director of the Institute for providing necessary facilities to conduct the research work. The financial support from ICFRE project (ID-206) is greatly acknowledged.

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