

Executive Summary on RAC 11th Plan Project on “Storage and Preservation of Fibrous Raw Materials used in Indian Pulp and Paper Industries”

1. Introduction

Activities of RAC Project entitled “Storage and preservation of fibrous raw materials used in Indian pulp and paper industries” were further extended in 11th Five Year plan to cover more number of paper mills & commonly used indigenous raw materials.

Studies during 11th plan focused on storage of bagasse, hardwoods like subabul, casuarinas, acacia and eucalyptus. Following mills were selected for studies on storage of above mentioned raw materials.

1. The Andhra Pradesh Paper Mills Ltd., Rajahmundry (A.P.) – Hard wood (Subabul, Casuarina)
2. ITC Bhadrachalam Paperboards Ltd., (A.P.) - Hardwoods
3. The Mysore Paper Mills Limited , Bhadrawati (Karnataka) - Bagasse
4. Star Paper Mills Ltd., Saharanpur(U.P.) - Eucalyptus

2. Quantified deliverables of the Project

1. A comprehensive data on storage practices of fibrous raw materials used in India and world wide will be generated.
2. Effect of storage on end product quality of indigenous raw material covering diversified raw materials used by Indian Paper industry.
3. Reduction in storage losses employing environment friendly preservatives to improve the product quality.

3. Proposed Activities

1. Compilation and documentation of Data on storage practices of fibrous raw materials used in India and world wide.
2. Studies on effect of storage of raw material on end product quality of paper produced from indigenous raw materials covering diversified raw materials base used by Indian Paper industry.
3. More number of mills to be studied in addition to 4 mills already being studied presently.
4. Studies on reduction in storage losses employing environment friendly preservatives to improve the product quality.
5. Dissemination on information to paper industry.
6. Draft report preparation and submission of final report.

4. Work carried out

4.1 Compilation and documentation of Data on storage practices of fibrous raw materials used in India and world wide

A detailed literature survey on storage practices in India and world wide was carried out. Literature was surveyed in ABIPST, TAPPI, IPPTA, JPPS, wood science and Technology. Anthology on storage practices was prepared to facilitate the work plan and report preparation.

4.2 Studies on Storage

All the four mills were visited periodically (3, 6, & 9/12 months) for collection of data on storage practices & collection of sample for further evaluation at CPPRI. Data base on storage practices was further updated. Evaluation of Bagasse, Casuarina & Subabul, Eucalyptus stored for a period of three, six, nine & twelve months were characterized for the following :-

- ❖ Proximate chemical analysis
- ❖ Pulping characteristics
- ❖ Physical & Optical properties
- ❖ Fibre fractionation
- ❖ Fibre characteristics
- ❖ Presence of degrading fungi

4.3 Storage on preservation

Studies on preservation of raw material were carried out using conventional as well as environment friendly preservatives to control the losses during storage.

5. Observations

5.1 The Andhra Pradesh Paper Mills Ltd., Andhra Pradesh

The major observations of The APPM Mills Ltd. are as follows:

1. Deterioration of low molecular fraction of carbohydrate during storage was observed both in subabul & casuarina. In case of Casuarina N/10 solubility increased from 12.95% to 15.74% after 6 month storage, whereas in case of subabul it increased from 13.85% to 17.35%.
2. Degradation of carbohydrates was further evident from loss in unbleached pulp yield by 1.5% in case of Casuarina & 2.0 % in Subabul after six month storage period. The unbleached pulp yield dropped from 50.9 % (Zero month period) to 48.1% (6 month period) for Subabul and from 49.8 % (Zero months' period) to 48.3 (6 month period) for Casuarina.

5.2 The Mysore Paper Mills Ltd., Bhadravati (Karnataka)

Evaluation of stored bagasse from The Mysore Paper Mills Ltd. in the laboratory also revealed a similar trend as observed in case of hardwoods used in The Andhra Pradesh Paper Mills Ltd., Rajahmundry (A.P.). The major observations of The Mysore Paper Mills Ltd. are as follows:

1. N/10 solubility increased substantially from 27.06% in initial stage to 34.50 % which was strong indication of deterioration of low molecular fraction of carbohydrates during storage.
2. The unbleached pulp yield dropped by 2.6%. It dropped from 56.2% (Zero month period) to 53.6 (9 month period).
3. The physical strength properties of unbleached pulp i.e. tensile index dropped drastically from 76 to 58 Nm/gm.

5.3 Star Paper Mills Ltd., Saharanpur (Uttar Pradesh)

The major observations of Star Paper Mills Ltd. are as follows:

1. Holocellulose content dropped from 74.3 to 72.0%.
2. Alkali solubility increased from 13.55 to 14.13%.
3. Loss in pulp yield was observed only after second quarter of storage.
4. Total loss of ~4.0% in unbleached pulp yield was observed after twelve month storage period.
5. Tensile strength of unbleached pulp was affected drastically. It dropped from 84 to 62 Nm/g.

5.4 ITC Paper Mills Ltd., Bhadrachalam (Andhra Pradesh)

The major observations of ITC Paper Mills Ltd. are as follows:

1. Alkali solubility increased from 13.45 to 14.54% in case of subabul with bark and from 14.09 to 16.3% in case of debarked sample of subabul.
2. Unbleached pulp yield remained unaffected till 6 months and dropped by 1.4 point (2.82%) after 9 months of storage in case of subabul.
3. In case of casuarina alkali solubility increased by 26.9% and alcohol/benzene solubility i.e. extractives% dropped by 38.0 % while unbleached pulp yield dropped by 2.0%.

6. Effect of green liquor on storage of fibrous raw material – Eucalyptus

Based on the literature, preliminary laboratory studies indicated that sulphide ion rich green liquor could be used as a fungicide for preservation of cellulose raw

material. Green liquor washings which are not of further use by pulp mill can be effectively used for the preservation of woody raw materials.

Fungal attack on fibre's basic structure releases enzymes which shift the pH of surface. It destroys the cellulose content and hence reduces the fiber yield drastically. In order to check the degradation of cellulose raw material during storage, the use of an environment benign fungicide is required.

Preliminary findings on the use of weak green liquor washings as fungicide/preservative were further validated on Eucalyptus chips collected from a nearby pulp & paper mill. Eucalyptus chips were stored for a period of 2 months. Samples were periodically drawn after 15, 30, 45 & 60 days. Details of laboratory experiment are as under:-

6.1 Collection of chips

Eucalyptus chips collected from nearby pulp & paper mill were spiked with weak green liquor washings at laboratory and for better and fast growth of enzymes, chips having larger surface area were selected.

6.2 Treatment of chips with enzymes

Three set of chips were stored in batches of four to draw the sample after each 15 days. Following are the details of the sampling carried out:-

- Chips treated with weak green liquor and inoculated with fungi,
- Chips inoculated with only fungi ,
- Control sample (without any fungi inoculation and weak green liquor addition).

6.3 Each sample was subjected to the following analysis

- a) Proximate chemical analysis
- b) Pulping experiments
- c) Pulp characterization
- d) Physical strength Properties evaluation

Results of experiments revealed that green liquor washings can effectively be used as fungicide, which aids in preserving the fiber during storage of raw material.

7. Observation of Treatment of green liquor washings (GLW) on eucalyptus chips quality in terms of preservation of storage losses:

1. The green liquor washings (GLW) treated chip showed substantial preservation of fibrous raw material. In the present study the fungal treated

chips without GLW treatment showed weight loss of around 6.0-8.0% when compared chips treated with green liquor and fungus.

2. The yield loss after pulping also indicated the degradation of fiber from 1.0-3.0%, in case of fungal treated raw material.
3. There is no adverse affect of GLW treatment on initial pulp brightness. Results showed that initial brightness of pulp was better in case of pulp obtained from GLW treated Eucalyptus chips than obtained from without treated ones.
4. Intrinsic strength of fiber after pulping dropped in case of fungal treated chips, which was preserved by green liquor washings. A comparison of viscosity of pulps of controlled sample, G.L.W treated chips and fungal chips treated (without GLW) after 15 days storage cooked under identical conditions of pulping revealed drop in viscosity from 610.45 cc/g (control), 627.13 cc/g (GLW treated)) to 578.70 cc/gm (fungal treated). The similar trend followed in case of samples of higher storage period.
5. Results of physical strength properties of pulps in above three sets were evaluated (control, GLW treated & fungal treated). The strength properties of controlled and GLW treated samples were identical. The Tear index of only enzyme treated pulp dropped (*after 15 days) from 7.40 m.Nm²/g to 6.80 mNm²/g, while other properties were affected marginally.