

Fungal Biodeterioration of Documentary Heritage (Manuscripts) and Their Conservation through Tradition Way of Conservation with Special References to Paper and Palm Leaf Manuscripts

Ravindra Goswami¹, Dr. Anuradha Chauhan², Dr. Seema Bhadauria³

¹Dept. of Botany, RBS College Agra

²Dept. of Botany, SBS (PG) College, Umedpur, Etah

³Dept. of Botany, RBS College, Agra

ABSTRACT

Fungi damage valuable documents mechanically, chemically and aesthetically because they form hyphae, excrete pigments and organic acids, generating particular local conditions that modify the physical-chemical properties of the different documentary supports. The genera *Aspergillus*, *Cladosporium*, *Fusarium*, *Scopulariopsis* were predominant. Isolated strains excreted acids into the culture medium; most of them grew well on cellulose and a few excrete pigments. The formation of a mature biofilm and the production of extracellular polymeric substances by fungi, as well as a dense biofouling mainly formed by dust mites. These strains are able to attach to paper fibre causing damage on them. The Cultural developments are the reasons for urging to write and leading to search new writhing materials, which played a vital role in the field of education and development Libraries. Various type of materials such as stone, clay tablets, metal sheets, wood, papyrus, palm leaves, barks of trees, cloth, leather, paper etc., were used for writing. Writing on the above materials on hand is called manuscripts. Manuscripts are the form of recorded information, which are the vehicle for preservation and dissemination of knowledge to the endless generations to come. Generally Manuscripts are rare commodities written on wide range of subjects like religion, philosophy, history, literature, medicine, and science. Manuscripts can be classified on the basis materials used.

INTRODUCTION

Leaves of palm trees are used for writing, which are called Palm leaf manuscripts. Palm leaf is a natural material, which are available in India and south Asian countries. Even though more than 300 varieties of Palm trees available, only three varieties were used for writing, which are

1. *Corypha umbraculifera*

2. *Borassus flaberlifer*

3. *Corypha utan*

The leaves of the above three varieties are differ with their character, size and other physical and chemical compositions. For the logitivity of the manuscripts leaves were collected, separated, dried, burnished, seasoned and written. Even the string holes were made in an order to tie the leaves bound. For writing on stylus, seasoning was done to soften the surface and blackening the letters vegetable juice with a mixture of lamp shoot is applied. The written manuscripts were bound with external guard using planks of bamboo or teak wood. Chords or silk threads are used for string the manuscripts.

Palm leaves are organic nature, which are generally considered to be more susceptible to deterioration. Palm leaves are made up of cellulose fiber content materials. Though which are having very good tensile strength compared to paper; it becomes very brittle due to dryness. Lignin present in palm leaves is susceptible to oxidation and hydrolysis, yielding acidic derivatives, which affect the fiber bond of the leaves.

Generally physical, biological, and chemical agents, which are light, heat, moisture, fire, fungi, insects, air pollution etc. Human error also caused damages to manuscripts. The Ultra Violet rays coming directly from the sun and other sources affect the manuscripts' brittleness and discoloration. Light not only affects the manuscripts directly but also indirectly it activates the chemical deterioration. Heat causes evaporation of moisture in the manuscripts, which leads to dryness, brittleness in manuscripts and alters the physical size. Incorrect temperature that can be too high causing gradual disintegration or discoloration ; too low causing embrittlement, Fluctuations in temperature also cause fluctuations in RH. Incorrect relative humidity dampness which causing mold growth. Organic materials will gradually disintegrate and discolor, especially materials that are chemically unstable at any RH level above 0%. Fluctuating RH will shrink and swell unconstrained organic materials, crush or fracture constrained organic materials. Most objects are affected by a variety of these agents of deterioration at the same time. As you improve preventive care of your collections, you will be addressing each of the agents of deterioration through a variety of policies and procedures.

Deterioration brought by biological agents is generally referred as 'Bio deterioration'. The problem of bio deterioration is a matter of considerable significance of tropical-humid climate. The climate condition accelerates the growth and multiplication of living organisms. The common biological agents for deterioration of papers are fungus, insects and rodents. High humidity is helpful for the growth of fungus. The fungi produces enzymes, which mend the sheets one another. The organic contents are nutrition to the living organisms. Most of the common insects affect the manuscripts are silverfish, termites, cockroaches, bookworm, booklice etc.

The impurities in the atmospheric gases such as Hydrogen sulphide, sulphur-di-oxide, carbon monoxide ozone, dust and other susceptible impurities are the main chemical factors. The chemical factors create acidity on the materials, which break the cellulose bonds, and make the paper brittle and colour changes.

Other Form of deterioration:

Stains and Spots: Stains of insect's excreta, dust accumulation, lamp shoot, fungus etc., could be occurring on the surface of the palm leaves, which makes stains in the leaves.

Discoloration of the Surface: Discoloration of the palm leaf may be due to presence of lignin, which reacts with light and other atmospheric gases to form acidity or may be formed due to frequent application of oil with dust or smoke deposit or fungus stains. Discoloration also cause die to ageing

Fungal Effect: In a humid condition the palm leaves and the dust accumulated on the manuscripts absorbs water. In a suitable climate the spores in the atmosphere grows as fungus over the leaves. The fungus makes stains and spoiled the glazy layers. Due to the growth of fungus, the leaves stick one another, which lead to cleavage and crumbling. Filthy Smell of the fungus attracts insects.

Splitting and Cleavage of the surface: The main cause of splitting in the surface of the leaf is variations in the climatic conditions. The splitting on the edges are due to rough handling and storage. Fungus affect makes irregular surface softness which lead to cleavage of surface layer from the main body of the leaf. This problem is mostly found in the shritala manuscript.

Insect Damage: Insects were attracted, when palm leaves absorbs more moisture or at the time of fungal attack. the most common insects, which affect palm leaves are cockroaches, termites and worms (*Gastrallus indicus*).

DISCUSSION

"Preventive Conservation" means to protect the Cultural Property, from by various agents of deterioration. It is the mitigation of deterioration and damage to Cultural Property through the formulation and implementation of policies and procedures for

- Appropriate environmental conditions
- Proper Storage
- Proper Handling
- Integrated pest management
- Periodical verification and emergency preparedness

Objective of Preventive Conservation:

1. To extend the life of manuscript

2. To reduce the risk of catastrophic loss of manuscript
3. To defer, reduce, or eliminatethe need for interventive treatment.
4. To extend the effectiveness of interventive treatment.
5. To provide a cost-effective method for the preservation of collections.

Preventive Conservation is an ever ending Process that continues throughout the life of the manuscripts. By using preventive conservation techniques, we could limit the deterioration of manuscripts. The art of Preventive conservation is not new. It was known from the inception of writing materials. In ancient days people used some indigenous Technique and the development of Science and Technology pave the way for better preservation techniques for the manuscripts

RESULTS

Palm leaf manuscripts need to be stored in proper environmental conditions. Generally they must be stored in a proper temperature of 21°C and relative humidity of 50-55% RH with controlled lighting, and clean air environment. In ancient days several indigenous techniques and materials were used for preservation. Indians understood the four basic factors for deterioration i.e. dust accumulation, direct sun light, heat and humidity. To Overcome these problems manuscripts were covered with mostly red colour silk or cotton cloths. The cloth will control dust, light, heat and humidity. They used red colour cloth because “Red colour” itself acts as repellent to insects. That was the reason that in ancient South Indian houses were drawn with red lines in front of the houses in the month of December – January. The reason was to avoid insects entering into houses after rainy season. This is the reason, the spine of the Back volumes were bound with red colour cloth or leather in most of the Indian Libraries. Since Turmeric has germicidal power. Turmeric paste or water was applied over the leaves to avoid fungal attack.

Proper Storage is one of the factors for Preventive Conservation. In South India, palm leaf manuscripts were preserved in the houses of Pandits, Temple treasures, Religious mutts and Royal Palaces. In the learned people’s houses, the palm leaf manuscripts were kept in the kitchen to preserve from fungus and insects. In Ancient days mostly thatched houses were built with mud walls. Due to heavy rain most of manuscripts were affected with fungus and insects. To avoid fungus and insect attacks the palm leaf manuscripts were kept in the kitchen laft or hang in the beam. Mostly the kitchen would be warm and smoke deposit over bundles keeps away the insects. Preventive conservation would need proper storage conditions. In Temples manuscripts were stored in a room in the second level of the entrance. To protect the palm leaf manuscripts from deterioration factors, Palm leaf manuscripts were buried in a mixture of tiny sand with calcium hydroxide powder. Later Camphor wood or teak wooden cupboards were used for storage, because the wooden cupboard would acts as buffer to control heat and Humidity. Palm leaf manuscripts are wrapped with Red cotton cloth or acid free cardboard boxes are being used.

Advancement of Science and Technology pave way for storage with controlled Heat and climate by making round the clock Air-conditions and oxygen free environment by keeping the manuscripts in special air tight cupboards filled with inert gases like Helium or Nitrogen.

Palm leaf manuscripts should be handled with carefully. To avoid mechanical damages, proper guard on either side with raw unwritten leaves or bamboo strips or teak wood reaper. The tying thread must be one third of the size of the hole and the thread must be very soft and not with more twist. Preferably silk thread many used. for reading the manuscripts book support may be used for careful handling. During cleaning the brush must be moved from centre to either side with gentle pressure. Cotton should not use directly.

Integrated pest management is one of the main activities in preventive conservation of palm leaf manuscripts. Monitoring and using insect repellent would control the Biological factors. Using insect repellent is since preparation of writing materials. Turmeric paste is used for fungus repellent; *Dhadhura* and *Cocina Indica* juice were applied to the palm leaf manuscripts as insect repellent. Ceder wood oil and balls are used for insect repellent. In India Sweet flag, dried *Margosa* Leaves (Neem Leaves) (*Azadirachta indica*), its seed powder, Tobacco, Camphor, Black cumin, Snake slough, Peacock feathers was also used as insect repellent. Even now these indigenous processes are followed in some Libraries and Museums.

The Thanjavur Maharaja Serfoji’s Sarasvati Mahal Library, at Thanjavur use a mixture of the following spices in powder form:

Black cumin	4 parts
Sweet flag	4 parts
Cloves	1 part

Pepper	1 part
Bark of cinnamon	4 parts

20 grams of camphor is to be added with this powder mixture and wrapped in a small cloth as bundle. These bundles are kept in the cupboards as insect repellent. This is effective for six months.

To give flexibility to the leaves, essential oils like citronella Oil, Lemongrass oil are smeared on the surface with a three to five years intervals. These oils would give good clarity to the letters, flexibility to leaves and acts as insect repellent. Movement of silverfish is the monitoring element for fungus growth on manuscripts. Insect trap and mice trap may be used to protect from biological deteriorations. Wire mesh to the windows and other opening may be fixed to control the movement of rodents.

Periodical verification is needed for Preventive conservation. From ancient days, mostly manuscripts' are cleaned and taken care in before rainy seasons and after seasons. To do cleaning and other Preventive conservation work a day Sarasvati Puja was fixed before rainy season and after rainy season mostly palm leaf bundles were rebound and kept near the windows for evaporation of excess moisture absorbed. Mutt heads cleaned the palm leaf manuscript during chatur mash (Four months of rainy days), change new cloth and any damaged manuscripts were prepared copies presented to interested persons. In this way more manuscripts were prepared on the same title.

CONCLUSION

There are a variety of ways you can protect your collections from the agents of deterioration. Here are few steps to stop or minimize damage,

- Avoid the agents of deterioration.
- Block the agents when you cannot avoid them.
- Test the methods you use to block agents of deterioration by Monitoring
- Monitoring and assessing condition of collections
- Monitoring and evaluating museum environment and alerting staff to Signs and causes of deterioration
- Practicing proper methods and techniques for storing, handling, packing and pest management.
- Developing and implementing ongoing Integrated Pest Management (IPM), and housekeeping/maintenance program for collections

Prevention is better than cure. Hence, Proper storage, Proper Environment, Integrated pest management system. Periodical verification, thorough understanding of the materials, causes of deterioration, proper preventive conservation techniques and Proper accompanying materials would give best Preventive conservation of Manuscripts.

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