



From Forest to Market: Quality Assessment and Storage of Non-Wood Forest Products

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Forests provide far more than timber. A wide variety of products such as gums, resins, leaves, fibres, spices, fruits, seeds, medicinal plants and essential oils are obtained from forests and trees outside forests. These are collectively known as Non-Wood Forest Products (NWFPs) or Non-Timber Forest Products (NTFPs). India is one of the world's biologically diverse countries, with ten biogeographic zones supporting a wide range of ecosystems and plant species. This diversity makes NTFPs an important component of the country's forest economy. For many rural and forest-dependent communities, collection and processing of NTFPs provide income, employment and opportunities for traditional livelihoods. However, the economic value of an NTFP depends not only on its availability but also on its quality. Products that are clean, properly dried, correctly graded and safely stored generally have better market acceptance. Quality assessment therefore plays an important role in maintaining product value, ensuring safety and improving consumer confidence.

What Determines the Quality of an NTFP?

NTFPs are biological materials and their characteristics can change during harvesting, processing and storage. Quality assessment generally involves three major aspects: physical, chemical and microbiological properties. Physical assessment includes characteristics such as colour, size, shape, texture, moisture content and foreign matter. Chemical evaluation may be necessary to determine active compounds, nutritional constituents or other important chemical properties. Microbiological testing helps detect harmful bacteria, fungi, yeasts and moulds. For commercial products, proper harvesting, drying, handling, packaging and storage are equally important. Packaging should protect the material from moisture, light and pests, while product labels should provide information such as botanical name, origin, batch number and expiry date.

Gums: Valuable Natural Exudates- Gums are dried exudates obtained from trees and have applications in food, pharmaceutical and industrial products.

Gum Arabic: Gum Arabic is obtained from *Acacia senegal*. Its quality is assessed through moisture content, foreign matter and microbiological safety. The report indicates permissible moisture of about 12–14% and foreign matter of about 3–5%. Tests for organisms such as *Salmonella*, *Escherichia coli* and *Staphylococcus aureus* should be negative. Food-grade Gum Arabic is covered by BIS specification IS 6795:1972.

Gum Karaya: Gum Karaya is obtained from *Sterculia urens*. It is commercially divided into five grades: HPS, Superior No. 1, Superior No. 2, FAQ and Siftings. Higher grades are generally cleaner and lighter in colour. BIS specification IS 12408:1988 applies to food-grade Gum Karaya.

Gum Ghatti: Gum Ghatti is obtained from *Anogeissus latifolia*. It is classified into No. 1, No. 2 and Unsorted grades. The best grade is lighter in colour, has low ash and high viscosity, whereas unsorted material is much darker. BIS specification IS 7239:1974 is available for food-grade Gum Ghatti.

Salai: Salai is a gum-resin obtained from *Boswellia serrata*. Commercial grades range from Super Fine to Quality-III, with colour varying from light yellow in the highest grade to dark brown in the lowest grade.

Storage of Gums: Gums should be protected from heat and sunlight and stored in cool, dry conditions. Jute or burlap sacks are commonly used, with graded material packed in heavy-duty bags.

Resins and Rosin: Resins are another important forest product with considerable industrial value. Rosin, also called colophony, is the solid form of resin obtained mainly from pines and other conifers. Along with turpentine oil, it is used in several industries. Rosin is commercially graded according to colour. The Indian grading system recognizes twelve grades, ranging from pale grades such as X and WW to darker grades such as E and D. For storage, rosin is packed in tin patra barrels of about 200 kg capacity and kept under cool conditions in a shed.

Beedi Leaves: Quality in Every Leaf- Tendu leaves are an important NTFP used in the manufacture of beedis. Their commercial quality depends mainly on size and other physical characteristics. The leaves are divided into five quality classes, and standard beedi lengths include 5 cm, 6.25 cm and 7.25 cm. After collection, leaves are bundled and packed in breathable jute or gunny bags. They are stored in well-ventilated godowns under cool, dry and shaded conditions. Humidity needs to be controlled because excess moisture encourages mould, while excessive dryness makes leaves brittle.

Essential Oils: Quality Hidden in Aroma: Essential oils are volatile mixtures produced by living organisms and are valuable in perfumes, cosmetics and other industries. Their quality is assessed through sensory, physical and chemical methods. An experienced evaluator can obtain information about an oil from its aroma and evaporation pattern. Physical tests include moisture, specific gravity and solubility, while chemical tests may determine parameters such as acid value, ester value, aldehydes, carbonyl compounds and phenols. Essential oils are best preserved in airtight, dark-coloured glass bottles kept in cool and dry conditions. Amber bottles help reduce exposure to ultraviolet light, while smaller bottles reduce the amount of air in the container.

Cinnamon: A Spice Where Quality Matters-Cinnamon is marketed in several forms, including quills, quillings, featherings, chips and ground cinnamon. Good-quality quills should be well formed, well dried and light brown in colour. Its characteristic aroma and flavour are important indicators of quality. Commercial specifications include moisture, volatile oil content, colour, aroma and shelf life. The report indicates a maximum moisture content of 15% for quills and 12% for other grades, while the minimum volatile oil content is 1% for quills and 0.7% for other grades. Properly dried cinnamon should be packed in clean, dry materials such as jute, cloth, paper or polyethylene bags.

Natural Plant Fibres: Strength from Nature- Natural fibres are valued for their suitability in yarn and other products. Their quality is determined by physical properties such as strength, fineness, colour, defects, root content and density. The chemical composition also varies among fibres. The report shows that cellulose content is approximately 71.2% in flax, 74.9% in hemp, 71.5% in jute, 76.2% in ramie, 73.1% in sisal, 43% in coir and 65.5% in banana fibre. Coir has notably higher lignin content, around 45%, compared with most of the other fibres listed. Such differences contribute to the distinct properties and uses of natural fibres.

Storage: Protecting Value After Harvest- Harvesting a good-quality product is only half the process. Improper storage can reduce its quality before it reaches the market. Different NTFPs require different storage conditions. Gums need protection from moisture, heat and sunlight. Beedi leaves require controlled humidity and good ventilation. Essential oils require

protection from light and air, while rosin needs suitable containers and cool storage. Therefore, storage should always be designed according to the nature of the product rather than using a single method for all NTFPs. Simple measures such as clean storage areas, appropriate packaging, adequate ventilation and protection from pests can significantly reduce post-harvest losses.

Quality and Livelihoods: NTFPs are closely linked with the livelihoods of forest-dependent communities. Improving quality provides an opportunity to increase the value received from the same forest resource. Cleaning, grading, drying, packaging and basic value addition can transform an unprocessed forest product into a more attractive commodity. Quality certification can further improve consumer confidence and market opportunities. Organic, food-safety, quality and sustainable-harvesting certifications may be particularly useful when products enter organized or international markets. The emphasis should therefore be on better quality rather than simply greater quantity. Sustainable harvesting combined with improved post-harvest handling can benefit both forest conservation and rural livelihoods.

Conclusion

NTFPs represent an important link between forests, industries and rural communities. Gums, resins, beedi leaves, essential oils, cinnamon and plant fibres demonstrate the wide variety of products that can be obtained from forest resources. Their commercial value depends greatly on quality. Physical appearance, moisture, chemical composition, purity and microbiological safety are important indicators, while careful harvesting, processing, packaging and storage help preserve these qualities. Scientific quality assessment and appropriate storage can reduce post-harvest losses, improve market value and strengthen livelihood opportunities. At the same time, sustainable harvesting ensures that these resources remain available for future generations. Thus, the real potential of NTFPs lies not simply in what the forest produces, but in how responsibly we harvest, how carefully we preserve and how intelligently we add value to those products.