Oriental Lacquer and Its Care

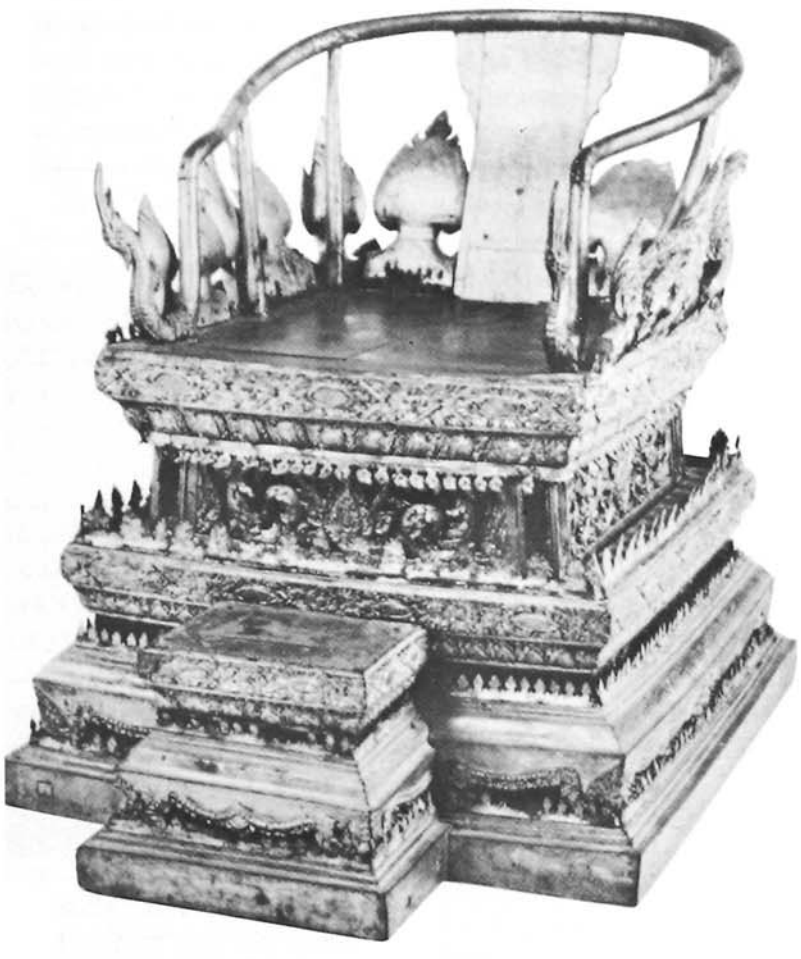
by Dr Sirichai Wangchareontrakul

More than 4,000 years ago the Chinese discovered that application of the sap of lacquer trees on objects could produce a surface coating that was both aesthetically pleasing and functionally suited for prolonged endurance. In 1973 excavations in China, at T'ai-hsi-ts'un, have established that wooden vessels decorated with painted lacquer were made as early as the Shang Dynasty, probably in the 13th or 12th century B.C.

Oriental lacquer, which is also called lac is a readily available natural product derived from the sap of lacquer trees. Lacquer has been used, by natives in Asian countries, as a surface coating on various kinds of materials such as wood, bamboo, textiles, ceramics, leather and metal.

After hardening the lacquer coating not only serves as a decorative finish but also acts as a preservative, a stiffener, and a protective coating. This surface coating has many advantageous properties because it is weather proof, waterproof, heat resistant, mildrew and rot proof.

It is important to emphasise that this lacquer is different from the fast drying lacquer made by dissolving a cellulose derivative and other modifying materials in a solvent. It is also unlike shellac which is obtained from secretions deposited by insects, *Laccifera lacca.*



A wooden throne decorated with lacquer and gold leaf. Chiang Mai National Museum, Thailand.

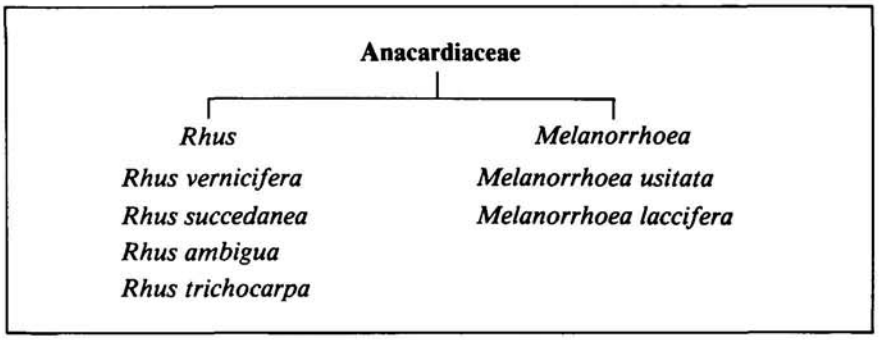
Historical Development of Lacquer Work

An early technique used for making ancient lacquer objects was known as "the direct lacquering method". Here the articles were covered with lacquer as a preservative and protective coating. Gradually the art of using lacquer advanced and developed a glossy appearance. Colour painting added an elegant touch.

Progressive changes and advances in craftsmanship developed with the use of fabric. Fabric was used to reinforce and strengthen the body and lacquer was applied in many layers. These multi-layered lacquer objects were later improved by using gold and silver ornaments, usually in leaf form. The use of the mother of pearl inlay design as a surface decoration on some types of ceremonial and luxury vessels was also found.

The development of oriental lacquer spread over a period of more than three thousand years. Historically, it may be divided into two periods. Initially, the Chinese had the whole field of lacquer manufacturing to themselves. The materials from this period were obtained entirely from excavations. Gradually the techniques used by the Chinese to manufacture lacquerware spread to other countries of East Asia: first to Korea and Japan, then to Southeast Asia.

Several ancient lacquered artefacts believed to be made about the beginning of the Christian era have been excavated in Japan. However, a distinctive style soon developed in Japan. And Japanese lacquerware soon developed its own individual style, largely independent of outside influence.



Scheme 1: Classification of Lacquer Trees

The manufacture of lacquerwares in most of the countries of Southeast Asia including Burma, Thailand and Vietnam is well established at the present time. But the origins of the manufacturing processes are quite obscure. There is no doubt that basket containers and wood were covered with lacquer, to render them watertight. This was made throughout this region from prehistoric times. But there is no reliable evidence on when sophisticated objects were first made or how they were derived.

Bhirasri stated that Thai lacquer work reached a high state of development in the Ayutthaya period (15th-18th century). The capital of Thailand moved from Ayutthaya to Thonburi in 1767. And then in 1782 the capital was moved to Bangkok where the technique of lacquer work followed essentially the characteristics of the early classical specimens. Some typical styles of Thai lacquer work such as "Lai Rod Nam" and mother of pearl inlay decoration are illustrated in Fig. 1 and Fig. 2.

Classification of Lacquer Trees

In the Anacardiaceae family, there are two genera of trees used as sources of lacquer, as shown in Scheme 1.

In the *Rhus genus* there are four species of lacquer trees suitable for the manufacture of lacquerwares. These are *Rhus vernicifera* (Japanese lacquer tree), *Rhus succedanea* (Vietnamese lacquer tree), *Rhus ambigua* and *Rhus trichocarpa.*

Japanese lacquer tree is the most important source of lacquer. It was introduced into Korea and Japan from China. The second species, *Rhus Succedanea,* grows in Southeast Asia as well as in Japan and the Ryukyu Islands. It provides lacquer for the manufacture of Vietnamese lacquerware. The third species, *Rhus Ambigna,* is found in Formosa, the Ryukyu Islands and Japan. It has been used as a source of lacquer in Formosa. The fourth species, *Rhus Trichocarpa,* grows in China, Korea and Japan.

Two species of the *Melanorrhoea* genus are considered to be important sources of lacquer. *Melanorrhoea usitata* (Burmese lacquer tree) has been mainly used as the source of lacquer in Burma and Thailand. *Molanorrhoea laccifera* on the other

hand has been reported as the source of lacquer in Southern China.

The Burmese lacquer tree is found in Manipur and the upper Chindwin district of Burma, southwards to Tenasserim, and the Northern part of Thailand. The tree grows in dry mixed deciduous forests. The bole is usually clean and straight, and the tree reaches a height of 15-20 meters. It may attain a girth of up to 3 meters (see Fig. 3). The sap, leaves, bark and root of the tree have also been used medicinally in Thailand.

Tapping of Lacquer

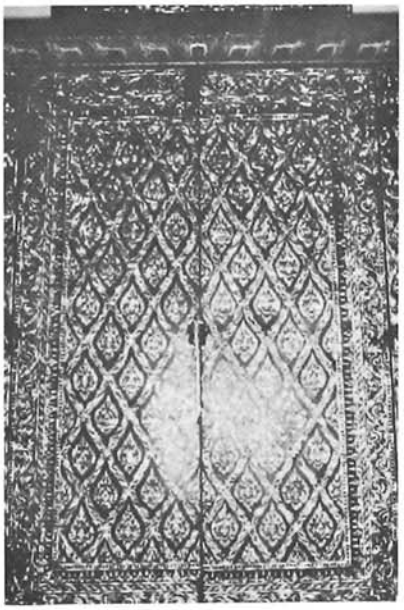
In Japan, the sap of *Rhus vernicifera* is collected during the summer months. Each tree yields only 50-100 grams of raw lacquer per six-months harvesting season.

In Thailand the tapping of lacquer from *Melanorrhoea usitata is* usually done in the rainy season. It continues until the advent of the dry season when growth of the tree slows and the yield of the sap becomes comparatively poor. The method of tapping is done with a long specially made chisel. The bark of the tree is cut, deep enough into the cambium, and in such a way that an area of sapwood is exposed.

The cut takes the shape of a triangular notch in the tree trunk with apex downward. It is about 10-15 cm high. The cut is slightly torn above from the cambium. A bamboo shoot is inserted in such a way that the sap drains into it as shown in Fig. 4. Initially the sap is light brown but it rapidly turns black when exposed to air.

Above : Fig. 1 Too Phra Thamma, a typical religious scripture cabinet in Thailand. This cabinet is done in lacquer using the classical Thai motif known as "Lai Rod Nam".

Fig. 2 Another scripture cabinet, also done in lacquer using the pearl inlay design.



Chemistry of Lacquer

Majima analysed lacquer from Japanese lacquer trees, Vietnamese lacquer tree and Burmese lacquer trees. He reported that urushiol, laceol and thitsiol are the main components of these individual lacquers, respectively summarised in Table 1. In his analysis it became apparent that a group of very closely related substances, with very similar chemical and physical properties, was present in the lacquer and that these substances were extremely unstable.

The sap of the lacquer tree is also poisonous. It causes acute skin irritations, boils and allergic reactions similar to those cause by poison ivy. Recently, it has been reported that urushiol is composed of 18 components whereas thitsiol consists of a mixture of 28 compounds. A synthesis of urushiol, laccol and thitsiol have also been described.

In the past two decades, a few papers have been published concerning polymerisation studies on urushiol from Japanese lacquer trees.

The nature of the hardening or setting reaction, usually referred to as "drying", is known as a polymerisation with cross-linking. It certainly involves an enzyme (laccase) and oxygen. It proceeds best in a humid atmosphere at a relatively low temperature. The polymerisation mechanism of lacquer is quite complicated since it involves enzymic reactions. At present there is no clear explanation on the behaviour of lacquer in the polymerisation process.

Care of Lacquered Objects

In order to understand how lacquered objects are preserved, one should know what deterioration is and the various factors which damage

Table 1 : Lacquer Trees and Their Chemical Constituents

Lacquer Trees	Growing District	Common Name	Main Constituent
Rhus vernicifera	China Japan Korea	Chinese Lacquer or Japanese Lacquer	Urushiol
Rhus succedanea	Formosa* North Vietnam	Indo-China Lacquer or Vietnamese Lacquer	Laceol
Melanorrhoea usitata	Burma Cambodia Laos Thailand	Burmese Lacquer	Thitsiol

* Formosa or Taiwanese Lacquer may also be obtained from *Semecarpus vernicifera*. Its main constituent is laccol.

Fig. 3 Melanorrhoea usitata (Burmese lacquer tree) found in Nong-U, Chiang Mai, Thailand.

Fig. 4 Tapping of lacquer.

objects. Deterioration is the alteration of an object and the factors of its destruction.

A full understanding of the chemical and physical nature of the material is necessary. The characteristics of the factors responsible for deterioration are also essential. There are several agents which act upon the material continuously and cause it to deteriorate, slowly but steadily. To mention a few, they are: humidity, temperature and air pollution.

Wood is usually used as the base of lacquered objects. It is usually susceptible to distortion caused by variations in humidity. When the relative humidity is too dry, lacquer finish tends to be brittle and may chip easily. On the other hand, if the relative humidity is too high (above 70%) it will promote the growth of micro-organisms. And this can cause the break down of the structure of lacquered materials like wood. Therefore it is recommended that the relative humidity suitable for keeping lacquered objects should be about 55%.

Termites, beetles, and micro-organisms such as fungus may attack the wooden base of lacquered objects. Simple measures of strict cleanliness, assuring plenty of ventilation and the use of appropriate insecticide and fungicide can be applied to eleminate insects and micro-organisms. The damaged parts of the lacquered object may be restored by use of filler and pigment mixed with lacquer or synthetic resins such as acrylic emulsion.

In the case of lacquered metal objects, lacquer cannot penetrate into the metal. After hardening, there is no binding between the metal surface

and the lacquer film. This causes the surface of the lacquer fragile. Lacquered objects of this kind should neither be in contact with one another nor with any hard or rough surfaces. Abrasion should also be avoided.

The thin film of lacquer is stable against almost all kinds of chemicals but is not resistant towards the harmful effects of light. Absorption of ultra-violet rays from light causes scission of the polymerised lacquer film to smaller molecules. This results to the fading of the film. It is, therefore necessary to minimize the intensity of light, especially sunlight upon lacquered objects.

Gold leaf decorations are likely to rub off. Therefore lacquered objects should be handled with soft cloth as perspiration and oil from hands leave stains. Only soft cloths and brushes should be used for cleaning and rubbing should be avoided. Carelessness in handling or transporting lacquered objects from one place to another may result in their physical damage. For storage, lacquered objects should be wrapped in soft tissue paper and kept in padded shelves or in padded cabinets.

If a lacquered object is in a deteriorated condition, a curator or a person in charge of the collection should consult a conservator. It is important to note that conservation is a specialised subject and an untrained person may make more harm on the object than no conservation at all.

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REFERENCES

Agrawal, O.P. **Care and Preservation of Museum Objects.** New Delhi: National Research Laboratory for Conservation of Cultural Property 1977, p. 109.

Aranyanak, C. **SPAFA Training Course Research Methods for Conservation of Organic Materials.** Bangkok: Conservation Section, National Museum, 1985, Vol. 2 p. 485.

Bhirasri, S. **Thai Lacquer Work.** 4th ed. Bangkok: The Fine Arts Department, 1959, p.3.

Birillo, B. **Art of Asia.** 1982, **12,** 65.

Burkill, I.H. **A Dictionary of the Economic Products of the Malay Peninsula.** Kuala Lumpur: Ministry of Agriculture and Co-operative Kuala Lumpur, 1966, Vol. 3, p. 1459-1460.

Du, Y., R. Oshima, H. Iwatsuki, and J. Kumanotani. **J. Chromatogr.** 1984, **295,** 179.

Du, Y. and R. Oshima, **J. Chromatogr.** 1984, **284,** 463.

Du, Y., R. Oshima, Y. Yamauchi, J. Kumanotani, and T. Miyakoshi, **Phytochemistry.** 1986, **25,** 2211.

Garner, H. **Chinese Lacquer.** London: Faber and Faber, 1979, p. 15-52, 264-274.

Halim, H., H.D. Locksley and J.J. Memon. **J. Chem. Soc. Perkin Trans. I.** 1980, p. 2231.

Halsey, W.D., **Collier's Encyclopedia.** New York: Macmillan Educational, 1979, Vol. 14, p.242-242B.

Jefferson, A., M.V. Sargent and S. Wangchareontrakul. **Aust. J. Chem.** 1988, **41,** 19.

Jefferson, A. and S. Wangchareontrakul **J. Chromatogr** 1986, **367,** 145.

Kenjo, T. **Conservation-restoration of leather and wood; Training of restorers; sixth International Restorer Seminar, 1987, Hungary.** Budapest: National Centre of Museums, 1988, p. 29-30 (**AATA,** 1988, **25,** 1800).

Kumanotani, J. **FATIPEC Congr.** 1976. **13,** 360.

Kumanotani, J. **Organic Coatings Science and Technology.** New York: Marcel Dekker, 1983, Vol. 5, p. 239-253

Lee, Y.K. **Oriental Lacquer Art.** New York: Weatherhill. 1972, p. 20-21.

Majima, R., **Ber. Dtsch. Chem. Ges.** 1922, **55,** 191.

Oshima, R., Y. Yamauchi C. Watanabe, and J. Kumanotani. **J. Org. Chem.** 1985, **50,** 3073.

Plesch, P.H. **Shell Polymers.** 1982, **6,** 47.

Pothisoonthorn, V. **The Art of Mother of Pearl Inlay.** Bangkok: The Fine Arts Department, 1981, p. 42-44.

Premrasmi, T. and B. Mukdasmitra **Experiments on Tapping Lacquer Trees.** (Translation from Thai), Bangkok: The Thai Royal Forest Department, 1962, p. 1-2.

Sargent, M.V. S. Wangchareontrakul and A. Jefferson. **J. Chem. Soc. Perkin Trans. I.** 1989, 431.

Takada, M., R. Oshima Y. Yamauchi, J. Jumanotani, and M. Seno. **J. Org. Chem.** 1988, **53,** 3073.

Tyman, J.H.P. and A.J. Mattews. **J. Chromatogr.** 1982, **235,** 149.

Yamanchi, Y., Oshima R., and J. Kumanotani, **J. Chromatogr.** 1982, **243,** 71.

Yang Rak. (Translation from Thai), Bangkok: The Thai Department of Industrial Promotion 1964, p. 15.

Wiest, F.K. **Arts of Asia** 1979, **9,** 125.