

Shellac

For the minimalist rock trio, see [Shellac \(band\)](#).

Shellac is a resin secreted by the female lac bug, on



Some of the many different colors of shellac

trees in the forests of India and Thailand. It is processed and sold as dry flakes (pictured) and dissolved in ethanol to make liquid shellac, which is used as a brush-on colorant, food glaze and wood finish. Shellac functions as a tough natural primer, sanding sealant, tannin-blocker, odour-blocker, stain, and high-gloss varnish. Shellac was once used in electrical applications as it possesses good insulation qualities and it seals out moisture. Phonograph (gramophone) records were also made of it during the 78-rpm recording era which ended in Western countries during the 1950s.

From the time it replaced oil and wax finishes in the 19th century, shellac was one of the dominant wood finishes in the western world until it was largely replaced by nitrocellulose lacquer in the 1920s and 1930s.

1 Etymology

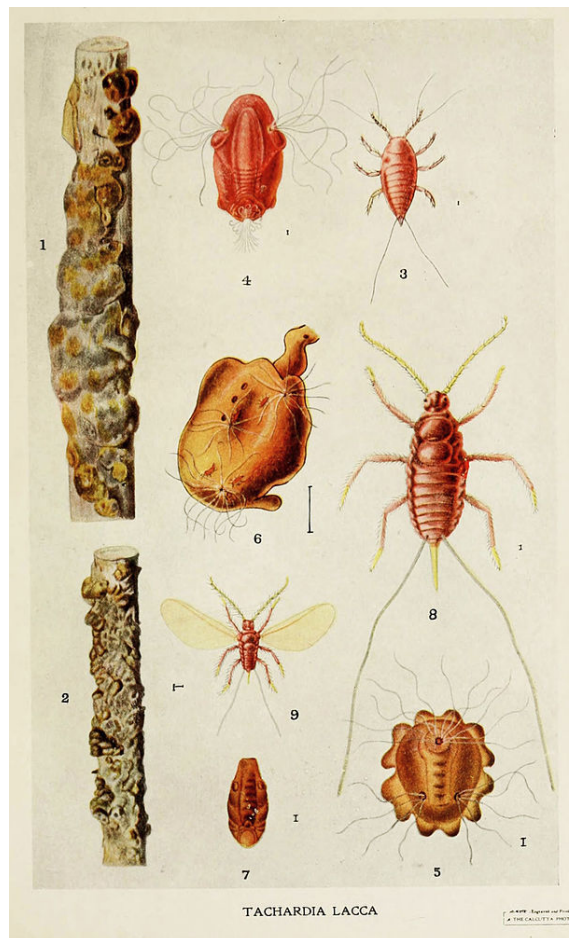
Shellac comes from *shell* and *lac*, a calque of French *laque en écailles*, “lac in thin pieces”, later *gomme-laque*, “gum lac”.^[1] Most European languages (except Romance ones and Greek) have borrowed the word for the substance from English or from the German equivalent *Schellack*.

2 Production

Shellac is scraped from the bark of the trees where the female lac bug, *Kerria lacca* (Order Hemiptera, Family Kerriidae), also known as *Laccifer lacca*, secretes it to form a tunnel-like tube as it traverses the branches of the



Lac tubes created by Kerria Lacca



Drawing of the insect Kerria lacca and its shellac tubes, by Harold Maxwell-Lefroy, 1909

tree. Though these tunnels are sometimes referred to as “cocoon”, they are not literally cocoons in the entomo-

logical sense.^[2] This insect is in the same Superfamily as the insect from which cochineal is obtained. The insects suck the sap of the tree and excrete "sticklac" almost constantly. The least coloured shellac is produced when the insects feed on the kusum tree (*Schleichera*).

The number of lac bugs required to produce 1 kilogram (2.2 lb) of shellac has variously been estimated as 50,000,^[3] 200,000,^[4] or 300,000.^{[5][6]} The root word *lakh* is a South Asian unit for 100,000 and presumably refers to the huge numbers of insects that swarm on host trees, up to 150 per square inch.^[7]

The raw shellac, which contains bark shavings and lac bugs removed during scraping, is placed in canvas tubes (much like long socks) and heated over a fire. This causes the shellac to liquify, and it seeps out of the canvas, leaving the bark and bugs behind. The thick, sticky shellac is then dried into a flat sheet and broken into flakes, or dried into "buttons" (pucks/cakes), then bagged and sold. The end-user then crushes it into a fine powder and mixes it with ethyl alcohol prior to use, to dissolve the flakes and make liquid shellac.

Liquid shellac has a limited shelf life (about 1 year), hence it is sold in dry form for dissolution prior to use. Liquid shellac sold in hardware stores is often marked with the production (mixing) date, so the consumer can know whether the shellac inside is still good. Some manufacturers (e.g., Zinsser) have ceased labeling shellac with the production date but the production date may be discernible from the production lot code. Alternatively, old shellac may be tested to see if it is still usable: a few drops on glass should quickly dry to a hard surface. Shellac that remains tacky for a long time is no longer usable. Storage life depends on peak temperature, so refrigeration extends shelf life.

The thickness (concentration) of shellac is measured by the unit "pound cut", referring to the amount (in pounds) of shellac flakes dissolved in a gallon of denatured alcohol. For example: a 1-lb. cut of shellac is the strength obtained by dissolving one pound of shellac flakes in a gallon of alcohol. Most pre-mixed commercial preparations come at a 3-lb. cut. Multiple thin layers of shellac produce a significantly better end result than a few thick layers. Thick layers of shellac do not adhere to the substrate or to each other well, and thus can peel off with relative ease; in addition, thick shellac will obscure fine details in carved designs in wood and other substrates.

Shellac naturally dries to a high-gloss sheen. For applications where a flatter (less shiny) sheen is desired, products containing amorphous silica,^[8] such as "Shellac Flat," may be added to the dissolved shellac.

Shellac naturally contains a small amount of wax (3%–5% by volume), which comes from the lac bug. In some preparations, this wax is removed (the resulting product being called "dewaxed shellac"). This is done for applications where the shellac will be coated with something else (such as paint or varnish), so the topcoat will ad-

here. Waxy (non-dewaxed) shellac appears milky in liquid form, but dries clear.

3 Colors and availability

Shellac comes in many warm colors, ranging from a very light blond ("platina") to a very dark brown ("garnet"), with many varieties of brown, yellow, orange and red in between. The colour is influenced by the sap of the tree the lac bug is living on and by the time of harvest. Historically, the most commonly sold shellac is called "orange shellac", and was used extensively as a combination stain and protectant for wood paneling and cabinetry in the 20th century.

Shellac was once very common anywhere paints or varnishes were sold (such as hardware stores). However, cheaper and more abrasion- and chemical-resistant finishes, such as polyurethane, have almost completely replaced it in decorative residential wood finishing such as hardwood floors, wooden wainscoting plank paneling, and kitchen cabinets. These alternative products, however, must be applied over a stain if the user wants the wood coloured; clear or blond shellac may be applied over a stain without affecting the color of the finished piece, as a protective topcoat. "Wax over shellac" (an application of buffed-on paste wax over several coats of shellac) is often regarded as a beautiful, if fragile, finish for hardwood floors. Luthiers still use shellac to *French polish* fine acoustic stringed instruments, but it has been replaced by synthetic plastic lacquers and varnishes in many workshops.^[9]

4 Properties

Shellac is a natural bioadhesive polymer and is chemically similar to synthetic polymers, and thus can be considered a natural form of plastic. It can be turned into a moulding compound when mixed with wood flour and moulded under heat and pressure methods, so it can also be classified as thermoplastic.

Shellac scratches more easily than most lacquers and varnishes, and application is more labor-intensive, which is why it has been replaced by plastic in most areas. But damaged shellac can easily be touched-up with another coat of shellac (unlike polyurethane) because the new coat merges with and bonds to the existing coat(s). Shellac is much softer than Urushi lacquer for instance, which is far superior in regards to both chemical and mechanical resistance.

Shellac is soluble in alkaline solutions such as ammonia, sodium borate, sodium carbonate, and sodium hydroxide, and also in various organic solvents. When dissolved in denatured alcohol or ethanol, shellac yields a coating of good durability and hardness.



A decorative medal made in France in early 20th century moulded from shellac compound, the same used for phonograph records of the period.

Upon mild hydrolysis shellac gives a complex mix of aliphatic and alicyclic hydroxy acids and their polymers that varies in exact composition depending upon the source of the shellac and the season of collection. The major component of the aliphatic component is aleuritic acid, whereas the main alicyclic component is shellolic acid.^[10]

Shellac is UV-resistant, and does not darken as it ages (though the wood under it may do so, as in the case of pine).^[4]

5 History

The earliest written evidence of shellac goes back 3,000 years, but shellac is known to have been used earlier.^[4] According to the *Mahabharata*, an entire palace was built out of dried shellac.^[4]

Shellac was in rare use as a dyestuff for as long as there was a trade with the *East Indies*. Merrifield^[11] cites 1220 for the introduction of shellac as an artist's pigment in Spain. *Lapis lazuli* as ultramarine pigment from Afghanistan was already being imported long before this.

The use of overall paint or varnish decoration on large pieces of furniture was first popularised in Venice (then later throughout Italy). There are a number of 13th century references to painted or varnished cassone, often dowry cassone that were made deliberately impressive as part of dynastic marriages. The definition of varnish is not always clear, but it seems to have been a spirit varnish based on gum benjamin or mastic, both traded around the Mediterranean. At some time, shellac began to be used as well. An article from the *Journal of the American In-*

stitute of Conservation describes the use of infrared spectroscopy to identify a shellac coating on a 16th-century cassone.^[12] This is also the period in history where “varnisher” was identified as a distinct trade, separate from both carpenter and artist.

Another use for shellac is sealing wax. Woods's *The Nature and Treatment of Wax and Shellac Seals*^[13] discusses the various formulations, and the period when shellac started to be added to the previous beeswax recipes.

The “period of widespread introduction” would seem to be around 1550 to 1650, when the substance moves from being a rarity on highly decorated pieces to being described in the standard texts of the day.

6 Uses

6.1 Historical

In the early- and mid-20th century, orange shellac was used as a one-product finish (combination stain and varnish-like topcoat) on decorative wood paneling used on walls and ceilings in homes, particularly in the US. In the *American South*, use of knotty pine plank paneling covered with orange shellac was once as common in new construction as *drywall* is today. It was also often used on kitchen cabinets and hardwood floors, prior to the advent of polyurethane.

Until the advent of vinyl in 1949, most gramophone records were pressed from shellac compounds. From 1921 to 1928, 18,000 tons of shellac were used to create 260 million records for Europe.^[7] In the 1930s, it was estimated that half of all shellac was used for gramophone records.^[14] Use of shellac for records was common until the 1950s and continued into the 1970s in some non-Western countries.

Until recent advances in technology, shellac (French polish) was the only glue used in the making of ballet dancers' pointe shoes, to stiffen the box (toe area) to support the dancer en pointe. Many manufacturers of pointe shoes still use the traditional techniques, and many dancers use shellac to revive a softening pair of shoes.^[15]

Shellac was historically used as a protective coating on paintings.

Sheets of *Braille* were coated with shellac to help protect them from wear due to being read by hand.

Shellac was used from the mid-19th century to produce small moulded goods such as picture frames, boxes, toilet articles, jewelry, inkwells and even dentures. Advances in plastics have rendered shellac obsolete as a moulding compound.

Shellac (both orange and white varieties) were used both in the field and laboratory to glue and stabilize dinosaur bones until about the mid 1960s. While effective at the

time, the long-term negative effects of shellac (being organic in nature) on dinosaur bones and other fossils is debated and shellac is very rarely used by professional conservators and fossil preparators today.

Shellac was once used for fixing inductor, motor, generator and transformer windings, where it was applied directly to single layer windings in an alcohol solution. For multilayer windings, the whole coil was submerged in shellac solution, then drained and placed in a warm place to allow the alcohol to evaporate. The shellac then locks the wire turns in place, provides extra insulation and prevents movement and vibration, reducing buzz and hum. In motors and generators it also helps transfer force generated by magnetic attraction and repulsion from the windings to the rotor or armature. In more recent times, synthetic resins, such as glyptol, (Glyptal), have been substituted for the shellac. Some applications use shellac mixed with other natural or synthetic resins, such as pine resin or phenol-formaldehyde resin, of which Bakelite is the best known, for electrical use. Mixed with other resins, barium sulfate, calcium carbonate, zinc sulfide, aluminium oxide and/or cuprous carbonate (malachite), shellac forms a component of heat-cured capping cement used to fasten the caps or bases to the bulbs of electric lamps.

6.2 Current

It is the central element of the traditional "French polish" method of finishing furniture and fine violas, guitars and pianos.

Shellac, edible, is used as a glazing agent on pills (see excipients) and candies, in the form of *pharmaceutical glaze* (or, *confectioner's glaze*). Because of its acidic properties (resisting stomach acids), shellac-coated pills may be used for a timed enteric or colonic release.^[16] Shellac is used as a 'wax' coating on citrus fruit to prolong its shelf/storage life. It is also used to replace the natural wax of the apple, which is removed during the cleaning process.^[17] When used for this purpose, it has the food additive E number E904.

Shellac coating applied with either a standard or modified Huon-Stuehrer nozzle, can be economically micro-sprayed onto various smooth candies, such as chocolate coated peanuts. Irregularities on the surface of the product being sprayed typically result in the formation of unsightly aggregates ("lac-aggs") which precludes the use of this technique on foods such as walnuts or raisins (however, chocolate-coated raisins being smooth surfaced, are able to be sprayed successfully using a modified Huon-Stuehrer nozzle).

Because it is compatible with most other finishes, shellac is also used as a barrier or primer coat on wood to prevent the bleeding of resin or pigments into the final finish, or to prevent wood stain from blotching.^[2]

Shellac is an odour and stain blocker and so is often used as the base of "solves all problems" primers. Although its durability against abrasives and many common solvents is not very good, shellac provides an excellent barrier against water vapour penetration. Shellac-based primers are an effective sealant to control odours associated with fire damage.

Shellac has traditionally been used as a dye for cotton and, especially, silk cloth in Thailand, particularly in the northeastern region.^[18] It yields a range of warm colours from pale yellow through to dark orange-reds and dark ochre.^[19] Naturally dyed silk cloth, including that using shellac, is widely available in the rural northeast, especially in Ban Khwao District, Chaiyaphum province. The Thai name for the insect and the substance is "khrang" (Thai: ค้างคาว).

6.2.1 Other

Shellac is used:

- in the tying of artificial flies for trout and salmon where the shellac was used to seal all trimmed materials at the head of the fly.
- in combination with wax for preserving and imparting a shine to citrus fruits, such as lemons.
- in dental technology, where it is occasionally used in the production of custom impression trays and (partial) denture production.
- as a binder in India ink.
- for cycling as a protective and decorative coating for handlebar tape,^[20] and as a hard-drying adhesive for tubular cycle tires, particularly for track racing.^[21]
- for reattaching ink sacs when restoring vintage fountain pens, the orange variety preferably.
- for fixing pads to the key-cups of woodwind instruments.
- for Luthier applications, to bind wood fibers down and prevent tear out on the soft spruce soundboards.
- to stiffen and impart water-resistance to felt hats, for wood finishing^[22] and as a constituent of *gossamer* (or *goss* for short), a cheesecloth fabric coated in shellac and ammonia solution used in the shell of traditional silk top and riding hats.
- to increase the strength and longevity of ballet point shoes as a remedy for moisture weakening.^[23]
- for mounting insects, in the form of a gel adhesive mixture composed of 75% ethyl alcohol.^[24]

- as a binder in the fabrication of **abrasive wheels**,^[25] imparting flexibility and smoothness not found in vitrified (ceramic bond) wheels. 'Elastic' bonded wheels typically contain **plaster of paris**, yielding a stronger bond when mixed with shellac; the mixture of dry plaster powder, abrasive (e.g. corundum/aluminium oxide Al_2O_3), and shellac are heated and the mixture pressed in a mould.
- in fireworks pyrotechnic compositions as a low-temperature fuel, where it allows the creation of pure 'greens' and 'blues'- colours difficult to achieve with other fuel mixes.
- in watchmaking, due to its low melting temperature (about 80-100 °C), to adjust and adhere pallet stones to the pallet fork. Also for securing small parts to a 'wax chuck' (faceplate) in a watchmakers' lathe.
- in the early 20th century, it was used to protect some military rifle stocks^[26]
- in the cosmetic industry, shellac is known as a nail treatment that lasts longer than regular polish. It also gives it a better glossy finish.^[27] It is a combination of gel and regular polish and offers a water resistant seal among nail protection. The process consists of three steps and a UV light finish.^[28] Removal of Shellac is a simple 15-minute process, similar to how you would remove regular nail polish.^[29]
- in Jelly Belly jelly beans, in combination with beeswax to give them their final buff and polish.^[30]

7 Gallery

- Blonde shellac flakes
- Dewaxed Bona (L) and Waxy #1 Orange (R) shellac flakes. The latter—orange shellac—is the traditional shellac used for decades to finish wooden wall paneling, kitchen cabinets and tool handles.
- Closeup of Waxy #1 Orange (L) and Dewaxed Bona (R) shellac flakes. The former—orange shellac—is the traditional shellac used for decades to finish wooden wall paneling and kitchen cabinets.
- “Quick and dirty” example of a pine board coated with 1-5 coats of Dewaxed Dark shellac (a darker version of traditional orange shellac)

8 References

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9 External links

- [Shellac.net](#) US shellac vendor - properties and uses of dewaxed and non-dewaxed shellac
- [The Story of Shellac \(history\)](#)
- [DIYinfo.org's Shellac Wiki](#), practical information on everything to do with shellac
- [Reactive Pyrolysis-Gas Chromatography of Shellac](#)
- [Shellac A short introduction to the origin of shellac, the history of Japanning and French polishing, and how to conserve and repair these finishes sympathetically](#)
- [Shellac Application By Smith & Rodger](#)

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