The Use of Some Vegetable Oils as Wood Finishing Substances in Furniture Industry

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Abstract:

The choosing of wood finishing substances for furniture, woodworking and wood structure is an important issue to be decided. Protection, aesthetics properties and effects caused in terms of health of products obtained from wood and wood-based materials in the selection of wood finishing substances used are considered as important factors to be taken into account. As wood finishing substances in the products manufactured from wood are generally used paints, pigments and lacquers. However, due to rising health concerns has focused on the use as wood finishing substances in the furniture industry of vegetable oils in recent years. Especially, for wood toy industry are preferred natural finishing substances compared to wood finishing substances having chemical content. These substances which are oil or oil-based offer natural structure, quite aesthetic appearance, not containing any harmful chemicals and due to water-repellent properties can be used in the external environment. In this regard, the uses of tung oil, teak oil, linseed oil, jojoba oil and shellac which are within the scope of non-wood forest products used in the furniture industry as wood finishing substances were investigated in this study.

Key Terms: Furniture industry, Wood finishing, Vegetable oils, Tung oil, Teak oil

Introduction:

Wood is an essential material used in interior and exterior residence, furniture-decoration and construction elements. Also, it is renewable material and it has the many advantageous features due to aesthetic and technical properties. Thus, wood material is rapidly consumed and its value increased day by day. On the other hand, wood has certain negative features. It is damaged by plant and animal, and indurable against burning, mechanical and chemical effect. (Bozkurt and Erdin 1997; Ilhan 1984).

Wood material is usually used for certain purposes such as siding, woodworking, garden furniture and decoration. But, wood material is very sensitive against external weather conditions without any protection precaution. In many cases, cracks occur due to continuously changing moisture content of wood material. Also, color and mold fungi develop in the cracks and ultraviolet rays damage unprotected wood surface. Thus, wood material gains an undesirable appearance (Bozkurt et al. 1993).

Experts have been developed methods and substances protecting wood and its natural appearance and improving the negative aspects of the wood. These methods and substances provide water repellency and protection of surface. In practice, wood finishing substances having chemical content such as lacquer and varnish are widely used. The substances create a layer protecting physical appearance of wood and preventing surface wettability. But, clour and mold fungi are develop on surface of wood material because finishing layer crack about one year (Yildiz 1988; Rowell 1985). Due to chemical content and these negative properties, in the some usage areas (garden furniture and toys) are preferred wood finishing substances not containing any harmful chemicals instead of wood finishing substances having chemical content. These substances which are oil or oil-based offer natural structure, quite aesthetic appearance, not containing any harmful chemicals and due to water-repellent properties can be used in the external environment.

In this study, the uses of tung oil, teak oil, linseed oil, jojoba oil and shellac which are
within the scope of non-wood forest products used in the furniture industry as wood finishing substances were investigated.

**Definition and Objectives of Wood Finishing for the Furniture Industry**

Wood finishing can be defined as the protection of furniture and decoration elements produced from wood, and creating of a protective layer to improve the aesthetic values of these elements (Sonmez 2005). There are three important reasons including cleaning, protection, and decoration for wood finishing.

**Cleaning:** Wood contains countless holes of various sizes because it is a porous material. These holes can accumulate dirt, grime from handling and atmospheric contaminants. Grimy wood is unattractive, and it can be a health hazard, providing a breeding place for bacteria. A finish protects the porous surface making it less susceptible to soiling and easier to clean (Sonmez 2000).

**Protection:** This purpose means the protection of wood material against the effects of various factors. These factors can be listed as follows.

- Mechanical effects (friction, wear, cracking, fracture)
- Physical effects (dust, dirt)
- Chemical effects (acids, alkalis and similar chemical substances)
- The effect of light (the effects of short-wavelength sunlight, UV radiation)
- The effect of the biological pests (fungi and micro-organisms, insects)
- The effect of external environment conditions (heat, light, moisture, water, raw) (Sonmez 2000).

**Decoration:** Wood has been an indispensable material in the production of interior and exterior decoration materials for prehistoric times. Because, wood material is very esthetics compared to other materials (Sonmez 2000). The desired color, brightness and pleasing architecture of furniture can be obtained by wood finishing (Kurtoglu 2000). Shortly, wood finishing is very important to increase the aesthetic value of wood products (Sonmez 2000).

**The Major Considerations in the Selection of the Wood Finishing Substances**

Wood finishing substances are grouped into four classes as oils, varnishes and lacquers, and paints. These finishing substances differ in terms of protection levels, ease of application and maintenance, durability and aesthetics. (Anonymous 1999; Flexner 1994; Bulian 2009; Dresner 1999). In this regard, it is important to take into consideration the following properties for choosing a wood finishing substance.

**Appearance:** Potential film formation, clarity, and color should be considered to choose wood finish substances in terms of appearance (URL-1).
- Film Build
- Clarity
- Color

**Protection:** Resistance to water penetration is important for choosing wood finish substances. A finish substance slowing the penetration of water protects wood and glue joints. Resistance to water-vapor exchange is one of the most important functions of a finish substance. Excessive water-vapor exchange between the wood and the atmosphere causes splits, warps, and joint failure (URL-1).

**Durability:** Finish durability divides almost exactly between crosslinking and non-crosslinking finishes. Crosslinking finishes (varnish and conversion) are more durable than non-crosslinking finishes (shellac, lacquer, and water base). The exceptions are oil and oil/varnish blends, which, though crosslinking, give poor durability because of their thinness. There are two concerns about wood finish durability (URL-1).
- Wear or scratch resistance
- Solvent, acid, alkali, and heat resistance

**Ease of Application:** The ease of application for a wood finish substance depends on two factors (URL-1).
- Availability of spray equipment
- Speed of Curing
Safety: There are three issues in terms of safety (URL-1).

- Safety to You
- Safety to the Environment
- Safety to the Consumer

Reversibility: Reversibility refers to the ease of repair and ease of removal of a finish substance. Reversibility is the opposite of solvent resistance (URL-1).

Ease of Rubbing: There are two qualities in wood finishes that make them easier to rub for sheen; the hardness of the cured finish, and the ability of finish coats to fuse together to form a single layer. Both of these properties are a function of the wood finish cures (URL-1).

- Hardness
- Fusing of Layers

Applicability of Vegetable Oils as a Wood finishing

In the last few decades, oil finishes have become among the most popular finishes used by woodworkers. This is partly due to close-view of wood that oil finishes produce, and the ease of its application. However, the main reason is that vegetable oils have natural content compared to wood finishing substances having chemical content (URL-1). Vegetables oils are penetrating finishing substances that cure by absorbing oxygen from the air, a process that strengthens the finish. These oils are durable, water-resistant, and easy to apply, but, they require several coats and are slow-drying substances. Because of increasing public awareness for indoor air pollution and chemical toxicity in household and building products, manufacturers of wood finishing substances struggle to offer more products that are low in volatile organic compounds (VOCs). They aim to formulate finishing substances without aromatic solvents, heavy metals and cancer-causing chemicals. As organic materials in finishing substances evaporate during the drying/curing process, VOCs are released into the air, and they affect indoor and outdoor air quality. VOCs and their byproducts can produce a number of physical problems, including eye and skin irritation, lung and breathing problems, headaches, nausea, muscle weakness, and liver and kidney damage (URL-2). Therefore, applicability of vegetable oils as a wood finishing is very important.

Linseed Oil: Linseed oil is extracted from seeds of the flax plant. It is also one of the most useful natural oils. It is used as a wood preservative, an ingredient in paints, varnishes, and stains. This oil is an inefficient finish in its raw state because it takes many days to cure. Therefore, metallic driers are added to make it more effective. These driers are usually salts of cobalt, manganese, or zinc. They act as catalysts to speed the curing (URL-3).

With driers added, linseed oil cures in about a day and is called "boiled" linseed oil. "Boiled" linseed oil is not boiled. The actual boiling of some oils changes their drying characteristics. It is the addition of certain solvents that cause linseed oil to dry more quickly, though, acting as if it were boiled. This makes it a better product for preserving tool handles, decks, and furniture (URL-4).
Tung Oil: Tung oil is extracted from nuts of the tung tree, which is native to China. Tung oil has been used for centuries in China, but it was not introduced into the other countries until the very end of the nineteenth century. However, it is now cultivated in South America. The nuts and seeds of the tree are harvested and pressed to release the oil, which is often mixed with varnish or other additives to create a tung blend. Though tung oil is more expensive than linseed oil, tung oil has established a firm position in the paint and coatings industry because it is one of the most water-resistant oils. Many high-quality varnishes are made with tung oil. But, although tung oil has important properties, it is seldom used as a finish in its own right (URL-1).

Tung oil can be made fairly water-resistant after five or six coats. But it is too soft and thin to resist scratching and water-vapor exchange, and it is difficult to make the finish looks nice. The first three or four coats appear flat and splotchy on the wood and feel rough to the touch. However, after five or six coats with sanding between each coat, highly polished surfaces can be achieved. But the finish is still not as smooth to the touch as linseed oil.

The curing of tung oil is faster than raw linseed oil, but, it is slower than boiled linseed oil. Therefore, for a good curing between coats needs to wait several days. Water resistance after five or six coats is the most important advantage of tung oil compared to linseed oil (URL-1).
Tung oil has a very wet and shiny finish that many users consider attractive. It is non-toxic and safe to use around food. Tung also has a pleasant natural odor and tends to dry more quickly than teak oil (URL-5).

**Teak Oil:** Teak oil comes from the teak tree, which grows primarily in Southeast Asia. Because teak is a rare and endangered tree in many areas, most products labeled as teak oil are really refined tung oil. Teak oil is one of the most effective wood sealers for outdoor use. It helps to create a protective coating on the wood that is the highly resistant to rain, moisture and humidity. This can greatly extend the life of wood furniture while helping to maintain its appearance and smooth finish. However, pure teak is expensive and is usually mixed with tung or other additives, which can reduce its level of water-resistance (URL-5).

![Figure 5. Teak tree and its seeds](image)

Teak oil can be applied to any type of wood product, including indoor furniture, patio furniture, architectural wood work or trim. It should be applied in multiple coats until the wood is not able to absorb any more of the oil. In addition, it should be reapplied every 6 months to a year depending on how much the wood has started to dry out. In general, teak oil is used in outdoor applications while tung oil is used indoors (URL-5).

![Figure 6. The uses of teak oil as wood finishing](image)

While teak oil and other many vegetable oils are used primarily for wood finishing, each of these wood finishing substances also has a number of other potential uses. For example, tung oil is added to most paints and stains to help pigments better adhere to an object during application. It is also used on piers and boats to minimize wear and damage to wood. Teak oil is most commonly used on outdoor furnishings, but, it is also used in some marine applications. Many modern yachts and warships are treated with teak oil to help protect wood elements from salt water exposure. Teak oil can also be added to some stains and solvents to improve moisture-resistant properties.

**Shellac:** Shellac is a natural resin found mostly in India and Thailand in its pure form. The resin is scraped from the twigs and branches of the trees. It is then melted, and strained to remove bug parts and other foreign matter, and formed into large thin sheets that are broken up into flakes and shipped around the world. Although it creates a brilliant shine, shellac’s uses are limited because of its susceptibility to damage from liquids and heat. Shellac is useful for touch-ups because it bonds well to most other finishes (URL-2).

Shellac is also used as a sealer and under-coat with lacquer or varnish and polyurethane. It may not be compatible as a sealer under certain polyurethanes, though, because of the natural wax it contains (URL-2).
The Use of Some Vegetable Oils as Wood Finishing Substances in Furniture Industry

Figure 7. The uses of shellac of wood finishing

It is well known for its weaknesses—short shelf life and poor resistance to water, alcohol, heat, and alkalis. It is seldom mentioned for its strengths, which include some attractive characteristics:

- Shellac is the only finish with a proven track record for longevity. It was the favored finish for quality furniture throughout the nineteenth and early part of the twentieth century. Much of this furniture has survived with its original shellac finish in very good shape.

- Shellac forms an excellent barrier against humidity, silicone contamination, and existing stains caused by water, grease, crayons, or natural wood resins. Many professional refinishers use shellac regularly for their first "sealer" coat because of this quality.

- Shellac is unsurpassed as a touch-up material for repairing rubs, scratches, and gouges in other finishes. It bonds well to almost all finishes without damaging them, and it dries quickly.

- Shellac resin is so safe, and it is approved by the Food and Drug Administration (FDA) for use as a coating on candy and pills.

- Shellac's solvent, denatured alcohol, is not polluting to the atmosphere as mineral spirits or lacquer thinner, and it is not harmful unless one drink it or breathe excessive amounts of it.

Because of shellac's poor resistance to water, alcohol, heat, and alkali, it is not the best finish for tabletops or other surfaces that are subject to frequent use. However, shellac can be used almost everywhere else. Interestingly, while shellac is a weak barrier against water penetration, it is one of the best barriers against the passage of water vapor. Since one of the main purposes of a finish is to slow water-vapor exchange, shellac rates high in this respect as a protective finish (URL-1).

Jojoba Oil: Jojoba oil is a natural plant oil which is extracted by pressing jojoba seeds from the jojoba tree (Simmondsia chinensis) and this oil is used mainly in cosmetics and finishing without any refining either mixed with other substances or just as-is (URL-6).

Figure 8. Jojoba plants (a. Male jojoba plant, b. Female jojoba plant)
The seeds of jojoba that come from the jojoba plant contain up to 60% of their weight in oil, which is isolated by cold pressing of the seeds. The golden ‘jojoba oil’ obtained is really not an ‘oil’, but a ‘liquid wax’. Its structure is devoid of glycerine, the backbone in the structure of all oils and fats. Jojoba liquid wax is called as oil only because it is a liquid (URL-6).

Jojoba plants which exist in the wild as bushes, until its discovery in 1970 and its cultivation in 1980, its seeds have been used by the Red Indians by isolation of its oil for food and medicinal uses (URL-6).

Jojoba oil can be used to finish wood floors. Jojoba is a good choice because it is natural, and it dries completely. Because jojoba oil is expensive, it may be more appropriate for smaller surface areas or buffing isolated areas where finish needs refurbishing. Furthermore, jojoba oil is widely used in the fields of medicine and cosmetics (URL-6).

**Conclusions:** Wood finishing is very important to ensure various purposes such as protection, aesthetics, and so on in the furniture industry. As wood finishing substances in the products manufactured from wood are generally used paints, pigments and lacquers. However, these finishing substances have less used especially due to the chemical content in the some usage areas in recent years. Due to rising health concerns has increasingly focused on the use as wood finishing substances in the furniture industry of vegetable oils instead of them. These substances which are oil or oil-based offer advantageous aspects indicated following.

- Natural structure
- Quite aesthetic appearance
- Not containing any harmful chemicals
- Water-repellent properties
- Highly resistant to rain, moisture and humidity
- Using in the external environment.

In addition advantage properties, they are expensive and slow-drying finishing substances. Nevertheless, it is suggested that the oil-based finishing substances should be prefer for using such as garden furniture and toys due to the large number of the desired properties.
The Use of Some Vegetable Oils as Wood Finishing Substances in Furniture Industry

References

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URL-1.
URL-2.
URL-3.
URL-5.
URL-6.