

Lac and Paper Industry

By

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Lac is a versatile natural resin and is unique even among natural resins being the only one of insect origin. It is extensively used in a number of industries because of its many valuable properties. It is a solid solution¹ of several inter- and intra-esters of hydroxy carboxylic acids. The average molecular weight is about 1,000 and, in the average molecule, there are a little more than one free carboxyl and about three ester and five hydroxyl groups, and unsaturated linkage and one aldehyde group. All these are obvious centres capable of chemical modification for improving the properties of the resin in desired directions.

Literature provides references^{1, 2, 3} to a variety of modifications of lac by admixture and/or reaction with chemicals, drying and non-drying oils as well as semi-synthetic and synthetic polymers. Shellac has also recently been graft/co-polymerised with synthetic monomers.⁴ These modifications naturally result in a wide range of improved properties such as higher softening and melting points, improved hardness, gloss and elasticity and better heat, water, solvent and weather resistance.

Paper is one of the products in which shellac had been traditionally used, although in limited quantities, for a variety of end uses. With the development of newer modifications, the field is naturally widened. Some of the major traditional, present and potential uses are reviewed below. The chief function of shellac in there is a film former, electric insulator, adhesive, impregnating resin, plastic binder and so on.

As a Film Former (Coating Material)

As is well known shellac is one of the most important varnish resins. It is widely used in varnishes and lacquers for the natural lustre, hardness and adhesion of its films. It also finds use as a paper varnish^{3, 5} for glazing wrappers, labels, display cards, etc. A superior formula of shellac paper varnish, developed at Indian Lac Research Institute, consists of bleached lac, hydrolysed lac and spirit. Films of this varnish withstand reasonable bending without formation of crinkles and cracks on the surface. This varnish may be applied by brush, spray or roller coating.

Glossy and silky finish⁵ on high-class playing cards is obtained by giving blanks a coat of shellac (Platina) varnish. For the good 'slip' shellac is always superior to synthetics. A coating material⁶ for playing cards is also prepared from nitrocellulose, shellac, etc. A shellac varnish⁷ has been

developed recently based on aqueous solution of shellac which gives good gloss, flexible film and soil resisting finish for playing cards.

In the manufacture of wall paper^{8, 9} shellac plays a very important role as a finishing agent of good moisture resistance. A process for preparation of shellac oil varnish^{10, 11} suitable for water proof papers was developed at the Indian Lac Research Institute. In the manufacture of coated papers¹², viz., waterproof paper, shelf paper, holiday wrapping paper, Christmas seals and tags in various colourful designs having glazed finish, alcoholic shellac is applied in a very thin film. Oil proof coatings¹³ for paper are done by shellac soap. Papers are made grease and waterproof¹⁴ by shellac suitable for wrapping foods, etc. Wrapping paper for chewing tobacco¹⁵ has been recently developed by applying alcoholic bleached lac varnish on tissue paper and alkathene and pressing under hydraulic press. Resin coated papers, pergamyn and parchment papers¹⁶ for use in packing are coated with synthetic resin and shellac dispersion.

In the preparation of translucent papers¹⁷, outer surfaces are given a coating of shellac. In the manufacture of stencil sheet papers^{18, 19, 20} are treated with a solution containing shellac and other materials. Articles of transparent papers²¹ are made to appear like ivory by immersing them for a short period in a solution of white shellac and then in a collodion solution.

For clear transparent top size²² or varnish, wax-free shellac is used. Orange white and garnet shellac are also used in coated specialties. A sizing composition²³ for application to the surface of a book binding material comprises 3—15 per cent of resin mixture consisting of shellac and other resins. Alcoholic shellac solution is also used in transfer²⁴ for transparent rosin sized paper.

Suitable sprayable shellac varnish (colourless transparent lacquer) for preservation of work of art has also been developed²⁵. A thin coat of it on oil and water colour paintings on paper or canvas, make them last longer and protect them against dust, abrasion and also humid weather. Finger prints²⁶ on paper soaked with shellac solution does not disturb the print and make it permanent.

In libraries, more so in tropical humid climate, apart from fungus growth, books are also often attacked by insects such as silver fish, termites,

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etc. It has been found that if a layer of shellac book varnish²⁷ is brushed or sprayed on the top surface of the bound cover, the books are protected from the above damage. An insect repellent may be added to the varnish with advantage.

As an Insulator

Shellac due to its relatively low dielectric constants is extensively used as electric insulating material. For the manufacture of paper laminated insulating tubes and cylinders shellac is used as the bond. Such insulators^{2,28} are used in electrostatic generators, terminal boards, barriers in transformers, lifting and operation of links in H.T. gear and in manufacture of radio goods. Where 'non-tracking' qualities are required shellac bonded materials are preferred to synthetic resin bonded paper products. Shellac coated papers are extensively used as electric insulators. There are many patents^{29, 30, 31, 32} on the subject. Shellac coated papers may be produced either from shellac varnish or by hot spraying shellac.

As an Adhesive

Shellac is well reputed in the field of adhesives. Laminated paper boards² can be produced with cheap paper and shellac as bond, which are suitable for use for making various types of construction materials, table tops, boxes, partition walls, for decorative panelling and for special acoustic properties in studios, theatres, etc. Shellac is also used as an adhesive in the preparation of sand paper or similar abrasive papers².

Experiments have shown that shellac modified with urea and formaldehyde or casein³³ confers improved adhesion between laminæ. Improved bonds³⁴ for fibrous materials like paper can also be produced from shellac modified with phthalic anhydride, castor oil, linseed oil, fatty acid, etc. With the use of modified shellacs, it is possible to produce materials having heat and water resistance.

One of the most familiar uses of shellac as an adhesive is in dry mounting tissue paper^{35, 36}. An improved process of making it has been developed at Indian Lac Research Institute. Shellac is also used as an adhesive coating material for overlaying paper with leaf metals^{37, 38}. In a coating process for paper³⁹ shellac is also used as adhesive by rubber dispersion, etc.

As an Impregnating Resin

Shellac also finds use in the paper industry as an impregnating resin. Unsized paper² is impregnated with lac varnish which may then be laminated and are moulded under heat and pressure. Artificial wood⁴⁰ can also be prepared from fillers like paper and shellac as a binding constituent. Asbestos pulp is mixed with celluloid,

lignoid, coroline, shellac, resin or gums and formed into paper sheets⁴¹.

As a Plastic Binder

Shellac is one of the oldest plastic known to civilisation. Use of shellac in plastic moulding composition is well recognised due to its thermo-plastic and other desirable properties.

Plastic compositions suitable^{42, 43, 44, 45} for preparing light but strong materials, e.g. hat blocks, etc. is prepared from paper pulp, shellac and other materials. A patented process describes a process in which wood pulp is spread on paper treated with shellac and wound on mandrel and the resulting tubes cut and shaped into motor-car steering wheels⁴⁶. Unsized paper pulp incorporated with shellac reduces brittleness of lac bangles⁷ and provides a good impact resistance.

In Quality Control for Paper

Dennison waxes⁴⁸ of graded adhesive property are used in testing surface hardness or "pick strength" of sized and unsized paper. These waxes are imported from U.S.A. Recently compositions⁴⁹ containing shellac and having similar properties have been developed at Indian Lac Research Institute which have been found suitable for use as substitute for imported Dennison waxes.

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