Indo Global Journal of Pharmaceutical Sciences, 2012; 2(4): 379-382

INDO GLOBAL JOURNAL OF PHARMACEUTICAL SCIENCES
ISSN 2249- 1023

Evaluation of Nail Lacquer

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ABSTRACT: The review aims to introduce the quality control parameters and the procedure to determine the quality of nail lacquers. The use of nail lacquers in increasing day by day as women paint their nails with the same shade of their dressing. The quality determination is mandatory due to frequent use of these by human being. Legislation demand the assurance of three important features, namely safety, efficacy, and quality of nail lacquers as in case for pharmaceuticals or foods. The performance of a nail enamel and its components is of primary concern to the lacquer chemist, he must prescribe the tests, interpret and refine the data while recognizing their overall significance and apply conclusion based on the information obtained in the tests.

KEYWORDS: Nail Lacquer; Quality Control; Quality Assurance.

INTRODUCTION

Regular care and treatment is very much important for nail grooming and to maintain the in good condition. A set of manicure preparations consists of a number of different cosmetic products which are concerned with cleansing and preparations of the nail and its decoration. Nail polish or nail varnish is a lacquer that is applied to the nails of both the fingers and toes, usually cosmetically, but also as protection for the nails. [1] The nail lacquers are the largest and most important group of manicure preparations. The application of nail covers the nail with water -and air-impermeable membrane which remains for days and normally can be removed only by suitable solvent. So there is demand for removers as much as that of lacquers, as users changes the colour or shade frequently to suit their choice and necessity. [2]

History of nail polish

3000 BC Nail polish originated in china. The early mixture contained bees wax, gelatin, gum, Arabic and egg whites. To produce colour Chinese added petals of flowers, such as rose and orchids to their polish. During the same time period in Egypt, upper class member wore nail polish. Then it become symbol of social rank and used in various colour and form (like cake, paste, powder) in its developing era. In 1920 the modern invention of the car inspires the creation of nail polish with the development of automobile paint, nail lacquer followed close behind. Today nail art has become somewhat a trend, as new polish textures, sheens and embellishments are made available for intricate designs. [3]

Evaluation of nail lacquers

Determination of non-volatile content- the amount of nonvolatile matter in nail lacquers is determined by taking a definite amount of lacquers and applying on a plate of flat surface. The heating of plate is done for 3-4 hours at 80^0 C. heating should be discontinued immediately when the solvent odor disappears or when the odor of camphor, if present become noticeable. Weight of the residual film after evaporation of solvent indicates the non-volatile content. [4] The Indian standards (IS: 9245-1994) prescribe a minimum limit of 20% by mass. [5] The nonvolatile matter is separated into its components by utilization of various solvents. The separated individual components are indentified by their infrared spectrum. [4]

Procedure- disperse 5 g of sample in 25 ml of acetone in a corex test tube, with the aid of small magnet and magnetic stirrer, and centrifuge the mixture at 10,000 rpm for 10 min. the acetone-insoluble materials collect at the bottom of tube and the gelling agents such as bentonite, appears as a gel layer on the top of pigment layer. Decent the acetone into tared beaker and save both layers. Repeat the acetone extraction twice with 25 ml of acetone. Dry the gel layer at 105^0C and identify it from the infrared spectrum. Evaporate the composite acetone fraction in tared beaker to dryness on steam bath and weigh**.** [6]

Drying time

The application and performance properties of a nail coating depend greatly on the volatility characteristics of its solvent system and therefore on its drying time. A thin layer of lacquer is spread or flowed out on a clean and clear glass panel and observed. The time taken to dry is measured with a stop watch, and checked by pressing the film with a finger, until no mark remains on surface. This may be done by application of wet films standards against batch using a 3-mil Bird film applicator. The two films should be checked by finger tips. The two films should be dry to touch at approximately the same time. Dry-to-touch is the condition at which the film may be touched with a clean fingertip without the resultant transfer of any material to the finger. The total time should be less than 10 min. film should be applied under controlled temperature and humidity condition at 25^0C and 50% relative humidity to a completely nonporous surface, in order to standardize this technique. [7]

Smoothness

This is the character of the film. The film is applied on a surface and the surface characteristics of the film are studies microscopically. Before applying a nail lacquer, moisture and traces of soil should be removed from the surface to ensure good adhesion and gloss. [2]

Hardness

This is the measure of the hardness of film. Two methods of film surface hardness evaluation can be used are Sward Rocker and Tukon microhardness tester. Film of 0.0006 inch should be cast on a glass plate and dried for 48 at 25^0C and an additional 2 hours at 71^0C. the film is evaluated with Rocker. The rocker consist of two 4 inch metal rings spaced 1 inch apart, a gravity bob for regulating the oscillation frequency or period of the moving system at 1.2 S. in order to make hardness test, the rocker is placed on the leveled surface and set in motion. The total time required for the amplitude of oscillation to decay by a fixed amount corresponding to certain number of complete oscillation is a measure of hardness of the test panel. A greater number of rocks will be recorded for a harder of the test panel. A range between 8 to 11 oscillations is normal.

The Tukon microhardness tester consists of a load applicator and indenter and a microscope fitted with a movable stage. A conduct a test, a coating of film is applied to a rigid surface. After the film is dried for a given period, a load is placed on the surface of coating for approximately eighteen second through a pyramid shaped diamond. The resultant permanent impression made by the diamond is measured with a Filar micrometer and the length of the identification is converted to a Knoop Hardness Number (KHN).

This number relates the applied load in grams to the unrecovered projected area in square millimeters. KHN increases in magnitude with increasing film hardness. [7]

Adhesion

There are no quantitative evaluation tools available to assess the medicinal nail lacquer at this time. Adhesion properties of any nail lacquer are not only critical in screening various formulations, but also useful in selecting an ideal formulation with optimum aesthetic properties. A Texture Analyzer was used to develop a method to test the adhesiveness of nail lacquer films. Method- The test material is spread over a glass plate (using a Bird Type Film Applicator with fixed cut) forming a layer of uniform thickness. A TA XT2i Texture analyzer from stable Microsystems was used to quantify the adhesive characteristics. The glass plate was clamped down and the force applied was measured against time and distance. A TA-57 (7mm-1"R) probe was used in this study. The probe was lowered from a height of 10 mm with 0.5 to 1.0 g of force until it reached the product surface. When it detected the surface, a trigger force of 40 g was applied for 1 second. The probe was then withdrawn from the film, and the force required to pull the probe away was recorded and plotted against time.

The maximum amount of (peak) force required to remove the probe from the sample was reported as the tack or adhesive strength of the formulation. The AUC indicated the adhesive work. Finally, the distance to peak force was reported as stringiness. These parameters are useful in comparing the formulation variables and their effect on adhesion. [8]

Abrasion resistance

The Taber Abraser can be used to measure abrasion resistance through the action of two resilient abrading wheels which are made to rub the coated surface. The nail enamel coating is applied to a special four inch square steel panel having a center spindle hold. The panel is placed on a turntable operating at a constant speed. Two abrading wheels, each ¾ inch wide are fixed on each side of the spindle and in contact with the coating surface. A load of up to 1000g may be placed on the wheels in addition to their own 250 g weight. The direction of the abrasion pattern developed by the one wheel is from the outside. A tachometer is provided to count the number of turntable rotations. Between the wheels, vacuum device acts to remove loose particle abraded from the coating. The instrument is operated for a specific number of cycles or until a portion of substrate is exposed. Result may be reported either as the number of cycles to failure per mil of film thickness or as the weight loss in milligrams per 1000 cycles**.** [7]

Water resistance

This is the measurement of the resistance towards water permeability of the film. A 0.0006 inch film on three glass plates should be applied and dried then weigh these. The plates should then be immersed in a water bath containing distilled water at 37^0C for 24 hours. The panels should then be removed and dried by placing the plate between absorption papers and reweighed. The increase in weight is calculated. Higher the increase in weight lowers the water resistance**.** [2]

Viscosity

The viscosity of nail lacquer can be measured using viscometer. The preferred viscometer is Brookfield and rotating viscometer. [9] For Brookfield viscometer the sample should taken in a closed jar to minimize the solvent evaporation. Sample should be aged at leat 8 hours at 25^0 C before performing the test. At 25^0 C, shake vigorously, start timer, insert spindle into the sample to the scored line, with the motor running at 60RPM. Spindle should be in correct position in less than one minute. Read the instrument at the end of ten minutes then switch the speed control to 6 RPM and read the instrument again at the end of another ten minutes. In order to convert the dial reading to centipoises, multiply by following factor- 60rpm X 20; 6rpm X 200. The viscosity-thixotropy relationship of cream nail enemal should be about 375-500cps at 60 rpm, at 25^0 C. [7]

Colour

Colour comparing with master color standards by applying on thumbnails, holding them side by side, moving the thumb with the standard first on the right and then on left. Artificial acrylic nails have been utilized as well for matching comparative shades. [1]

Stability

The stability study of nail lacquers is very important and essential. This can be done by accelerated stability test. (The Indian standard for nail lacquers amended in July 1998 to mention the "Best before…Mention month & year". [5]

CONCLUSION

Extreme attention to quality control is essential throughout the manufacturing process. Not only does quality control increase safety in the process, but it is the only way the manufacturer can be assured of the consumer confidence and loyalty. The nail polished should be tested throughout the manufacturing process for several important factors drying time, smoothness of flow, hardness, abrasion resistance, non-volatile content, water resistant, colour, and viscosity. The nail lacquers must be carefully tested to make sure that they meet the performance specifications which have been set up both marketing and technical executives.

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Indo Global Journal of Pharmaceutical Sciences(ISSN 2249 1023 ; CODEN-IGJPAI) indexed and abstracted in EMBASE(Elsevier), SCIRUS(Elsevier),CABI, CAB Abstracts, Chemical Abstract Services(CAS), American Chemical Society(ACS), Index Copernicus, EBSCO, DOAJ, Google Scholar and many more. For further details, visit http://iglobaljournal.com