EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 6
437-443
Year: 2022

SMART SAFETY NAIL PAINT FOR WOMEN SAFETY: A REVIEW

Ramesh Pareek[1*], Dr. Vandana Sharma[2], Ashok Kumar Sharma[1], Vani Madaan[1], Pratibha Singh Meena[3], Preeti Sharma[3], Javed Ansari[3], Anisur Rahman[3] and Visambar Dayal[3]

[1]Asso. Professor, Arya College of Pharmacy, Kukas, Jaipur.
[2]Principal, Arya College of Pharmacy, Kukas, Jaipur.
[3]Research Scholar, Arya College of Pharmacy, Kukas, Jaipur.

***Corresponding Author: Ramesh Pareek**
Asso. Professor, Arya College of Pharmacy, Kukas, Jaipur.

Article Received on 21/04/2022 **Article Revised on 11/05/2022** **Article Accepted on 01/06/2022**

ABSTRACT
Nail polish originated in China and traces all the way back to 3000 BCE. Around 600 BCE, during the Zhou administration, the regal house favoured the tones gold and silver. During the Ming line, nail clean was frequently produced using a combination that included beeswax, egg whites, gelatin, vegetable colors, and gum arabic. Over the natural course of time, the accessible tones and impacts for nail clean expanded significantly from natural and inorganic shades to metal powders, metallic colors and impact shades. Today, the US Food and Drug Administration (FDA) controls those shading added substances that can be utilized in nail polish and beauty care products overall. The rundown of OK shading added substances can be found in the FDA Code of Federal Regulations.

KEYWORD: Nail, Zhou, Inorganic, Metallic, Beauty, Federal Regulations.

INTRODUCTION

Nail polish originated in China and traces all the way back to 3000 BCE. Around 600 BCE, during the Zhou administration, the regal house favoured the tones gold and silver. During the Ming line, nail clean was frequently produced using a combination that included beeswax, egg whites, gelatin, vegetable colors, and gum arabic.

The fixings included beeswax, egg whites, gelatin, and vegetable colors. Egypt, nail clean was even used to imply class rankings. The expression modern restorative might appear to be an interesting expression; be that as it may, it applies impeccably to nail clean. Nail clean contrasts from different beauty care products in its jobs as both an ornamental restorative and a covering to oppose an assortment of difficulties to its respectability. While nail clean, additionally alluded to as nail finish or nail veneer, is an advancement of the twentieth century, improving nails returns similarly as the antiquated Egyptians in 1500 B.C.[1] and the Chinese in 3000 B.C.[2] The Egyptians utilized henna to shading nails, with dull reds and dark red being held for ladies of the greatest social request. The Chinese likewise brightened their nails utilizing home grown concentrates and a "polish" produced using gum arabic, egg whites, gelatin and beeswax. Like the Egyptians, the Chinese held dull tones like red and dark for eminence.

For the most part, techniques to apply shading to the nails have emulated the accessible innovations for coatings at given timeframes. For example, before the 1920s, most ladies sought after a cleaned look by kneading colored powders and creams into their nails, then, at that point, polishing them for sparkle. The advancement of vehicle paint in 1920, nonetheless, gave the beginning to present day nail clean since, up to that point, it was basically impossible to bestow enduring hued film on the nails. Michelle Menard is for the most part attributed as the primary individual to foster nail clean in light of car paint. From that point forward, nail clean definitions have advanced to give a stage to the assortment of nail tones and impacts wanted by the shopper. Prior to examining how nail clean is figured out to accomplish the ideal exhibition, the article will audit the assortment of materials that confer shading and impacts in nail clean.

Figure 1: Shades of nail polish.

Nail Polish Colors and Effects

A predetermined number of tones were accessible when nail clean was first presented. Red was the most widely recognized shading until the 1930s, when Charles Revson fostered another sort of nail lacquer and established Revlon. The new nail clean utilized shades rather than colors, which took into account a more extensive scope of nail clean tones. By the 1940s, nail clean turned into a staple of a ladies' shading beauty care products.

Over the natural course of time, the accessible tones and impacts for nail clean expanded significantly from natural and inorganic shades to metal powders, metallic colors and impact shades. Today, the US Food and Drug Administration (FDA) controls those shading added substances that can be utilized in nail polish and beauty care products overall. The rundown of OK shading added substances can be found in the FDA Code of Federal Regulations.

EVALUATION OF NAIL LACQUERS

The various methods required for the evaluation of nail polishes are as follows.

1. Test for Non-Volatile Content: The test is done in order to check the quantity of the non-volatile content in the preparation. The method is known as dish method and involves a simple process described below.

- The sample is spread on a flat plate as a circle 8 cmsin diameter.
- The quantity is weighed and kept in an oven at a temperature o 105 for l hr.
- The quantity of substance remaining on the plate is weighed arid this constitutes the non-volatile content.

2. Rate of Drying: The test is done in order to check the rate of evaporation of the preparation. It involves a simple process in which the film is applied with an applicator on to a completely non-porous surface. It is kept at 25°C and 50% RH and the time required to dry is noted by touching it with finger. When no matter is adhered to the finger tip, then the product is said to be completely dried.

3. Colour of the Product: The colour of the product is tested by comparing it with, a standard colour. This can be done by applying the standard colour on one nail and the prepared product on the adjacent nail. From this comparison, the contrast in the colours can then be easily noted.

4. Test for Smoothness of the Film: The smoothness is the most important characteristic of the film. The surface property can be studied by the microscopic analysis. The film should not contain any foreign matter or particles of the coating material. It should also be free from the orange peel effect when seen under microscope.

5. Estimation of Gloss: The gloss of the product can be determined by the use of an instrument that works on the principle of reflection of light.

6. Test for Hardness of the Film: The test is done in order to measure the extent of hardness of the substance. It is done by spreading the film on a glass plate and then drying it for 48 hrs at 25°C.

- It is then further dried at 70°C for 2hrs.
- It is then cooled at 25°C for 48 hrs.
- The hardness is then checked by applying mechanical force externally.

7. Test for Adhesive Property: This is done in order to measure the extent of adhesion of the film with adhering material. This is done by the following method. The film is spread on metal surface and allowed to settle for some time. The adhesion character is then determined by measuring the mechanical force applied externally to remove the film.

8. Test for Resistance to Abrasion: This is done by applying mechanical abrasive forces externally on the film surface. The surface characteristic of the film before and after the application of abrasive force are then studied.

9. Test for Resistance to Water Permeability: This is a measure of resistance of the film towards absorption of water. This is done as follows. A continuous film is

spread on the surface of a metal plate. The plate is then immersed in water. The weight of the film before and after the immersio n into water is noted. An increase in the weight is calculated. The lesser the increase in weight, the greater is the water resistance.

10. Test Application Property: It is a measure of ease of application of the product. It is carried out more reliably by applying on nails. The degree of evenness and smoothness of brushing and the presence of any air bubbles are checked out.

11. Test for Viscosity: It is the most important parameter that determines the evenness of application. The viscosity can be measured by using Brookfield's viscometer.It can be easily carried out by checking the flow of product from the applicator and comparing it with standard product.

12. Test for Stability: It is it measure of long lasting ability of the product. It can be done by using the acceleration stability test.

Composition

Nail polish, like any industrial coating, must meet a variety of needs. It must be easy to apply, dry quickly, wear well and remove easily. Nail polish is subject to more mechanical and chemical insults than any other cosmetic and is often exposed to both types of wear; in addition, while most color cosmetics are expected to wear for hours, nail polish is expected to wear for days.

The mechanical wear of nail polish can be caused by activities such as typing, texting, handling paper, washing dishes, etc. Meanwhile, chemical wear can occur with exposure to detergents, soap, shampoo, hand creams and lotions and sun protection products. For example, shampooing the hair exposes nails to both the chemicals in the shampoo as well as the abrasive action of washing. Therefore, nail polish must be a durable, shiny, hard, flexible film that it is resistant to cracking, chipping water and other chemical insults. This seemingly difficult task is accomplished with a balanced blend of film-former(s), plasticizers, solvents that dissolve the film formers(s), pigments (organic and inorganic, as well as effect pigments), suspending agents for the pigments and miscellaneous additives.

Pigments

The present individual consideration market has a perpetual assortment of nail clean shades, as displayed in Figure 1, from straightforward crèmes to complex shades utilizing colors and blends of impact shades. Early nail clean shades were essentially crèmes containing colors yet without metallic impacts. They normally were created in red, pink and earthy colored shades. Over time and various shades of natural red as well as yellow and orange colors opened up, the assortment of nail clean shades expanded dramatically. Formula 1 shows a general crème nail clean equation, whereas Formula 2 shows an overall ice nail clean.

The utilization of titanium dioxide brought about light, delicate shades, particularly in the pink reach and diminishing the degree of titanium dioxide prompted conceals that were sheer and gave all the more a characteristic completion. The intelligent expansion of this was clear nail clean, which gives a completed hope to nails without adding shading. Clear nail shines are planned distinctively in that they don't contain the suspending specialists expected to hold shades back from settling. Fresher inorganic blue (ferric ammonium ferrocyanide) and green colors (chromium oxides and chromium hydroxides) furnish further assortment particularly when joined with metallic pigments.

Inorganic or organic pigments: Nail polish pigments are either inorganic or organic. Inorganic pigments are metal oxides and include titanium dioxide and iron oxides (red, black and yellow). These materials have high opacity but tend to be dull and "dirty," meaning the color is not pure but contains a black or brown component. Organic pigments, on the other hand are bright, highly colored materials that impart clean colors on the nail.

The organic pigments used in nail polish often are lakes. Lakes are produced by precipitating water-soluble organic dyes onto inorganic substrates. This is accomplished by reacting acidic substituents on the water-soluble organic dyes with an appropriate cation in the presence of an appropriate inorganic substrate. The inorganic substrates are insoluble metal salts such as barium sulfate, calcium sulfate, aluminum hydroxide and aluminum oxide (alumina). The name of the lake gives the type of metal salt used, i.e. D&C Red No. 7 calcium lake. Examples of some commonly used organic lakes are listed in.

Pearlescent Pigments

Effect and metallic pigments fall under the broader category of pearlescent pigments. While both provide visual effects, effect pigments provide a broader variety of effects due to their design to manipulate light in specific ways. The use of metallic pigments has dramatically increased the number of nail polish shades available to the consumer. Aluminum powder and bismuth oxychloride give a variety of silvery tones ranging from dark metallic to bright "foil" effects.

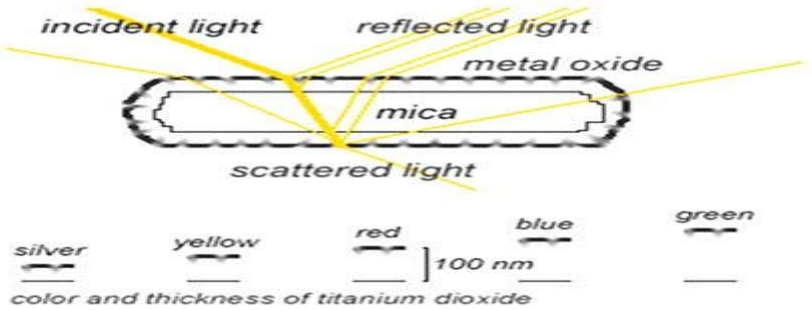

Figure 2 Interference pearl schematic.

Further, combining them with organic pigments such as the organic lakes can give a dramatic effect on the nails. The finish, in some cases, is reminiscent of the base coat/clear coat finish on cars.

Improvements and advances in manufacturing processes have given rise to a wide variety of effects from the same metal, such as aluminum. These effects can range from a brilliant shine to prismatic colors generated by embossing the aluminum platelets. A large majority of effect pigments are based on titanated micas, which are mica flakes coated with a thin layer of titanium dioxide. There are two broader effect pigment categories: reflectance pearls and interference pearls.

Reflectance pearls produce pearlescence through light reflection. The deposition of the titanium dioxide on the mica produces a sparkling effect. If titanium dioxide is used by itself, the resulting appearance is silvery white. Gold, copper, bronze or brown effects are achieved by adding a layer of iron oxide to the coating. Iron blue will provide a deep blue pearl effect while chromium hydroxide will produce a variety of green tones.

Interference pearls produce their effects through light refraction, as shown in **Figure 2**. The mica platelets are coated with a thin layer of titanium dioxide to produce a prismatic effect. Varying the film thickness produces the iridescence of different colors such as gold, orange, red, violet, blue and green.

Technological advances have led to the development of effect pigments where calcium sodium borosilicate is coated with titanium dioxide. The resulting effects, ranging from sparkling to multidimensional, vary depending on the size and thickness of the substrate, the thickness of the titanium dioxide, and additional substrate coating.

Pigments are predispersed before they are added to a nail polish formulation. It is important that the pigments be properly and completely dispersed for sufficient color development, gloss, application and smoothness. Dispersion can be accomplished using various devices such as media mills. Color chips consisting of nitrocellulose, plasticizer and pigment are prepared on a two-roll mill under a nitrogen blanket to avoid detonation of the nitrocellulose. The chips are then dissolved into a nail polish base to yield the pigment dispersion. This process provides good color dispersion, high transparency and gloss.

Primary Film-formers

As recently referenced, current nail lacquer was presented during the 1920s with the transformation of car paints into nail tones. While nitrocellulose is not generally used to paint vehicles, it is the most broadly utilized essential film-previous in nail clean. In spite of the fact that utilization of this material has disadvantages, its advantages incorporate minimal expense, sparkle, accessibility, absence of perilous monomers and low poisonousness. It is made by responding cotton or wood mash with a combination of nitric and sulfuric acids, as displayed in Figure 3. Nitrocellulose frequently is provided as a blend in with 30% ethanol or isopropanol, as dry nitrocellulose is hazardous when dry. This film-previous is combustible and touchy to debasement by daylight, heat, metals-particularly iron-and basic materials. It can likewise stain as it ages or debases, and arrangements can likewise stain and lose consistency on schedule.

Nitrocellulose is accessible in an assortment of grades and arrangement viscosities. These various grades are the aftereffect of the degree of nitration, with the most extensive level of nitration being utilized for nail clean. Thickness is reliant upon the atomic load of the polymer, which likewise influences adaptability, film strength and synthetic opposition. Higher atomic weight material will in general have better film qualities yet will in general form arrangement consistency quicker. Typically a blend of various atomic loads is utilized to give the right solids level (lower sub-atomic weight) and great film attributes (higher sub-atomic weight).

Different polymers, for example, cellulose acetic acid derivation propionate and cellulose acetic acid derivation butyrate have been utilized instead of or notwithstanding nitrocellulose.[3-5] These materials are utilized in the plan of topcoats and clear nail shines where the yellowing propensity of nitrocellulose would be an issue. There are likewise licensed nail clean plans that utilization non-

cellulosic essential film-formers like different copolymers of acrylic corrosive, methacrylic corrosive, acrylate esters, methacrylate esters and acrylamide.[6-9]

Secondary Film-formers

Nitrocellulose has a high glass transition temperature (53oC Tg),[10] which means it forms brittle films. Nitrocellulose films exhibit moderate gloss and moderate adhesion to the nail. They are sensitive to water and other chemical insults. However, the adhesion, gloss, flexibility and resistance performance of these films in nail polish can be improved by adding one or more secondary film-forming polymers.

Secondary film-formers must be compatible with the nitrocellulose and other ingredients such as solvents and plasticizers. The proper ratio of secondary film-former to nitrocellulose is necessary so that the film is neither too hard nor too soft. The correct ratio will vary depending on the type of secondary film-former used. An excessive amount of secondary film-former can lead to films that dry slowly and are too soft and flexible, while insufficient amounts can lead to films that dry quickly and become hard and brittle.

The classes of secondary film-formers have changed with time. One commonly used for many years was toluenesulfonamide/formaldehyde resin (TSFR), which was first introduced in the late 1930s.[11] TSFR is an oligomer that is formed by the condensation reaction of toluenesulfonamide and formaldehyde. While it is an efficacious secondary film-former for nitro- cellulose, concerns about parts-per-million residual formaldehyde has led to a decline in its use since the 1990s. Since the safety of TSFR has been questioned, other classes of compounds have been evaluated as substitutes for TSFR. These include toluenesulfonamide/epoxy resin (TSER),[12-13] polyester resins,[14–15] acrylate/methacrylate copolymers and polyvinylbutyral.[16]

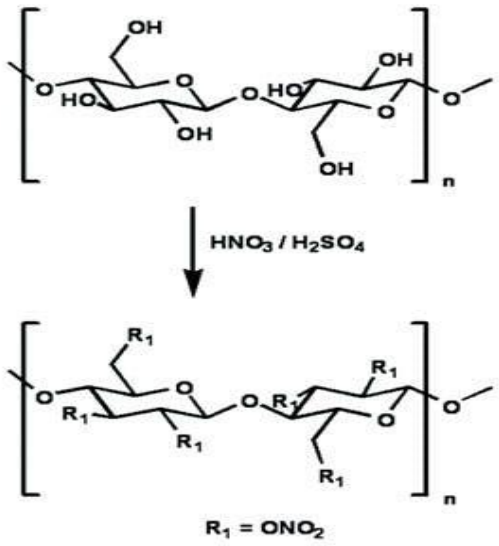

Figure 3: The nitrocellulose reaction.

Plasticizers

Since the glass change temperature of nitrocellulose is 53oC, which isn't adaptable at RT, a plasticizer should be added to the nitrocellulose to lessen its Tg and make an adaptable film. The proportion of plasticizer to film-previous is significant; an over the top measure of plasticizer will bring about a film that is excessively delicate and adaptable and dries too leisurely, while a lacking sum will bring about a film that is hard and weak and dries rapidly.

Various kinds of plasticizers might be utilized in nail finish plans, including: esters such ascitrates, benzoates (mono, di and tri)[17] and alkyl diesters of carboxylic acids;[18] N-subbed toluenesulfonamides;[14] and carbonates, for example, glycerol carbonate.[19] Dibutyl phthalate for a long time was the plasticizer of decision because of its impact on nitrocellulose, miscibility with nail clean definitions and minimal expense. In any case, since the 1990s, worries about the toxicological impacts of phthalates overall have prompted a diminishing in the utilization of dibutyl phthalate and an expansion in the utilization of different sorts of plasticizers.[17]

Solvents

Solvents are necessary to dissolve all the soluble components of nail polish such as the film-formers, plasticizers and other additives. Solvents help to regulate product viscosity, application, flow, leveling, drying time, hardness, gloss and stability. The most commonly used solvents are ethyl acetate, n-propyl acetate and n-butyl acetate. Ethyl acetate, with a boiling point of 77°C, is considered a fast-drying solvent while n-butyl acetate, with a boiling point of 126°C, is considered a medium-drying solvent. Small amounts of higher boiling esters are sometimes used as a “tail solvent” to ensure proper film formation. A blend of solvents is typically used to balance dry time with film formation. If the polish dries too quickly, it may not apply evenly and the film may not have a chance to properly form. If the polish dries too slowly, the film may be too soft for an extended amount of time, which can lead to smudging and sheet marks if applied before sleep. Quick-dry nail polishes contain higher amounts of the fast-drying solvents and tend to wear faster than polishes that contain higher levels of the medium-drying solvents. There has been speculation that low levels of the higher boiling solvents are retained in the nail polish film and keep the film more flexible to provide longer wear.

Small amounts of other volatile materials such as ethanol, isopropanol or n-butanol are added to improve the solvency of the primary solvents. They function by forming hydrogen bonds with polar materials in the formulation and remain in films longer than would be expected based on their boiling points. Isopropanol often is used because it does not have stringent regulatory issues. Nitrocellulose is supplied wet with 30% isopropanol.

Diluents are volatile materials added to a formulation to reduce its cost. Diluents do not dissolve any of the nitrocellulose, secondary film-formers, plasticizers or other additives but they are considered part of the solvent system because they are volatile liquids like the majority of the active solvents. Two examples of diluents are n-heptane and toluene. N-heptane is still utilized while the use of toluene has dramatically decreased since the early 1990s, when the California Air Resources Board imposed restrictions on its use. Further concerns about health issues also played a role in the removal of toluene from nail polish formulations.[20]

Suspension Agents

Suspension agents are added to pigmented nail polish to keep pigments and other colorants from settling to the bottom of the container. This keeps the product homogeneous and aesthetically pleasing to the consumer. Suspension agents are expected to function during the lifetime of the product, from manufacture to consumption, and to do so under challenging, ambient conditions. Popular suspension agents include organically modified montmorillonite clays, such as quaternizedhectorites and bentonites.

Stearalkoniumhectorite and stearalkonium bentonite are common in pigmented nail polish. Stearalkonium chloride is the quaternary ammonium compound used to treat the surface of the clays, and the organoclays impart thixotropy to the nail polish. As is generally known, thixotropy, as depicted is a rheological behavior that exhibits high internal structure/viscosity when undisturbed, but exhibits lower viscosity when exposed to high shear (shaking or brushing), which allows for mixing and easy application. The phenomenon is also referred to as shear thinning. The high internal structure/viscosity is what keeps the pigments suspended when undisturbed.

Organoclays are typically incorporated into nail polish in the form of suspension bases, also referred to as pre-gels, which are dispersions of the organoclay in nitrocellulose, sovent(s), activators and, optionally, resin(s) and/or plasticizers. Activators are usually polar organic solvents (lower alcohols and ketones, propylene carbonate, etc.), which are added before dispersion to maximize gel strength. Sometimes a small amount of water is added as well. The addition of these materials into the mixture of clay and resin solution helps the gels to swell. The suspension bases are produced using high shear dispersion under carefully controlled conditions.

Formulation

Colored nail polishes are formulated from suspension bases, additional solvent(s) to reduce the viscosity, pigment dispersions, pearlescent pigments (if required by the shade), additives to improve brushing, and other materials added to provide certain benefits. Additional materials have included powdered polytetrafluoroethylene, powdered diamond, vitamins, calcium salts, panthenol, biotin and other materials, and are usually added in small amounts as evidenced by their position in the ingredient labeling.

As noted, clear nail polishes and topcoats are formulated without suspension bases and pigments. They usually are comprised of higher levels of nitro-cellulose, other film-forming resins and plasticizers, and are are expected to perform like a pigmented nail polish. Topcoats are applied over the initial pigmented coats of nail polish and are expected to apply easily, dry quickly and form hard, glossy films. Additional resins are often added to improve gloss. Non-nitrocellulose polymers such as cellulose acetate and cellulose acetate propionate are often used due to their non-yellowing properties.

The most common issue encountered when formulating nail polish is that the shade does not match the standard. This requires formulators to have a good “color eye” so they can see what the differences are and adjust the shade accordingly. Further, if the viscosity of the formulation is too high or too low, the batch can be adjusted with additional solvent, when too high, or additional suspension base or nitro-cellulose solution, when too low.

CONCLUSION

Nail clean, as has been shown, is genuinely modern in its sythesis and definition, which take into consideration the bunch of shadings and impacts accessible to the buyer. As nail clean planning pushes ahead, the most probable changes will be in new pearlescent impact colors, which are not managed by the FDA. There may likewise be endeavors to present new film-framing pitches and plasticizers into nail finish details, despite the fact that it is improbable that nitrocellulose will be supplanted as the essential film-shaping gum because of its expense, accessibility and sustainable sources (cotton and wood). Extra guidelines may likewise go along that limit different fixings utilized in nail clean.

As noticed, the business has seen a development away from toluene, dibutyl phthalate and toluenesulfonamide/ formaldehyde sap, and extra materials, for example, plasticizers might go under ecological or toxicological survey. At long last, there might be endeavors to additionally diminish how much unstable natural mixtures (VOCs) in nail shines, albeit this is not yet clear. Regardless of these worries, the business can anticipate the nail clean class as having a "bright" future.

REFERENCES

1. J Peirano, Other film formers for nail enamels, *Amer Perf Cosm*, 84: 35–36 (Aug 1969)
2. US Pat 5,747,019, Nail polish top coat free of toluene, MJ Weisman, assigned to CS Martens (Apr 3, 1997)
3. US Pat 5,720,804, Top nail coat composition, FL Marten, assigned to Almell Ltd. (Nov 30, 1995)

4. US Pat 4,126,675, Nail lacquer compositions, J Boulogne and C Papantoniou, assigned to L'Oréal (May 9, 1977)
5. US Patent 4,384,058, G Galante, assigned to Avon Products (Mar 23, 1981)
6. US Patent 4,747,419, Nail polish compositions and means for applying same, MD Flynn and AJ Suares, assigned to Cheesebrough-Ponds, USA Co. (Jun 17, 1986)
7. US Patent 5,772,988, Nail enamel compositions from acetoacetoxy methacrylate copolymer, FC Pagano.
8. AA Patil, RW Sandewicz, WL Anton and HJ Spinelli, Assigned to Revlon Consumer Products Corp. (May 10, 1996)
9. RL Miller, Polymer Handbook, 3rd ed, Wiley-Interscience, New York (1989) pp VI/258.
10. AA Patil and RW Sandewicz, Society of Cosmetic Chemists, Monograph No. 6, Nail lacquer technology.
11. US Patent 4,996,284, Novel epoxy sulfonamide-based resins, a process for their preparation and use of same, LX Mallavarapu (Apr 24, 1991).
12. US Patent 5,001,175, Epoxy-sulfonamide compounds and compositions, SB Skora, assigned to Estron Chemical (Mar 19, 1991).
13. US Patent 5,326,796, Use of an arylsulphonyl-urethane as film forming resin in nitrocellulose nail varnishes, new arylsulphonylurethanes and new nitrocellulose nail varnishes, M LeCacheur, E Wimmer and V Mutterer, assigned to SocieteNationale des Poudres et Explosifs (May 4, 1993).
14. US Patent 4,301,046, Universal nail polish using polyester resin, ML Schlossman, assigned to Tevco Inc. (Jan 10, 1980).
15. US Patent 5,290,543, Long wearing nail enamel topcoat and related methods, H Ounanian, J Disomma, D Coleman, RW Sandewicz, A Castrogiovanni, assigned to Revlon Consumer Products Corp (Sep 17, 1992).
16. US Patent 5,225,185, Nail enamels containing glyceryl, glycol or citrate esters, A Castrogiovanni, RW Sandewicz, SW Amato, assigned to Revlon Consumer Products Corp (Apr 27, 1992).
17. US Patent 5,792,447 Nail enamel composition RL Socci and A Ismailer, assigned to Kirker.
18. Enterprises (Nov 15, 1996).
19. US Patent Application 20100158835, Plasticizer of Natural origin for Nail Polish, M Bandres, A Deswartvaegher, P De Caro, J-P Sennet and ST Roux, assigned to Durlin France (Jun 24, 2010).
20. C Drahl, What's that stuff? Nail enamel, Chemical & Engineering News 86 32 42 (Aug 11, 2008).