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(54) Title: AQUEOUS NAIL LACQUER

(57) Abstract

An aqueous nail lacquer comprising an alcohol soluble nitrocellulose, a plasticiser, an active solvent for dissolving the nitrocellulose and a bridging solvent soluble with the nitrocellulose, the active solvent and the water to form an aqueous nail lacquer solution.

AQUEOUS NAIL LACQUER

The present invention relates to nail lacquers and more particularly to aqueous nitrocellulose based lacquers.

Conventional nail lacquers employ an ester soluble nitrocellulose film former dissolved in a highly active ester based solvent system. Generally, the active solvent system is oily and is not water compatible. Water can only be incorporated into the lacquer using an emulsifier. Indeed, water when present in conventional nail lacquers is usually regarded as an impurity which can result in cloudy and opaque lacquers.

Typically, aqueous impurities are present at levels of approximately 1%. Higher levels of water impurity e.g. in the region of 10% are generally unacceptable as the nail lacquers then cloud and drying time can also be reduced. Therefore, the presence of water in standard nail polish formulations is unacceptable at more than trace amounts.

US-A-5284885 describes an aqueous nitrocellulose emulsion comprising a water phase and a lacquer phase. US-A-5102654 also describes a nitrocellulose based emulsion composition comprising a water phase and a lacquer phase.

US-A-4402935 discloses a nail lacquer comprising nitrocellulose and a combination of polyvinyl butyryl resin, water and urea to improve the moisturising properties of the lacquer.

US-A-4158053 discloses a nail lacquer comprising aqueous emulsion polymers instead of nitrocellulose.

The aqueous emulsion based compositions of the prior art are unsatisfactory due to the risk of phase separation over time resulting in an unattractive and inferior product.

Coloured nail lacquers generally require a suspending agent or thickener to suspend solid ingredients. Most conventional nail lacquer formulations utilise a clay thickener such as bentone which is dispersed in a volatile water immiscible solvent such as toluene.

Toluene is the most toxic solvent in current nail lacquer formulations and is designated as harmful under solvent regulations. However, bentonite suspending agents are highly compatible with the highly active ester solvent systems and are therefore preferred.

Nevertheless, the bentonites have certain disadvantages not least being their coatings which are derived from animals and which therefore can prove unattractive to some users.

Accordingly, standard nail lacquers require relatively high amounts of organic components which can be volatile and toxic. The organic components are generally used as solubilisers to solubilise nitrocellulose and clays in the lacquer.

Due to the high percentage of organic components in known nail lacquers, production procedures are difficult and costly due to necessary safety controls. Moreover, the resulting lacquers are flammable and potentially toxic. In addition, due to the use of the volatile organic components nail lacquer formulations can release unpleasant odours which are unattractive to the user.

Due to general water incompatibility of prior art lacquers, particularly in the absence of an emulsifier, many water soluble nail benefit agents can only be incorporated into the lacquers at very low levels, not at all or substituted with functionally equivalent but oily organic benefit agents. For example, the lacquers of the prior art frequently contain non-volatile organic components which can have unpleasant side effects e.g. formaldehyde which is used as a nail strengthener.

In short, attempts have been made to produce an aqueous nail lacquer formulation which obviates at least some of the aforementioned disadvantages of non-aqueous formulations. However, the resulting emulsions have been found to have inferior rheological properties and as indicated above often result in lacquers which separate on standing.

An object of the invention is to provide an aqueous nail lacquer comprising a base solution having a high water content, reduced volatile organic component content and reduced animal originating components.

A further object of the invention is to provide a nail lacquer having a clay free suspension system compatible with the aqueous solution.

Throughout this specification, unless the context requires otherwise, percentage values used in describing a composition are percentage by weight.

Throughout this specification, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or "comprising" will be understood to imply the inclusion of a stated integer or group of integers, but not the exclusion of any other integer or group of integers including method steps.

The above objectives are achieved by providing a cellulose based nail lacquer having a water content of from 1 to 20%. The cellulose comprises an alcohol soluble nitrocellulose.

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Specifically, in accordance with the invention there is provided an aqueous nail lacquer comprising an alcohol soluble nitrocellulose, a plasticiser, an active solvent for dissolving the nitrocellulose, water and a bridging solvent soluble with the nitrocellulose, the active solvent and the water to form an aqueous nail lacquer solution, characterised in that the bridging solvent comprises ethanol or propylene glycol monopropyl ether optionally together with other alcohols in a total amount of 20-50% by weight, and the content of water is in the range of 1-20% by weight.

Preferably, the water content is from 8 to 20%. Preferably, the composition comprises at least one alcohol. Preferably, the composition comprises 8 to 50% ethanol, and more preferably more than 10% ethanol.

Suitably, the composition comprises a suspending agent, preferably a silicate suspending agent and more preferably a hydrophobic silicate. More particularly, the compositions of the invention are clay free thereby eliminating raw materials of animal origin. Accordingly, the compositions are toluene free thereby minimising the content of dangerous organic components.

The compositions of the invention contain 1-20% water and high levels of ethanol.

In particular the invention provides an aqueous nail lacquer comprising an alcohol soluble nitrocellulose, a plasticiser, an active solvent for dissolving the nitrocellulose and a bridging solvent soluble with the nitrocellulose, the active solvent and the water to form an aqueous nail lacquer solution. Preferably, the active solvent is an ester. More preferably, the ester is an acetate ester selected from the group comprising ethyl acetate and butyl acetate or a mixture thereof.

Suitably, the bridging solvent comprises an alcohol. Advantageously, the alcohol is selected from the group comprising isopropyl alcohol, methoxypropanol, ethanol and mixtures thereof. Alternatively or in addition, the bridging

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solvent comprises propylene glycol monopropyl ether. Preferably the nail lacquer further comprises a non-clay based suspending agent. More preferably the suspending agent is a hydrophobic fumed silica. Suitably, the nail lacquer further comprises a nail benefit agent.

The invention also provides an aqueous nail lacquer comprising 7% to 25% alcohol soluble nitrocellulose, a plasticiser for the nitrocellulose, 20% to 50% active solvent for dissolving the nitrocellulose, 10 to 50% bridging solvent

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and at least 1% water, the bridging solvent being soluble with the nitrocellulose, the active solvent and the water. Suitably, the lacquer comprises 20 to 40% bridging solvent. Preferably, the nail lacquer comprises 1% to 20% water.

The nitrocellulose forms a primary film and should have a viscosity value that enables the manufacture of cosmetic nail lacquer compositions that flow readily and are capable of producing a film with sufficient gloss. The nitrocellulose should be perfectly neutral. Non-neutral nitrocellulose compositions may damage the fingernail and destroy the pigments used in tinting nail lacquers.

The solubility characteristics of nitrocelluloses are determined by their nitrogen content. Alcohol soluble nitrocelluloses are utilized in the nail lacquers of the invention. The alcohol soluble nitrocelluloses preferably comprise 10.9% to 11.7% nitrogen.

Particularly preferred alcohol soluble nitrocelluloses are AH25/IPA available from Hagedorn and DHL8/13 available from ICI.

The alcohol soluble nitrocelluloses utilised in the nail lacquers of the invention provide a nail lacquer which is flexible, glossy and has good plastics properties.

The alcohol soluble nitrocelluloses of the nail lacquers of the present invention facilitate lower levels of active solvent than is possible with the ester soluble nitrocelluloses. The level of alcohol bridge solvent used is in part determined by the level of nitrogen in the nitrocellulose - as the alcohol solubility decreases the level of active solvent required is increased.

The use of alcohol soluble nitrocelluloses in combination with the bridging solvent system of the present invention results in a nail lacquer having a reduced active organic solvent content and improved film forming properties.

The active solvent system of the invention comprises an ester solvent. Suitable esters include ethyl acetate and butyl acetate. Generally, the ester is present at 20% to 40% of the composition.

The plasticizer is suitably present at between about 5 and 10% about by weight of the composition. Suitable plasticizers include dibutyl phthalate, camphor, sucrose acetate, isobutylate and castor oil.

The bridging solvent preferably comprises an alcohol. Alcohols suitable for use in the present invention are those which are compatible with the alcohol soluble nitrocellulose and water. Examples include methoxypropanol, ethanol and isopropyl alcohol and mixtures thereof. Alternatively or in addition propylene glycol monopropyl ether can be used.

Alcohol from natural sources such as sugar cane can also be used in the aqueous nail lacquers of the invention. Fermentation alcohol from natural sources is sometimes preferred over petroleum sourced alcohol which can be perceived as being environmentally unfriendly.

As indicated above, the alcohol levels utilised in the present invention are to a large extent determined by the alcohol solubility of the nitrocellulose and hence the degree to which the active organic solvent system levels are reduced. Suitably, the alcohol is present at a level of at least 10%, preferably at 10 to 50% and more preferably 20 to 40%. Generally, the level of bridging solvent will also be

determined according to the final rheological properties required of the nail lacquer.

The nail lacquer solutions of the invention comprise high water levels. Generally, the nail lacquers have a total water content of from 1% to 20%, preferably from 4% to 12% by weight of the composition and most preferably 7.5% to 8.5%. The water can be added separately to the composition or can be present as an impurity or solvent in other components of the lacquer e.g. the alcohols.

The optimum level of water added to the nail lacquer solution is again determined in part by the alcohol solubility of the nitrocellulose and the respective levels of active and bridging solvent.

Plasticisers are also generally included in nitrocellulose based nail lacquers. Suitable plasticisers include castor oil, camphor, raw castor oil, dibutyl phthalate and tricresyl phosphate. The plasticisers can be used alone or in combination.

Generally, the nail lacquers of the invention are clear or transparent.

The nail lacquers of the invention can also comprise a non-clay suspending agent to suspend solid ingredients in the lacquer solution.

Suitable suspending agents include silicates such as hydrophobic or fumed silicas. The silicate suspending agents preferably have a surface area of 110-260m^2/g, more preferably 110 +/- 20$^2m/g$. The particle size can range from 7 to 18nm, is more preferably 12 to 18nm and is most

preferably 16nm. An example of a suitable suspending agent is Aerosil R872 (Trade Mark) available from Degussa.

Hydrophobic silicates are preferred as hydrophilic silicates can prove difficult to disperse and reduce gloss since they function as matting agents.

Silica suspending agents are not favoured in nail lacquer compositions of the prior art as they have been found to generate a matting effect and are difficult to disperse due to the water immiscible solvents of the current non-aqueous nail lacquer formulations. Accordingly, the suspending effects of the silica have been found to be poor and nail lacquer formulators have been forced to use clay systems.

However, the aqueous nail lacquers of the present invention facilitate the use of silicates which result in a low viscosity suspension which facilitates the incorporation of higher solids levels into the nail lacquer composition as compared with nail lacquer compositions of the prior art. Clay suspending agents result in a high viscosity product which necessitates a lower solids content e.g. lower levels of nitrocellulose, plasticizer or pigment.

Accordingly, the suspension system utilized in the nail lacquer of the present invention facilitates the use of higher levels of nitrocellulose which enhances film formation resulting in increased gloss and a thicker nail film.

The nail lacquer of the invention can also comprise a secondary resin. Suitable secondary resins compatible with nitrocellulose include most natural resins such as benzoin, Damar (Trade Mark), ester gum, Pontianac Sandara, Shellac and any synthetic resins such as the alkyl, acrylate and methacrylate based resins and polyester resins. Polyester

resin is a preferred secondary resin. Other secondary resins include: nylon acrylate copolymer resins and nylon/acrylate/acrylonitrile copolymers.

Nail benefit agents can be readily incorporated into the lacquers of the invention - water soluble additives being particularly suitable e.g. nail growth promoting ingredients such as panthenol, nail strengtheners such as glyoxal and other nail benefit agents such as calcium and UV light absorbers, vitamins and moisturising agents. Nail benefit agents are generally incorporated into the nail lacquer at comparatively low levels - 0.0001% to 1% being typical.

Water soluble dyes can also be added to the nail lacquer formulation of the invention to increase the potential colour range of the lacquers.

An advantage of the solvent system of the nail lacquer of the invention is that it is in the form of a clear solution which does not separate on standing as compared with opaque emulsions of the prior art i.e. the active solvent system, the bridging solvent and the water form a solution.

The solvent system is compatible with alcohol soluble nitrocelluloses in contradistinction to the ester soluble nitrocelluloses of the prior art. Moreover, the alcohol soluble nitrocelluloses provide a high degree of flexibility, plasticity and glossiness in the finished lacquer.

A principle advantage of the present invention is that a nail lacquer is provided which contains high levels of water and which the solvents are in the form of a solution. A bridging solvent or solution is provided by an alcohol between an active solvent for the nitrocellulose and the water. Therefore, the nail lacquer of the invention is not in the

form of an emulsion and is not susceptible to separating on standing.

The provision of the bridging solvent and the use of an alcohol soluble nitrocellulose reduces the level of volatile organic components required in the composition e.g. the active solvent system generally required in nail lacquer compositions.

The hydrocarbon components are replaced in the nail lacquer of the invention by high levels of alcohol which function as the bridging solvent.

The resultant nail lacquer is clear and the high levels of water do not result in clouding as is the case of the emulsions of the prior art.

The nail lacquer compositions of the prior art utilise an ester soluble nitrocellulose which requires high levels of organic solvents for dissolution. However, the combination of the alcohol soluble nitrocellulose and the alcohol bridging solvent of the present invention facilitates a significant reduction in the levels of organic solvents required.

The nail lacquers of the invention facilitate a 20% reduction in the levels of volatile organic components required as compared with the nail lacquers of the prior art. Accordingly, in addition to the aesthetic, consumer and production benefits the nail lacquers of the invention provide a significant environmental benefit over the formulations of the prior art.

The bridging solvent system of the invention facilitates the use of non-olay based suspension systems.

An advantage of the preferred silica based suspension agent is that it is a low viscosity suspension agent which facilitates the incorporation of higher solids levels in the nail lacquer composition than is possible with bentonites or hectorites.

Moreover, the use of a silica based suspension system obviates the need to use the toluene type solvents required for clays thereby further increasing the environmental advantages of the nail lacquer of the present invention.

The absence of clays results in a solution having a low viscosity which facilitates a solids content of over 30%, preferably 33-38% as opposed to 25-30% in a conventional nail lacquer. The combination of the higher solids content plus the high water content results in a total solvent content in the new system of approximately 58% as opposed to 72% for a conventional nail lacquer.

Water is incompatible with the lacquers of the prior art as the presence of water in such a system would slow down the drying time.

Surprisingly, we have now found that water can be added to the nail lacquer of the present invention without adversely effecting the drying time contrary to what would be expected in the formulations of the prior art.

It has also been found, that the nail lacquers of the invention reduce moisture loss from the nail, improve flexibility of the nail and also have been found to improve the strength of the nail. It is believed that the moisturising effect helps to maintain flexibility and reduce brittleness in the nail structure.

It is believed that the high water content in the nail lacquer facilitates dissolution of water soluble nail benefit agents into the nail lacquer e.g. glyoxal.

Although the Applicants do not wish to be bound by any theory, it is proposed that the moisturising effect exhibited by the nail lacquers of the present invention is due to the trapping of water molecules within a film lattice formed by the alcohol soluble nitrocellulose.

The trapped moisture molecules provide a moisturising effect. Moreover, it is believed that the trapped water molecules may provide a vehicle through which nail benefit agents, particularly water soluble benefit agents, such as glyoxal can be effectively transferred to the nail.

In addition, the high degree of flexibility exhibited by the nail lacquers of the present invention may also result from the lattice produced upon drying.

The nail lacquer of the invention is formaldehyde free. Formaldehyde has been shown to produce undesirable side effects, such as inflammation, hardening and/or formation of horn on adjacent skin area. Furthermore, formaldehyde can have dangerous toxic effects, especially on the nerve cells of the skin and capillaries.

Instead, the alcohol/aqueous nail varnish formulation of the invention facilitates the use of high levels of glyoxal; a nail strengthener, instead of formaldehyde. The amount of glyoxal in the cosmetic composition of the present invention found effective for strengthening nails when added to an aqueous nitrocellulose base nail lacquer preparation is about 0.0001-1%. Accordingly, the use of the aqueous solvent

system facilitates higher levels of glyoxal to obtain the beneficial effect of glyoxal in the formulation.

Embodiments of the invention will now be described having regard to the following examples:

EXAMPLES

Typical nitrocellulose based nail lacquer compositions of the prior art comprise the following ingredients:

Nitrocellulose	(7-25%, more preferably 10-18%, and most preferably 12-16%.)
Secondary Resins	(2-8%) e.g. Toluene Sulphonamide Formaldehyde Resin, Acrylates Copolymer, Polyester.
Plasticizers	(2-8%) e.g. Dibutyl Phthalate, Camphor, Sucrose Acetate, Isobutylate, Castor Oil.
Solvents	(55-80%, more preferably 65-80%) e.g. Toluene, Butyl Acetate, Ethyl Acetate, Isopropyl Alcohol.

Other optional ingredients include:

Thickening and Suspending Agents	(0.05-5%) e.g. Organically modified Smectite Hectorite, Bentonite, Montmorillionite Clays.
Ultraviolet Absorbers	E.g. Drometrizole, Benzophenone.
Colours	E.g. Iron Oxide, Titanium Dioxide, Ferric Ferrocyanide and Organic Lakes such as D & C Yellow No 5 Aluminium Lake and D & C Red No 6 Barium lake.

Decorative Materials E.g. Titanium Coated Micas, Bismuth Oxychloride, Mylar Glitters.

A typical example is:

Comparative Example 1 (Nail polish formulation of the prior art)

Butyl Acetate	24-40%
Toluene	16-30%
Ethyl Acetate	4-12%
Isopropyl Alcohol	2-6%
Butanol	2-6%
Dibutyl Phthalate	4-12%
Nitrocellulose	8-20%
Toluene Suphonamide Formaldehyde Resin	4-12%
Acrylates Copolyment	0.05-1%
UV Absorber	Less than 0.1%
Camphor	0.4-1.5%
Stearalkonium Hectorite	0.4-1.5%
Titanium Coated Mica	1.5-2.5%
D&C Yellow No.5 Aluminium Lake	0.02-0.1%
D&C Red No.6 Barium Lake	0.01-0.1%

Viscosity:	Initial	3000-3600cps
	High Shear	800-1000cps
	Recovery	1500-2000cps

Moisture Content: Less than 0.5%
Solids Contents: 26-28%

The abovementioned ingredients were mixed together in conventional manner to form a standard nail varnish having a low water content, a high volatile organics content and a low solids content.

Example 2 Coloured Nail Lacquer of the invention

Component	%wt	Function
Ethyl Alcohol	20-40%	Solvent
Ethyl Acetate	10-20%	Solvent
Nitrocellulose	10-20%	Primary film former
Butyl Acetate	10-20%	Solvent
Dibutyl Phthalate	5-10%	Plasticizer
Polyester Resin	5-10%	Secondary resin
Deionised Water	5-10%	
Isopropyl Alcohol	5-10%	Solvent
Silicone Dioxide	1-5%	Suspending Agent
Camphor	0.1-1%	Plasticizer
Di-isopropyl Adipate	0.1-1%	Plasticizer
Polysorbate 20	0.1-1%	Silicate activator
2.4 Dihydroxybenzophenone	<0.1%	UV absorber
Titanium Coated Mica	1-2%	
D&C Yellow 5 Aluminium Lake	0.01-1%	
D&C Red 6 Barium Lake	0.01-1%	
Iron Oxide	0.01-1%	Water soluble active
Glyoxal	0.01-1%	Water Soluble active
D Panthenol	0.01-1%	Water Soluble active
Lactic Acid	0.01-1%	Water Soluble active
Tocopheryl Acetate	0.01-1%	Active
Silk Hydrolysate	0.01-1%	Water Soluble active
Calcium Panthenoate	0.01-1%	Water Soluble active

Viscosity:	Initial	1000-1400 cps
	High Shear	400-600 cps
	Recovery	900-1200 cps

Moisture Content: 7-10%

Solids Content: 32-38%

The above mentioned components were mixed as follows:

1. A stainless steel mixing vessel was charged with Dibutyl phthalate, butyl acetate, ethyl acetate, half the ethanol, polyester resin and iso propyl adipate. The mixer was started and the following ingredients were added with sufficient agitation:

   Nitrocellulose, camphor, UV absorber.

   The mixture was stirred until fully dissolved.

The silica was then added under high shear mixing or an enclosed bead mill system to achieve optimum dispersion or gloss.

2. The remaining ethanol, deionised water and polysorbate 20 was blended and added slowly to phase 1 with mixing to prevent water precipitating out the nitrocellulose.

3. The remaining ingredients were added and stirred until homogeneous.

Example 3 Clear Nail Lacquer

Component	%wt
Ethyl Alcohol	20-40%
Ethyl Acetate	10-20%
Nitrocellulose	10-20%
Butyl Acetate	10-20%
Dibutyl Phthalate	5-10%
Polyester Resin	5-10%
Deionised Water	5-10%
Isopropyl Alcohol	5-10%
Camphor	0.1-1%

Di-isopropyl Adipate	0.1-1%
Polysorbate 20	0.1-1%
2.4 Dihydroxybenzophenone	<0.1%
Glyoxal	0.01-1%
D Panthenol	0.01-1%
Lactic Acid	0.01-1%
Tocopheryl Acetate	0.01-1%
Silk Hydrolysate	0.01-1%
Calcium Panthenoate	0.01-1%

Viscosity:	250-350cps
Moisture Content:	7-10%
Solids Content:	32-38%

The abovementioned components were mixed as follows:

1. A stainless steel mixing vessel was charged with Dibutyl phthalate, butyl acetate, ethyl acetate, half the ethanol, polyester resin solution and iso propyl adipate. The mixer was started and the following ingredients were added with sufficient agitation:

   Nitrocellulose, camphor, UV absorber.

   The mixture was stirred until fully dissolved.

2. The remaining ethanol, deionised water and polysorbate 20 was blended and added slowly to phase 1 with mixing to prevent water precipitating out the nitrocellulose.

3. The remaining ingredients were added and stirred until homogeneous.

Example 4

A typical nail lacquer formulation of the invention is as follows:

Component	%wt
Propylene Glycol Monopropyl Ether	27.00%
Ethyl Acetate	15.00%
Nitrocellulose	14.00%
Butyl Acetate	15.00%
Dibutyl Phthalate	6.00%
Deionised Water	8.00%
Isopropyl Alcohol	5.5%
Polyester Resin	6.0%
n Butanol	1.1%
Camphor	1.0%
Diisopropyl Adipate	0.5%
Polyoxyethylene 20 Sorbitan Monolaurate	0.5%
Miscellaneous ingredients including Glyoxal, Tocophenyl acetate, 2,4 Dihydroxybengophenone, Tocopheryl Acetate	
2.4 Dihydroxybenzophenone :	0.4%
Potassium Hydroxide	QS
Dye	QS

SOLIDS:	31-34%
MOISTURE:	6-8%
SPECIFIC GRAVITY:	0.97-0.99
COLOUR:	standard
FLASH POINT:	6°C
VISCOSITY:	270-330 cps
Ph:	6.5-6.8

Example 5 Nail Strengthening Characteristics

An experiment as described below was carried out to compare the nail strengthening characteristics of the lacquer of Example 4 with the lacquer of Comparative Example 1.

The objective of this experiment was to measure the strength of human fingernails before and after treatment with the nail lacquer of Example 4 and the lacquer of Comparative Example 1.

The method measured in vitro the stiffness of human fingernail clippings with an Instron Tensile Tester in a controlled temperature and relative humidity environment.

Materials and Method:

The products tested were:

Lacquer of Comparative Example 1
Lacquer of Example 4

Human fingernails were cut width-wise into rectangular bar shapes 7mm long and 3mm wide. Each fingernail served as its own control. The sample size was 15 fingernails per product.

Test Method TR-170 employed an Instron Model 4501 Universal Testing Instrument to produce a load VS. deflection (stress/strain) curve for each fingernail. The procedure used a Bjorksten Flexure Apparatus, which is essentially a miniature three-point bending fixture (Maloney MJ, Paquette EG and Shansky A, The physical properties of fingernails, 1. Apparatus for physical measurements, J.Soc. Cosmet. Chem **28**:415-425 (August 1977)). A computer controlled the data collection and calculation. The stiffness, or strength of

each fingernail was determined by measuring the slope of the stress/strain curve. Because fingernails are hygroscopic, all testing was done in a controlled environment of 21°C and 20% relative humidity.

The strength of each fingernail was measured after equilibrating at the test conditions for 48 hours. Next, one coat of each product was applied to the top and bottom surfaces of each nail with a brush. After drying for 18 hours the strength was measured.

The data is listed in the tables and displayed in the attached graph. Table 1 presents the actual stiffness, or strength before and after treatment, while Table 2 and Figure 1 present the per cent change as a function of treatment.

Conclusion

One application of lacquer of Comparative Example 1 increased the strength of fingernails 15%. One application of lacquer of Example 4 almost doubled the strength of the nails, increasing the strength by 28.8%. The effect was statistically significant at the 90% confidence interval.

TABLE 1

THE EFFECT OF NAIL POLISH ON THE STRENGTH OF FINGERNAILS
gram/cm, mean of 15 nails

APPLICATION	COMPARATIVE EXAMPLE 1	EXAMPLE 4
before	11652.1	10739.6
after	12928.0	13276.2

TABLE 2

THE EFFECT OF NAIL POLISH ON THE STRENGTH OF FINGERNAILS
per cent change from before, mean + 90% confidence interval

APPLICATION	COMPARATIVE EXAMPLE 1	EXAMPLE 4
1	+ 15.0 ± 5.5	+ 28.8 ± 5.1

Example 6 Moisturising Effect

The moisturising properties of the formulations tested in Example 5 were compared:

The following protocol was followed:

The environmentally controlled room was set to the temperature of the surface of the human skin (37°C) at 20% relative humidity one hour prior to commencing the experiment. This condition was maintained throughout the duration of the study. Once the required temperature was

obtained three glass beakers (250ml) were filled with water (200ml). Each beaker of water was then covered, the first beaker with a solvent resistant substrate (comfeel) without the test article (control), the second beaker was covered with the solvent resistant substrate which was cast with a film of the test nail polish and the third beaker was covered with the solvent resistant substrate cast with a thin film of the control polish. Each beaker was weighed. If the weight of the apparatus with the nail polishes cast on the solvent resistant substrate was more than that of the control then a few drops of water were added to the control beaker until all beakers weighed the same. The three covered beakers were placed on a bench/table and left in the environmentally controlled room for 24 hours. Each covered beaker was assessed gravimetrically at 0,4,8,12,16 and 24 hours.

The rate of moisture transmission through the film of nail polish was evident by a decrease in weight of the apparatus as a result of water evaporation.

If the rate was reduced by 20% with the solvent resistant substrate cast with the film of nail polish, then it could be concluded that less moisture would be lost from nail, leaving it moisturised.

The test was performed at 37°C and 30% relative humidity.

TABLE 3

Vessel	Weight (g) of Vessel at t = 0 hour	Weight (g) of Vessel at t = 24 hours	Weight (g) of moisture lost due to evaporation
1 (control)	387.200	377.835	9.365
2 (Example 4)	386.475	384.675	1.8
3 (Comparative Example 1)	387.390	384.380	3.01

The results shown in Table 3 show a significant improvement in moisturising properties of the nail lacquer of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1. An aqueous nail lacquer comprising an alcohol soluble nitrocellulose, a plasticiser, an active solvent for dissolving the nitrocellulose, water and a bridging solvent soluble with the nitrocellulose, the active solvent and the water to form an aqueous nail lacquer solution, characterised in that the bridging solvent comprises ethanol or propylene glycol monopropyl ether optionally together with other alcohols in a total amount of 20-50% by weight, and the content of water is in the range of 1-20% by weight.

2. An aqueous nail lacquer as claimed in claim 1 characterised in that the active solvent is an ester.

3. An aqueous nail lacquer as claimed in claim 2 characterised in that the ester is an acetate ester selected from the group comprising ethyl acetate and butyl acetate or mixtures thereof.

4. An aqueous nail lacquer as claimed in 1 characterised in that the alcohol is selected from the group comprising isopropyl alcohol, methoxypropanol, ethanol and mixtures thereof.

5. An aqueous nail lacquer as claimed in any of the preceding claims characterised by further comprising a non-clay based suspending agent.

6. An aqueous nail lacquer as claimed in claim 5 characterised by the suspending agent being a hydrophobic fumed silica.

7. An aqueous nail lacquer as claimed in any of the preceding claims further comprising a nail benefit agent.

8. An aqueous nail lacquer according to any preceding claim comprising 7% to 25% alcohol soluble nitrocellulose, a plasticiser for the nitrocellulose, 20% to 50% active solvent for dissolving the nitrocellulose, 10 to 40%

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bridging solvent and at least 1% water, the bridging solvent being soluble with the nitrocellulose, the active solvent and the water.

9. A nail lacquer as claimed in any of claims 1 or 8 comprising 4 to 12% water.

10. A nail lacquer substantially as hereinbefore described with reference to Example 2, 3 or 4.

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FIGURE 1
THE EFFECT OF NAIL POLISH ON FINGERNAIL STIFFNESS