

Solutions for Your TOUGHEST
MIXING Applications in

COSMETICS

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COSMETICS

Nail Varnish Manufacture

Nail varnish (also called nail polish or enamel) is a lacquer consisting of ingredients as illustrated in the table below. Varnishes are produced in a variety of colors and finishes such as clear, metallic and pearlescent.

Ingredient type	Typical %	Function
Solvent	70 - 80%	The most common solvents are acetone, ethyl alcohol, ethyl acetate and N-butyl acetate. Additional solvents such as toluene and isopropyl alcohol can also be used as diluents (to adjust final viscosity).
Resin	12%	Nitrocellulose is the main resin used, producing a hardwearing, glossy, non-toxic film with good adhesion. Additional "secondary" resins are often used to modify the film characteristics to improve flexibility, gloss, ease of application (brushability), resistance to chipping, adhesion etc. Recent developments include the introduction of other resins such as methacrylates and vinyl polymers to replace the nitrocellulose.
Colorant	5%	Organic D&C pigments and permitted inorganic pigments are used. These are generally premicronized. Colorants are also available as predispersed liquids.
Plasticizer	1%	Added to keep the product soft and pliable. Typically dibutyl phthalate is used.
Suspending agent	up to 7%	The pigments are suspended rather than dissolved into the varnish. Clays such as bentonite and hectorite are used to stabilize the suspension.
Filler	2%	Silica and other fillers may be added. Some fillers may be used to obtain special effects such as pearlescence, metallic finish etc.

The Process

Several processing requirements must be met in order to achieve the desired product:

- The mixer must provide vigorous in-tank movement to incorporate light powders which tend to float, and to prevent dense solids from sinking to the bottom of the vessel.
- Generally premicronized pigments are used, so particle size reduction (milling) is not applicable. However, the particles may need de-agglomeration and must be reduced to their finest constituent parts.
- Mixing equipment must be capable of blending fluids of widely differing viscosities e.g. liquid resins or pre-dispersed colorants (where used) into base solvent.

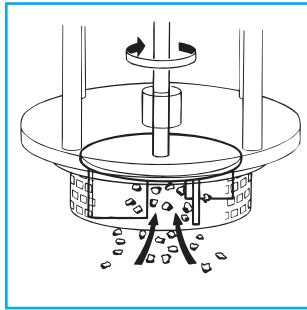
The Problem

Using conventional agitators several problems can be encountered:

- Nitrocellulose chips have a high specific gravity and tend to sink to the bottom of the vessel.
- The chips become tacky when in contact with solvent and have a strong tendency to agglomerate and/or stick to the base and walls of the vessel.
- The slow washing action of agitators takes a long time to dissolve the resin.
- Heating is often required to assist dissolving, however this increases costs and leads to problems with volatile and flammable solvents. Solvent loss often requires addition of extra solvent to standardize viscosity/color strength.
- Some powders float on the liquid surface and are difficult to wet out.
- Poor dispersion of pigment reduces color strength and stability, and can lead to streaking.
- High speed dispersers can be used for dissolving resins and dispersion of pigments, but they have a large energy requirement.

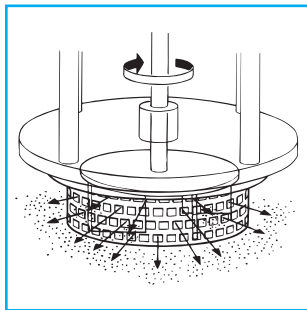
The Solution

The entire manufacturing process can be carried out in a single stage by using a Silverson high shear mixer. Operation is as follows:



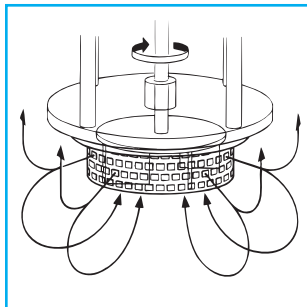
STAGE 1

The vessel is charged with solvent and the resin chips are added. The high speed rotation of the rotor draws the liquid and solids up from the base of the vessel into the workhead. Centrifugal force then drives the materials to the periphery of the workhead.



STAGE 2

The resin chips are subjected to a milling action in the gap between the tips of the rotor and the inner wall of the stator, rapidly reducing particle size. The product is then forced out through the stator at great velocity as fresh material is drawn in.



STAGE 3

The continuous intake and expulsion of materials through the workhead progressively reduces particle size and exposes an increasing surface area to the solvent, accelerating the solubilization process. Premicronized pigments and other powdered or liquid ingredients can be added and are dispersed/ deagglomerated as they are subjected to intense high shear with each pass through the workhead.

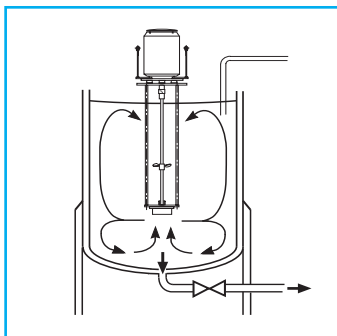
The Advantages

This offers a number of advantages:

- Processing time is dramatically reduced
- Resins can be dissolved at ambient temperature
- The entire manufacturing process can be carried out in the same vessel
- Rapid incorporation and wetting out of powders
- Improved dispersion maximizes color strength
- Greatly improved product quality, consistency and stability
- Easy to clean. A short run in the appropriate solvent is normally sufficient

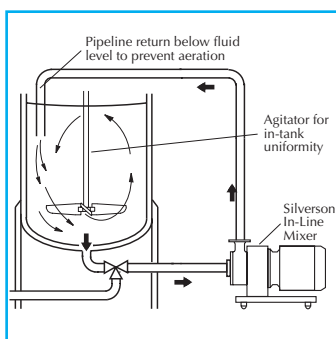
COSMETICS

The batch size, formulation, and type of ingredients dictate which machine from the Silverson product line is best suited to individual processing requirements:



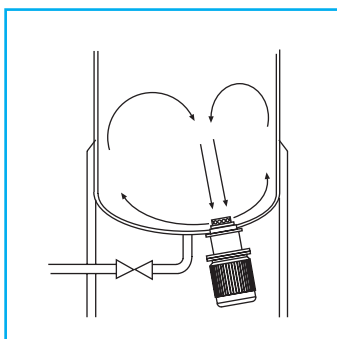
High Shear Batch Mixers

- Suitable for smaller batch sizes
- Can be vessel mounted or used on mobile floor stands
- Sealed units available for pressure/vacuum operation
- Small units available for R&D and pilot production



High Shear In-Line Mixers

- Ideal for larger batches where production is dedicated to one color
- Aeration-free
- Easily retro-fitted to existing process
- Self pumping
- The mixer, pipework, and vessel form a closed system, eliminating solvent emissions



High Shear Bottom Entry Mixers

- No immersed shaft- reduces cleaning requirements
- Suitable for operation in sealed vessels for control of solvent emissions
- Two-speed units available. Variable speed can be obtained with an inverter



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