

Solutions for Your TOUGHEST  
MIXING Applications in

# COSMETICS & TOILETRIES

**Introduction**

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Dispersion and Hydration  
of Carbopol<sup>®</sup>



# COSMETICS

## Dispersion and Hydration of Carbopol®

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Carbopol®\* is a water soluble vinyl polymer, used as an emulsifying, stabilizing, suspending, thickening and gelling agent in many industries. Carbopol® is available in several different grades, which are widely used in manufacture of cosmetics and toiletries, including gels, creams and lotions, detergents, and air fresheners. The gelling effect is activated in two stages, firstly the dispersion and hydration of the Carbopol®, and secondly “neutralizing” the solution by the addition of chemicals which increase the pH. Neutralizing agents include triethanolamine (TEA), sodium hydroxide and potassium hydroxide.

## The Process

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Manufacturing methods vary according to the type of product, but can generally one of two methods would be used:

### **Direct Dispersion**

The Carbopol® is added to water (the aqueous phase) and mixed until a lump-free dispersion is obtained. Other aqueous phase ingredients e.g. active ingredients, fragrance, color etc. would then be added. If the product is an emulsion this would then be combined with the oil phase. Finally the neutralizing agent would be added, activating the gelling effect. Typically a slow speed stirrer/scrapper would be used for this stage.

### **Indirect Dispersion**

The Carbopol® is premixed with the oil phase liquid. This reduces the tendency of the polymer to agglomerate. Remaining oil phase ingredients are then added. The aqueous phase is prepared separately; in some cases the neutralizing agent is added to the aqueous phase, alternatively it is added to the product as the two phases are combined, forming the emulsion and activating the gelling effect.

## The Problem

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- Carbopol® is generally supplied as a very light, low density powder. It tends to float when added to water, requiring vigorous agitation to be incorporated. This can cause dusting problems.
- When added to the water, Carbopol® tends to form agglomerates which are not readily dispersed.
- Some powders have poor flow properties, making controlled powder addition difficult.
- While some grades display no significant increase in viscosity until neutralized, others start to thicken immediately, making addition of powder increasingly difficult.
- Long mixing times are required to complete dispersion/hydration.
- Aeration can create a persistent foam which may require chemical additives to disperse.
- Entrained air is virtually impossible to remove, clouding clear gels and causing problems where packaging is filled by volume rather than weight.
- Potential full yield is difficult to obtain with conventional agitation; many formulations contain unnecessarily high levels of carbomer to compensate for this.
- Prolonged exposure to intense high shear can damage the polymer, reducing viscosity.

\*Registered trademark of Noveon, Inc.

## The Solution

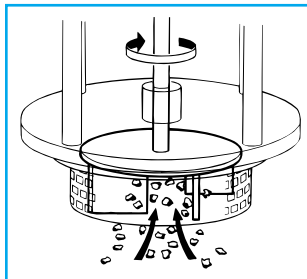
These problems can be overcome using a Silverson high shear mixer to disperse the Carbopol® and other ingredients, and for emulsifying oil and aqueous liquid phases.

### Dispersion

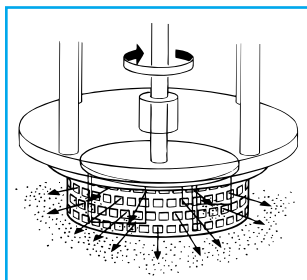
Dispersion is completed in a fraction of the time taken by conventional means, avoiding the risk of overshearing the polymer. Operation is described below.

### Neutralization

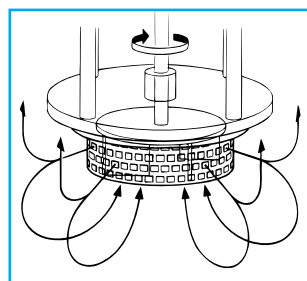
Silverson mixers can be used for the neutralization stage, depending on percentage and grade of carbomer. For high viscosity products, a low shear stirrer/scrapper would be used.



The vessel is charged with appropriate base fluid. The mixer is started, and the solid/ powdered ingredients are added. The powerful suction created by the high speed rotation of the rotor draws liquid and solids into the workhead where they are rapidly mixed.



The solids are de-agglomerated in the precision machined workhead before being forced out through the stator and circulated back into the mix. Simultaneously fresh material is drawn into the workhead.



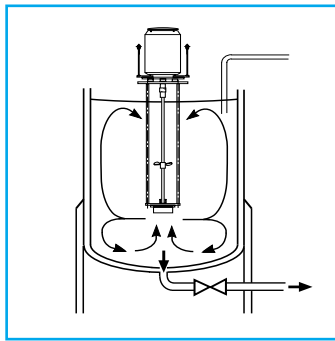
Once the powdered ingredients have been fully dispersed in the "continuous" liquid phase, the "dispersed" phase is added. The high shear mixing action of the workhead rapidly forms a uniform and stable emulsion before the viscosity increase is activated.

## The Advantages

- Agglomerate-free mix
- Maximized yield of raw material as carbomer is correctly dispersed
- Minimized aeration
- Consistent product quality and repeatability
- High speed dispersion keeps mixing times to a minimum, avoiding overshearing of polymer

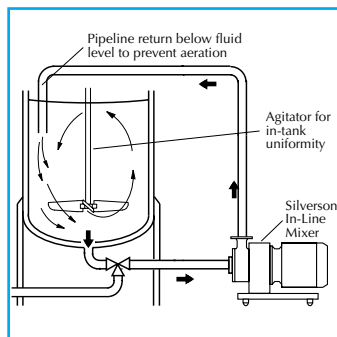
# COSMETICS

The batch size, the grade and percentage of carbomer, and the product viscosity (dependant on pH of solution before neutralization) dictate which Silverson mixer is most suitable for individual process requirements:



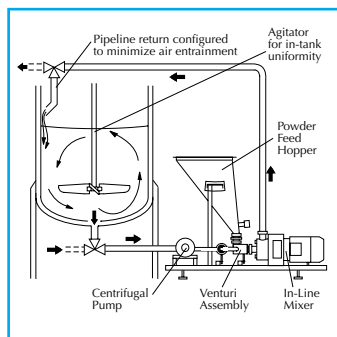
### High Shear Batch Mixers

- Suitable for batch sizes up to 400 gallons.
- Can be used on mobile floor stands for portability.
- Sealed units available for pressure/vacuum operation
- Small units available for R&D and pilot production.



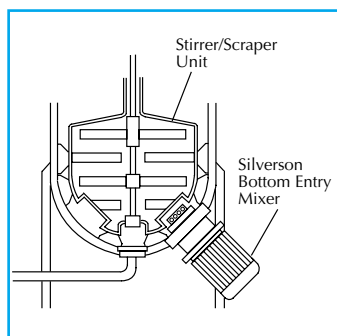
### High Shear In-Line mixers.

- Must be used in conjunction with an efficient in-tank agitator to wet out powder
- Aeration-free
- Easily retro-fitted to existing process
- Self-pumping, depending on product viscosity
- High viscosity products can be handled in combination with a positive displacement pump
- Multistage units available
- Ultra Hygienic units available



### Flashblend

- Ideal for larger batches
- Capable of rapidly incorporating large volumes of powder
- Minimized aeration
- Minimized cleaning requirements
- Minimum operator input required
- Easily automated
- Optional hopper flow aids available



### High Shear Bottom Entry Mixers

- Suitable for use on high viscosity creams in conjunction with an anchor stirrer/scraper.



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