

Solutions for Your TOUGHEST  
MIXING Applications in

# CHEMICALS

**Introduction**

Preparation of

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Polyvinyl Alcohol (PVA)

**The Problem**

Solutions

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# CHEMICALS

## Preparation of Polyvinyl Alcohol (PVA) Solutions

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Polyvinyl Alcohol (PVA, sometimes referred to as PVOH) is a water soluble polymer used widely in adhesives, paints, sealants, coatings, textiles, plastics etc. The polymer is normally supplied in powder form and several grades are available with varying viscosity and solubility characteristics.

This should not be confused with Polyvinyl Acetate, also known as PVA (sometimes PVAc) which is insoluble in water. PVAc emulsions are also used for adhesives, paints and various coatings but processing is different. This will be covered in a separate Application Report.

## The Process

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PVA is soluble in hot and cold water. A solution would typically be prepared as follows:

- The powder is slowly added to cold water to avoid formation of lumps, as it becomes sticky and the tendency to form lumps increases as temperature rises. In some cases water at lower than ambient temperature may be used to reduce this risk.
- Once the powder is fully dispersed the mix is heated to the temperature at which the polymer becomes solubilized (ranging from 194 - 208°F [90°C to 98°C] - this depends on the grade of PVA used).
- Mixing continues at this temperature until the PVA is fully solubilized. Depending on the grade of material and efficiency of the agitation system this can take some time to achieve.

## The Problem

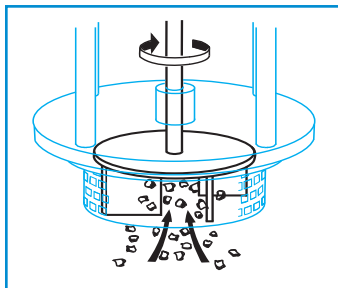
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Using conventional mixers and agitators, a number of problems can be encountered during production:

- Incorporation and dispersion of the powder becomes increasingly difficult as the viscosity starts to rise.
- Lumps cannot readily be broken down by agitation and long mixing times are required to complete solubilization.
- The vigorous agitation required to wet out the powder can lead to aeration problems.
- Inefficient agitation takes longer to achieve full solubilization at temperature. A degree of shear is required to accelerate the process.
- The heating stage of the process adds to costs and process time.

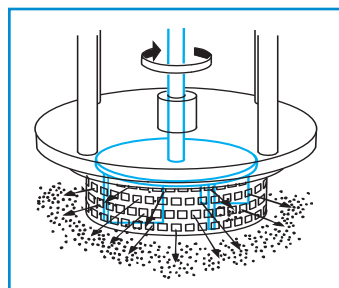
## The Solution

A Silverson High Shear Mixer can disperse and solubilize PVA powder in hot water, reducing mixing times to a fraction of that taken by conventional methods. A typical operating procedure would be as follows:



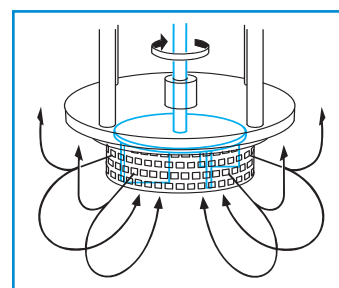
Stage 1

The vessel is charged with hot water and the mixer is started. The PVA is added to the water and is rapidly wetted out and incorporated into the liquid. The high speed rotation of the rotor creates a powerful suction which draws the ingredients into the mixer's workhead.



Stage 2

Centrifugal force drives the material to the periphery of the workhead where they are subjected to intense high shear in the gap between the rotor and stator before being forced out through the holes in the stator and projected back into the mix. Any agglomerates are rapidly dispersed.



Stage 3

Fresh material is simultaneously drawn into the workhead, setting up a circulatory pattern of mixing. The entire contents of the vessel passes many times through the workhead, progressively breaking down any agglomerates and accelerating the solubilization process.

## The Advantages

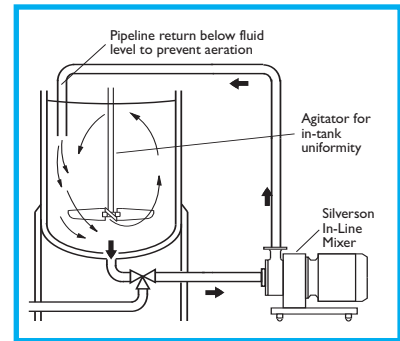
- Dispersing the PVA into hot water eliminates the heating stage, dramatically reducing process time.
- Rapid dispersion of powder eliminates operator error.
- Powder is fully dispersed before viscosity build-up commences.
- Any agglomerates are broken down by the intense high shear mixing, resulting in accelerated solubilization and better batch consistency.

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Typically PVA solutions are prepared in bulk. In-Line mixers are commonly used for very large volumes. In-tank mixers are also used depending on batch size, viscosity of end product etc. The Flashblend powder/liquid mixing system is not suitable as a vacuum cannot be generated above 176°F [80°C]

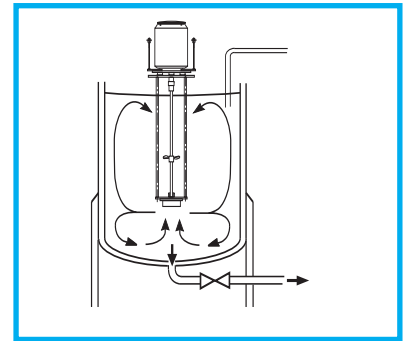
### High Shear In-Line Mixers

- Ideal for larger batches
- Aeration free
- Must be used in conjunction with an efficient in-tank agitator to wet out powder
- Easily retro fitted to existing plant
- Self pumping, depending on product viscosity
- Multistage units available for higher degree of shear
- Units for Explosion proof or Hazardous duties available.



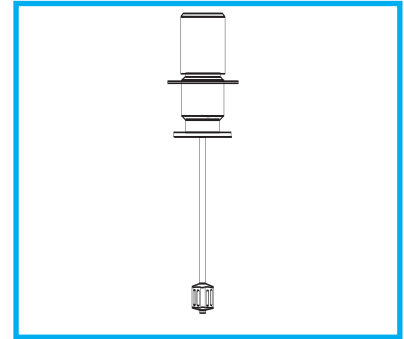
### High Shear Batch Mixers:

- Suitable for small batches
- Units for ATEX Category 2 duties available
- Sealed units available
- Special units for abrasive products available
- “V” Range mixers available with inverted workhead for incorporating low density powders which float or “raft” on the liquid surface



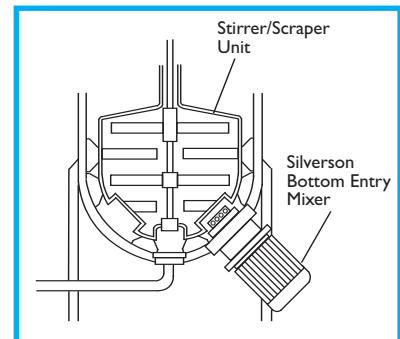
### Silverson Ultramix

- Ideal for larger batches
- Capable of rapidly incorporating large volumes of powders
- Suitable for high viscosity mixes
- Single-piece dynamic mixing head designed for CIP
- Units for Explosion proof or Hazardous duties available.



### High Shear Bottom Entry Mixers.

- Normally used in conjunction with an anchor stirrer/scraper on high viscosity products; can be used alone on lower viscosities.
- Two-speed units available. Variable speed can be obtained with an inverter
- Units for Explosion proof or Hazardous duties available.



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