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Highly effective manufacturing of paint and coatings

Dominik Seeger, Ystral GmbH, discusses the efficient and dust-free production of paint using the most effective dispersing and powder wetting technology

Whether in the manufacturing of decorative paints, industrial paints and coatings, coil coatings, automotive lacquer or printing inks, big amounts of powders have to be dispersed into liquids. In many cases this process is related to high efforts, it is time consuming and dusty.

More and more manufacturers are using a technology, which is completely different from the common way to produce their paints and coatings.

With the ystral Conti-TDS-Technology, pigments, fillers, thickeners and other powders can be inducted dust-free and from any container into liquids eg solvents, water and resins. The powders are inducted at up to 500kg/min and are dispersed immediately after the induction. The results are high quality dispersions and solutions with proven and significant savings in raw material consumption, production time, floor space and energy consumption. Depending on the ratio of powders, a 10t batch can be produced in 15-30min. On many products the process step of additional milling can be reduced to a minimum or can even be inapplicable.

These results can be achieved by the combination of five processing steps in one machine: Emptying of bags and containers, powder transport, powder incorporation and finally wetting and dispersing under vacuum.

directly into a vessel or lowered into the vessel by the means of a lift. Normally, the basic liquid is filled into the vessel and the raw materials are added simply by pouring them on to the surface of the liquid. Powders have a rather large specific surface, in extreme cases (eg for fine pigments or silica acids) it calculates to about 300.000m²/kg of powder. In most production scenarios, several kgs of these powders are added directly on to the surface of the liquid. The liquid only has an area of a few square meters so it soon becomes obvious that there is an adverse relation between the surface of powder and the surface of liquid. The result is that individual particles will not be wetted, only the agglomerates and aggregates become roughly wetted.

The powder floats on top of the surface and an intensive mixing effect has to be applied to wet all the particles. When a dissolver is used, a vortex builds up in the liquid and besides the powder, air is brought into the product as well.

Very often, different raw materials have to be dispersed into a liquid, creating a high work load for the handling of the different packing systems such as bags, barrels and containers that have to be moved and emptied.

Many of these powders are sticky and most tend to form dust. Layers of crusts and agglomerates build up at the wall of the vessel and other equipment installed inside the vessel. These agglomerates in a later process are very difficult to destroy and require a lot of energy and time. The quality of the product suffers by a coarse defined dispersion and with the consequence of different quality from batch to batch. Because of the inefficient use of the raw materials, much more raw materials than are normally required, have to be added in order to achieve the desired effect. A part of the raw materials 'disappear' as dust in the environment, exhaust systems and dust filter systems. In total, this results in high production and general costs.

THE HIGHLY EFFECTIVE WAY – DUST-FREE DISPERSING AND WETTING

Different to this common practise, the Conti-TDS powder wetting machine is installed outside and beside the vessel and connected via a piping system.

The basic liquid is circulated in a loop, which creates a vacuum inside the dispersing chamber of the machine. This vacuum is used to induct powders dust- and loss-free, directly from bags, containers, BigBags, silos or even from a silo truck. The powders are transported in a dense-phase with-

Figure 1. Dispersing results comparing Conti-TDS (directly after powder induction) and dissolver (after the original processing time)

THE COMMON PRACTICE – POWDER VERSUS LIQUID

Most types of dispersing machines are installed

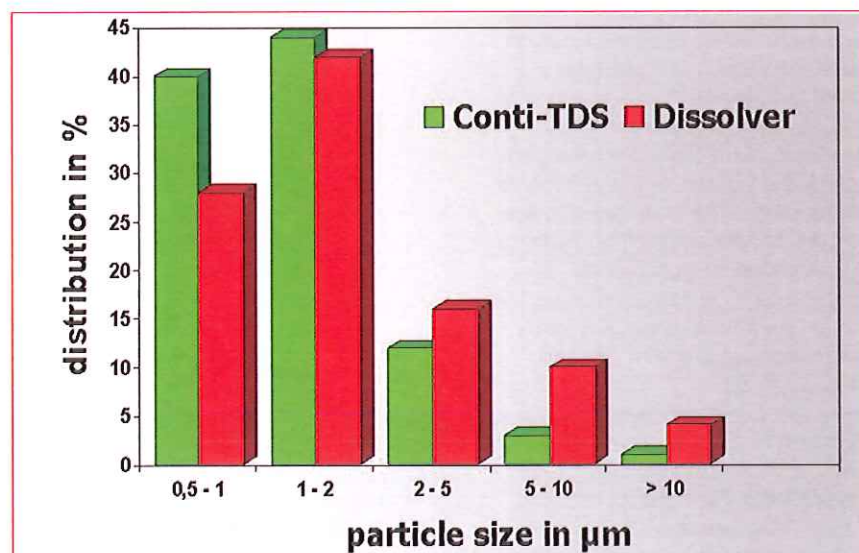




Figure 2. Fully automated Double Tank Powder Wetting and Dispersing Systems on load cells

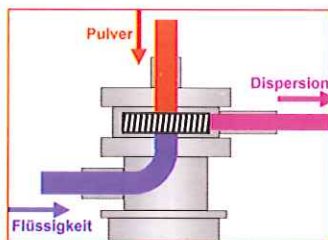


Figure 3. Functional principle Conti-TDS Powder Wetting



Figure 4. Conti-TDS Powder Wetting Module with JetStream Mixer and powder induction from BigBag Station

out the need for false air and are directly dispersed into the liquid under vacuum. Due to the vacuum, the entrained air is expanded, opening up the surface of the powder, ready for wetting. Simultaneously, the surface of the liquid in the dispersing zone is also extremely expanded. Only at this point, does the powder come in contact with the liquid and become wetted in a most efficient way. In this area, the shear gradient is about 1000 times higher compared to a dissolver. Due to the blast waves created during the pumping action the colloid wetting is completed. The micro air bubbles that stick on to the surface of the particles are separated, coagulated and will collect on the surface of the liquid as a layer of coarse foam, even in products considered difficult to ventilate.

The suspension produced in the dispersing chamber returns to the vessel as a 'ready made' product. Depending on the amount of powder and the required solids loading, the induction of the powder may be interrupted by closing the powder inlet. Additional dispersing, respectively homogenising in the recirculation loop in order to achieve a specific particle size distribution or homogeneity, is also possible. This procedure serves to de-aerate the product at the same time.

Independent from the viscosity, type of vessel and batch size, stable suspensions and solutions may be produced in a fraction of the time required by conventional mixing and dispersing systems.

Depending on the recipe, several different powders may be dispersed one after the other through a common inlet or multiple inlets for various containers and/or bags.

ALSO FOR HIGH VISCOUS PRODUCTS

Besides paints and coatings, a number of high viscosity products can be handled, such as sealing and insulation material, glue, resin, modelling or filling compounds. In this case, an additional volumetric pump has to be installed.

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SOME FACTS:

- Significant reduction in time to produce any given batch size, eg a 40t batch of 'slurry' in less than two hours with 26t of TiO_2 at 72% solids.
- Significant reduction of raw material eg in TiO_2 for the same colour strength due to highly improved dispersion and colloidal wetting of the powders.
- Significant reduction in energy required to produce any given batch, typically a reduction between 50% and 70% compared to High Speed Dissolvers.
- Significant reduction in milling times due to the excellent pre dispersing.
- Dust-free operation since we can induct directly from silo, (via buffer hopper) BigBags, sack or any container.
- High capacity on a small footprint eg a 10t batch of decorative emulsion at 50% solids in 15 to 30min on 30m².
- Flexible batch sizes from 500 to 50,000kg.
- Fully or semi-automated closed turn key systems incl powder- and liquid-handling, control system and CIP system for colour changes.
- 1000 times higher shear gradients of 50,000s⁻¹ compared to a dissolver.
- Reduction in HEC content and faster hydrolysis due to controlled shearing (less degradation of the cellulose structure) and optimised distribution.
- Thickeners, thixotroping and matting agents are completely wetted and achieve their performance immediately after the induction under controlled conditions.
- Light powders eg Expancel, Aerosil, ACEMatt can be inducted and dispersed under controlled shear forces dust and loss free.
- Constant and controllable energy input on temperature sensitive products like PVDF organosols or PVC crystals.
- Repeatable product quality due to defined induction and dispersing processes.

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