



## Realise the problem, solve the problem

### Emulsifying in a batch process

In the Chemical Industry as well as in the Pharmaceutical and Cosmetics Industry, emulsifying in a batch process is a significant processing step. Problems in the production will follow if the incorrect or inappropriate mixing equipment is selected

Emulsions are based on liquids that under normal conditions are not easy to be mixed together to a homogeneous mixture. The physical basis for this behaviour on one hand is the different density, and on the other hand the electro-chemical properties of the liquids involved. Only when using mechanical energy in form of shear energy and an emulsifier, it is possible to homogeneously combine two or more immiscible liquids to an inseparable mixture, a stable emulsion.

Processing of emulsions basically is a two step production, a mechanical part and a electro-chemical part. In the mechanical part, the disperse phase is dispersed to very small droplets. This is executed with shear energy that is applied to the mixture. Without the adding of an emulsifier, these small droplets immediately would recombine, constantly increase its size and soon float as a separated large bubble in the vessel.

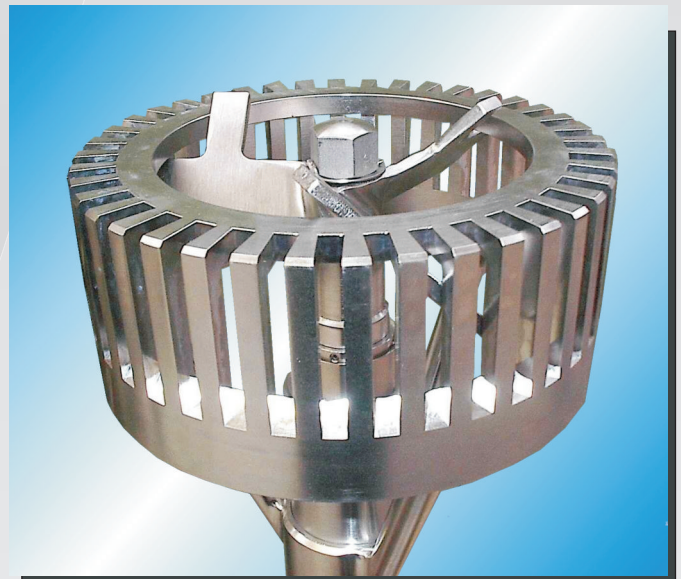
The electro-chemical part is used to bring the emulsifier as quick as possible and in dosed quantities in contact with the small droplets.

The aim of this step is to coat the surface of the dispersed droplets with the respective amount of emulsifier to change the electrical load of the so-called "Micell" to avoid the attraction of other "Micells".

Main effect of the coating of the droplets is the repulsion of the droplets to each other inside the surrounding continuous phase. A separation of the disperse phase and recombination of the droplets is not possible anymore.

The energy applied in this phase is very low, and not sufficient for the emulsifier to inhibit larger droplets from coalescing.

Processing aim is to produce a large number of very small droplets with the respective large surface.



# Ystral

## Normal stirring systems won't suffice

Generally during an emulsifying process, a pre-emulsion is produced in a batch and then additional "emulsifying" or "homogenising" is applied. The pre-emulsion is already the ready made mixture of a continuous and a disperse phase and the added emulsifier. To get the required droplet size, simple standard or conventional stirrers are used that are not able because of the low shear energy to produce small droplets.



Conventional stirrers in many cases are oriented radially and not axially and there is an uneven mix of the two phases from top to bottom of the vessel combined with increasing or decreasing droplet size towards the surface of the mixture. Because of the rotation of the liquid in the vessel, like in a centrifuge, large particles are accelerated to the outside of the vessel while light particles remain at the inside.

It is obvious that such a pre-emulsion will result in an unsatisfactory additional emulsifying process. Further processing steps and machines, such as Inline dispersing machines, that are continuously supplied with product from the outlet of the vessel have to treat continuously changing concentrations. and droplet sizes.

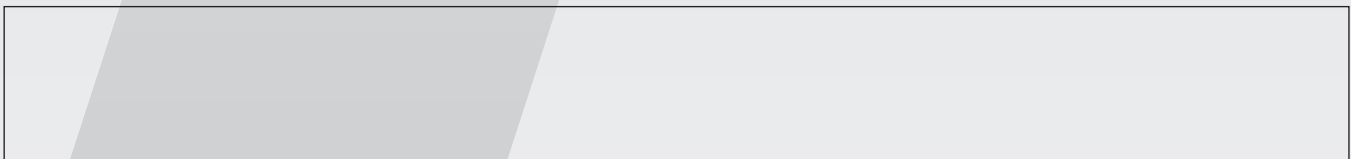


Mandatory for a homogeneous and reproducible batch emulsifying process is a perfect mixing of the contents in the vessel in combination with a system that applies sufficient shear energy to delay the dispersed droplets from recombining until the emulsifier has coated their surface.

The Dispermix system offers especially for emulsifying in a batch or the production of a pre-emulsion many advantages compared to other conventional systems. The basis of the system is the Jetstream mixer with a rotor-stator system combined with a batch shear ring machine. The design of the head is equal to the Jetstream mixing head that uses most of the applied energy to create a vertical flow of the liquid in the vessel different to other stirring or mixing principles. Additionally the Dispermix mixer creates the maximum speed in its centre and not at the edges of the blade and such absolutely suspends any sedimentation in the bottom of the tank and it also increases the heat transfer with the wall of the tank.

The slots in this head and the defined radial gap (distance of the rotor from the head) provide much higher shear energy compared to the normal Jetstream mixer or other stirring elements.

The shear gradient (quotient out of peripheral speed of the rotor and gap) in this case is much larger, and this again results in a smaller droplet spectrum.



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The emulsifier can be added directly into the head of the emulsifying system and thus to the area where the small droplets are created. This ensures that the coalescence is as short as possible and most of the small droplets are immediately coated with the emulsifier. In many cases an additional processing step with an inline dispersing system is no longer required as the quality of the emulsion after this step is already satisfactory.

## Mixing effect similar to a Jetstream mixer

With this type of dispersing system the whole contents of the vessel is homogeneously mixed. From start to the end of the pre-emulsifying process, it is guaranteed even during emptying of the vessel that a homogeneous pre-emulsion is fed to the additional processing step. The Dispermix replaces the very often used combination of a batch dispersing machine and stirrer and this results in lower purchasing cost and simple processing controls. The system may be used in low to medium viscosity products without any additional form of mixer. Where high viscosity products have to be treated, then the dispersing mixer may be combined with a wall scraper that feeds the product directly into the dispersing and mixing head.



As well as the emulsifier, very often stabilisers are used to adjust the "mouth feeling" characteristics of products in the food industry. These products also interact with the electro-chemical effect as they form a kind of ion layer around the particle resp. droplet and reduce the immobility of the complex mixture due to its size and load. In extreme cases, the system comes to a complete standstill. Stabilisers in many cases are supplied in powder form, and a loss of powder can be suffered during addition into the liquid. Many of these powders become sticky when they come in contact with a liquid and these stick to the wall or the mixing shaft in the form of big lumps or crusts. As a result, filter systems are required to remove these impurities.

The problem when adding such powders is that after adding it to the surface a large quantity of agglomerated lumps are formed that, compared to the liquid, have a lower density and for this reason float on the surface (CMC, Xanthan, Pectin, etc...). With radial acting stirrers it is very difficult to force these agglomerates and lumps from the surface into the liquid, and long treatment time is the result. In such cases these stirrers are operated in highest speed to achieve a Vortex to draw the powder into the liquid, but this also incorporates unwanted air as well. This air causes oxidation and such an uncontrollable change in the quality.

The Dispermix does not cause a Vortex and as such eliminates the problems described above.

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