7 Rotor-Stator-System (Homogeniser)

7.1 Review

For certain mixing tasks, i. e. emulsifying, the shear forces of the mixer are insufficient, in which case high speed rotor-stator-systems come into operation. The Herbst Rotor-Stator-System (Homogeniser) is mounted on the bottom outlet valve of the bowl.

Figure 73 illustrates the functional principle of the Herbst Homogeniser.

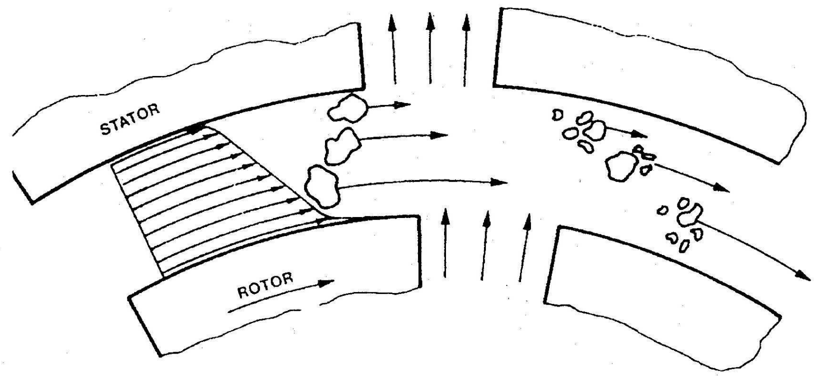

Figure 73: The functional principle of the Herbst Homogeniser

The product is sucked axially into the dispersion head where it is deflected through 90 degree angle into the rotor slots, which are operating at very high rpm. The stationary stator is also fitted with slots through which the product is forced to the homogeniser discharge.

The high acceleration subjects the product to very high shear forces, furthermore, the narrow space between rotor and stator introduces high turbulences which in turn lead to optimal mixing.

The externally located homogeniser provides a number of system advantages, such as defining when the bowl contents are transferred and emulsified, further more, no hindrance in the mixing operation due to obstruction in the bowl.

Figure 28 on page 52 shows a bowl with a rotor/stator system and a slow motion anchor mixing tool with forwarding transport elements. The installation of forwarding transport elements is not possible with the rotor/stator system which presents a disadvantage.

7.2 Inline-Homogeniser

The Herbst Rotor-Stator-System (Homogeniser) is fixed to the bottom discharge connection on the mixing bowl. After leaving the homogeniser the product is circulated through an external piping system back into the mixing bowl. Thereby it is possible that, contrary to the Rotor-Stator-Systems within the mixing bowl, the total contents of the bowl are homogenised evenly. The smallest Herbst Homogeniser HI 35 is shown in figure 74.

Figure 74: Herbst Homogeniser HI 35

The revolutions can be regulated within the range of appr. 2000 to 15000 rpm in order to provide an optimal suitability to various products. Based on water a maximum rate of 2300 litres per hour is possible.

The capacity of the homogeniser is limited by the viscosity of the product. Beyond a certain level of viscosity the pumping action of the homogeniser is no longer possible in which case a pump is installed prior to the homogeniser, thereby improving the throughput.

The homogeniser may be used to suck in free flowing powders into the liquid stream and thereby preventing a formation of dust in the mixer. The powder is moistened immediately prior to it's entry into the bowl.

Tests with a Herbst Homogeniser HI 60 (see figure 75) have proven that an optimum result in homogenising of most products can be achieved after only a few homogeniser passes, continuous homogenising can worsen the result or lead to degradation of the product. The graph in figure 76 shows the average droplet diameter x_{50} in relation to the homogeniser through-put passes N_D. Relatively fine droplet diameters are already achieved after a single pass, further throughput passes do not greatly reduce the droplet size. Measures were carried out with different rotor-stator-tools at constant homogeniser rotations. The droplet diameters were determined by a laser diffraction spectrometer.

Figure 77 shows the homogeniser HI 115. With a maximum rotational speed of approx.

Figure 75: Mobile Inline-Homogeniser HI 60-M

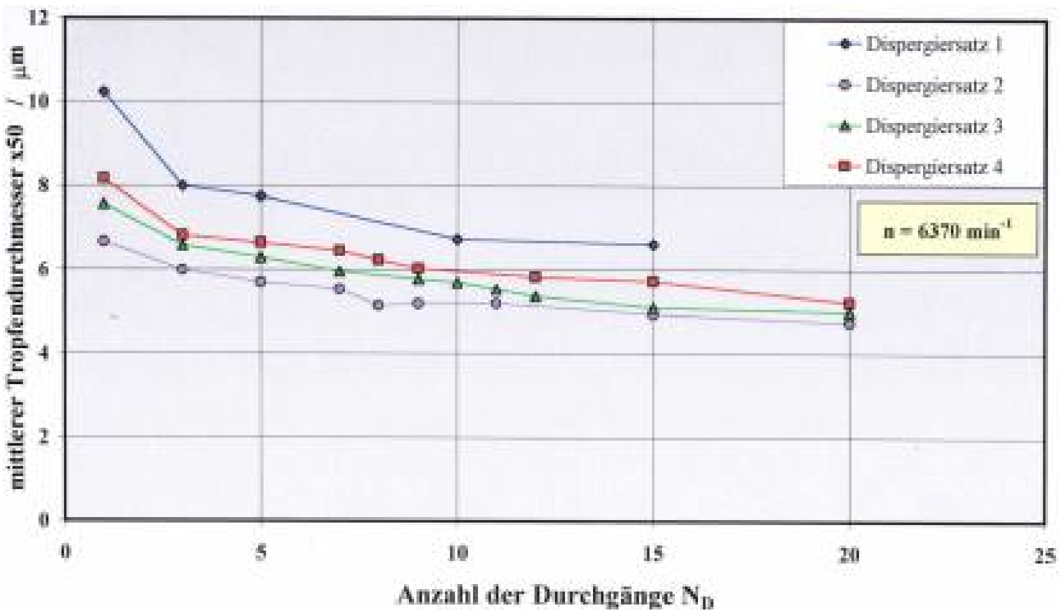

Figure 76: Average Droplet Diameter x_{50} in relation to the number of Homogeniser Throughput Passes N_D [9]

3000 rpm a flow rate of approx. 15000 litres per hour (with reference to water) was achieved.

Figure 77: Homogeniser HI 115

The most important technical data of the Herbst-Homogeniser is shown in table 6.

Special design based on specified performance data is possible.

Table 6: Summary of the essential technical data for the Herbst Homogeniser (Standard version)

	HI 35	**HI 60**	**HI 115**
Power Input P $[kW]$	1,0	2,2	5,5
Maximum revolutions at 50 Hz n $[UpM]$	22.000	6.500	3.000
Throughput performance $\dot{V}$ $[l/h]$ (related to water)	2.300	3.000	15.000
Maximum bowl capacity V_B $[l]$	35	150	1.500