

Continuous Process Powder Wetting



Continuous processes have the edge when it comes to high-quality, rapid powder incorporation into liquids: mixing, homogenization and dispersing take place in a single pass.

Vessels with stirrers are often used to achieve a homogenous mixture of solids and liquids. Industrial systems comprise a number of vessels, mixers and peripherals. Despite modern stirrer geometry and the possibility of increasing the speed of the mixer tools if required, the same problems always occur with batch systems, preventing a harmonious marriage of "solid and liquid".

Even with modern stirrers, ensuring a long-lasting, high-quality mix is a huge challenge. "Open" batch operation encourages the formation of agglomerates and dust. As a consequence, solid particles which have not been successfully mixed in are found on the stirrer shaft, vessel wall or vessel lid. This not only increases cleaning costs between the processing of different batches, but also prevents production of a mix of uniform



IKA® inline MHD machine for powder incorporation and wetting

quality. If air is used as a delivery medium for the solid, the possibility exists of unwanted air being entrained into the mix. Dust and solvent emissions are a problem from the point of view of workplace safety, as they present a potential health risk to employees.

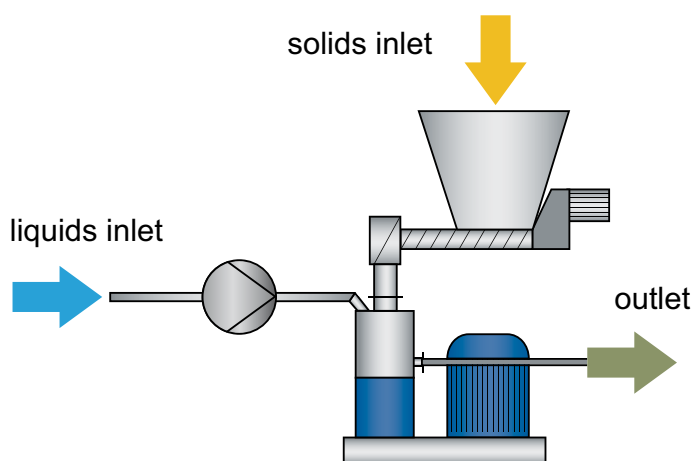
It can also be financially attractive to look for alternatives to conventional batch process. Depending on the type of operation, some product components may be "treated" more than actually necessary in a batch process, others less. In order to obtain satisfactory product quality over the batch as a whole, lengthy mixing and/or dispersion is required. As well as increasing energy consumption, this also produces significant heat in the products.

For all these reasons, modern continuous powder wetting systems are seen as increasingly attractive, even for relatively small quantities.

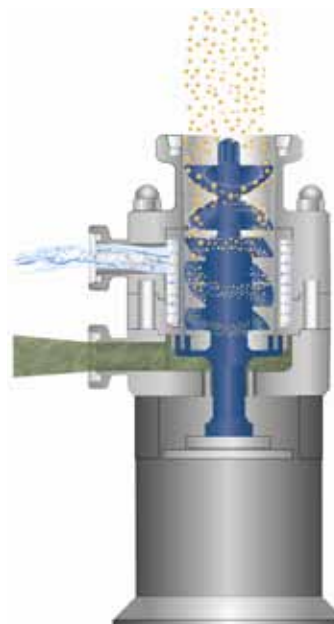
Solid and liquid become one. MHD plants for mixing, homogenization and dispersing

Modern inline systems overcome the disadvantages of conventional batch processes. IKA® MHD plant, for example, operates as a continuous process. Its name comes from the functions it performs: the mixing, homogenization and dispersing of solid and liquid phases in a single pass.

In an MHD mixing and dispersing machine, the product components are dosed in the correct proportions, then mixed, dispersed and discharged. Dosage of the solid in simple cases is via a volumetric dosage device. Here dosage is dependent on the volume introduced per unit of time and remains constant for the same bulk density and uniform filling of the dosage hopper.



MHD plant flow diagram



Section view of the IKA MHD module

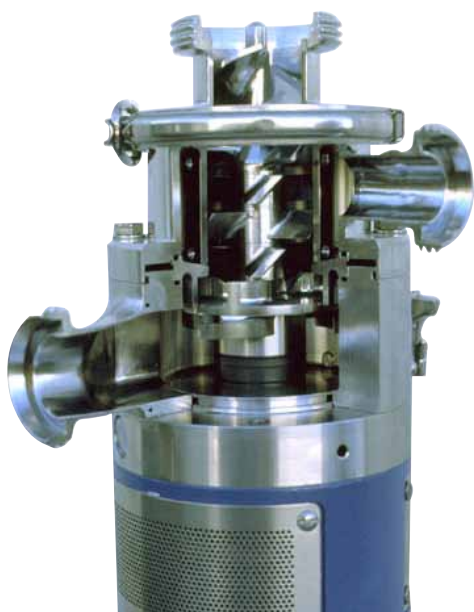
If greater accuracy is required or complex substances are to be input, gravimetric dosage is used. The various solids and dosage quantities are weighed on scales and compared with the pre-determined requisite amounts. Any discrepancies are automatically adjusted via a controlled drive. Changes in the bulk weight or material properties do not affect the dosage result. Consequently, concentration accuracies to within 0.5 per cent by mass or better can be achieved. The slightly higher dosage cost is offset several times over. On the one hand, only small reservoir capacities are required and, on the other, no additional mixing machines are necessary.

Delivery, dosage, mixing

While the solid is fed into the MHD from above, the liquid component of the mixture is introduced into the processing chamber at the side, for example by means of a pump. The liquid is separated into a large number of individual streams in a special drum by means of a perforated injector nozzle and injected into a pre-mixing chamber. Gravity conveys the solid on to the spiral blades of a conveyor screw operating vertically downwards and feeding the solid into the mixing chamber, where it also acts as a "sluice gate".

The patented design of the MHD module prevents splashes of liquid from reaching the solid inlet area, thus reliably preventing lumps from forming and ensuring that no problems occur with feeding the solid into the machine.

The phases come together in the pre-mixing chamber and are mixed efficiently by means of a special mixing tool. The multi-part, high-speed mixing tool creates a highly turbulent flow in the mixing chamber and thus results in optimum wetting and mixing of the solid particles.



Section view of the IKA inline MHD machine

Up to three rotor-stator tool systems can be used in the bottom section of the mixing chamber in order to disperse the pre-wetted mixture finely or to break it down wet. Depending on the initial materials, very fine suspensions can thus be produced continuously in a single pass. The product leaves the processing chamber through the discharge outlet, where a delivery pressure of up to 2 bar can be created.

Higher solid input

Depending on the product, up to 80% solid content can be input in a single pass. The MHD can produce anything from high viscosity products to pastes in the 50,000 mPas range. As the product only passes through the machine once, only a small amount of heat is generated and the product has only a short residence time in the machine. This is particularly important in the case of reactive processes and rapid increases in viscosity. The particle sizes in the suspensions produced by the MHD 2000 depend on the initial materials and are frequently in the range approx. 10 to 100 µm.

Versatile

MHD machines suitable for sterile conditions are available for use in the food industry. The high-quality design and easy to

clean components have 3A certification.

On request, the MHD system can be supplied with silo, big-bag or sack emptying units or as a complete production line with all associated powder or storage containers, pipework and heating/cooling equipment. A full measurement and control system for automatic operation can also be supplied. The level of automation can be adapted to suit all requirements, from simple manual operation to a fully automated system.

Broad range of applications

MHD systems cover a broad range of applications. Sectors where they are used include the chemicals, cosmetics and food industries. Continuous, proportional quantity mixing is suitable for a great many initial products.

The following products are suitable for the liquid phase: water, oils, resins, kerosene, alcohols, liquid polymers, low to high viscosity dispersions, molten urea, syrup or solvents. The following solids can be mixed with the fluid in each case: starch products, Carbopol®, Aerosil®, nuts, ammonium sulfate, aluminum oxide, spice powder, talcum, mineral pigments, coating products, reactive powder, polyamide fibers, thickeners, cellulose, fuller's earth, carbon black, pectin, pellets, etc.

Suspensions with concentrations of 50% aluminum silicate, for example, can be produced in a continuous process. In the bleaching process used in the preparation of vegetable oils, the oil and the fuller's earth are combined in a single pass in the IKA® MHD 2000 machine.



IKA® MHD 2000/30 machine

A modified version of the MHD plant is used successfully in the production of polymer-modified bitumen. Here a polymer (generally styrene-butadiene-styrene) is added to the liquid bitumen which has been heated to approx. 180 °C. The end product is used in the construction of roads and airport runways and is also in demand for high-quality roofing and waterproofing membranes.

Industry: Petrochemicals / Road building

Liquid	Bitumen
Solid	Polymer (SBS)
End product	Polymer-modified bitumen for road building
Supplied as	Complete plant for the continuous production of 35,000 kg/h of polymer-modified bitumen



Continuous process IKA® MHD system with solid and liquid dosage units



IKA® plant for the production of polymer-modified bitumen (PmB)

Advantages of the continuous process over batch processes:

- Efficient energy input
- Machine-guided product flow
- Variable, multi-stage rotor / stator systems
- Narrow particle size distribution and good reproducibility
- Compact
- Flexible production quantities
- No dust and solvent emissions
- Easy cleaning
- Reliable scale-up
- Ideal for relatively large production volumes



IKA® magic LAB® inline laboratory machine with powder input module

Scale-up

In times of increasingly short product cycles, efficient scale-up is ever more important. Scaling up new processes to the required manufacturing level has, therefore, now become one of the key disciplines in process engineering. Already at labora-

tory level, IKA® pilot plants give a realistic idea of the planned manufacturing plant, as the design is the same as that of subsequent production-scale machinery and plant.

At the same time, IKA® magic LAB®, LABOR-PILOT and PROCESS-PILOT help in selection of the process technology to be used in each case. Interchangeable modules enable a wide range of process techniques to be used in response to actual requirements and formulations. The IKA® pilots allow machine and plant sizes and the associated energy requirements to be defined. The required raw material quality and quantity can also be determined precisely at laboratory level.

And the most important question of all can be answered before scaling up. What quality characteristics should and must the end product possess? From the start, this gives project planners maximum certainty in planning and achieving a fully professional mix quality.



IKA® MHD pilot plant for the continuous mixing of solids and liquids



Designed
to work perfectly

IKA® - Werke GmbH & Co.KG
Janke & Kunkel - Str.10 · 79219 Staufen · Germany
Tel: +49 7633 831-0 · Fax: +49 7633 831-907
process@ika.de · www.ikaprocess.com

IKA®