



Whitepaper

WIP Process in Horizontal Mixing Systems

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In addition to reliable process functionality an efficient cleaning process of the horizontal mixing system is becoming increasingly important. Nowadays, those hygienic requirements are no longer limited to the pharmaceutical industry. An integrated cleaning system is more often requested for new machine's basic equipment in the food, cosmetics and chemical industries. A particular focus is the prevention of cross-contamination by allergens, flavors and active ingredients during product changeovers as well as the elimination of potential microbiological contamination.

In general, cleaning systems for process-related equipment can be divided into two categories: semi-automatic WIP systems (Wash-in-Place) and fully automatic CIP systems (Clean-in-Place). The latter does not require any manual cleaning steps. Horizontal mixing systems generally use a WIP system, since minor manual steps, such as removing a filter or installing a drainage cone on the machine outlet, are frequently required. Chemical disinfection of the system can be performed after machine cleaning, as needed. This is referred to as a SIP system (Sterilisation-in-Place).

Complex Cleaning Process

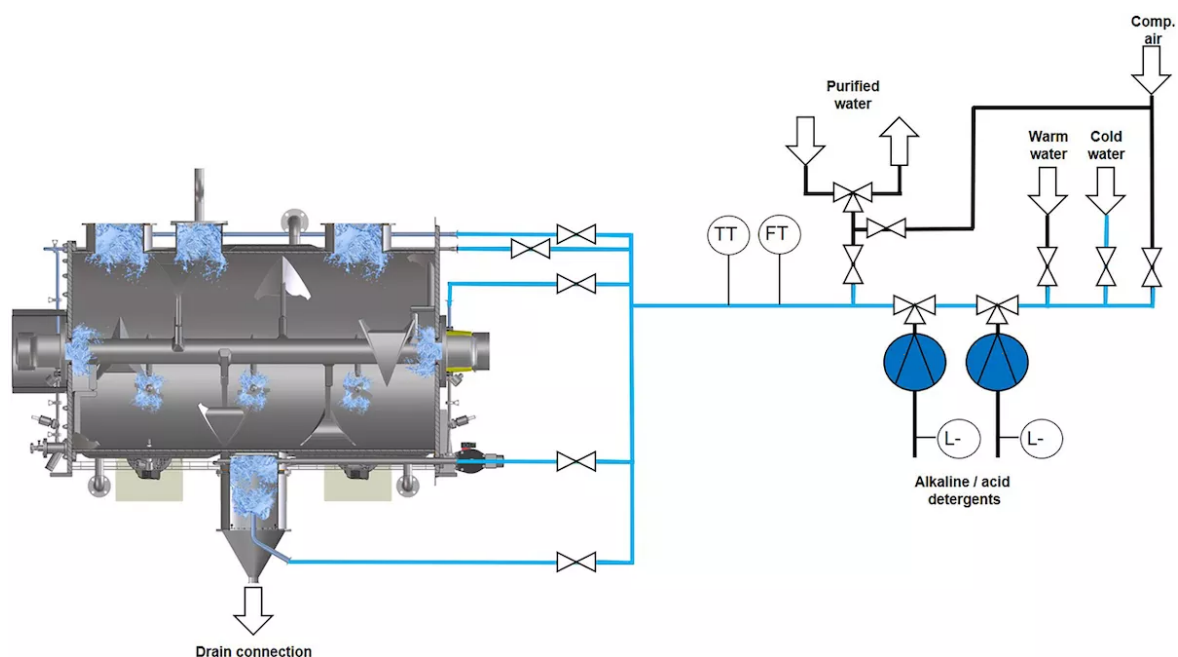


Example of a feeding socket with fixed cleaning nozzles and flushing supply (Source: Lödige)

The cleaning process itself comprises the residue-free removal of any remaining product and material build-up in the entire mixing drum. For this purpose, the air purged seals of the mixing shaft and choppers will be flushed with water to prevent ingress of cleaning water into the seals. Afterwards, the horizontal mixer is cleaned successively from top to bottom. For this purpose, all sockets on top of the machine are equipped with cleaning nozzles, which are either firmly welded on the inside of the socket or can be positioned on the socket as a separate washing adapter. It is also possible to install automated retractable cleaning nozzles. Filters are generally completely moistened while installed and then removed for further cleaning (e. g. in a dishwasher or an ultrasonic bath).

The rinsing water used for cleaning the sockets is collected in the mixing drum and later used for cleaning the mixer interior, which requires a filling level of 10 to 20 % with cleaning agent. The mixing drum itself is cleaned using the mixing shaft. It rotates forwards and backwards, effectively ensuring intense, turbulent contact between the mixer inner surface and the cleaning media. If necessary, any product residue remaining in the mixer can be soaked during this process. Mixing systems with higher volumes use additional rotating jet cleaners to maintain a reasonable water consumption per cleaning cycle. For this process it is possible to use both fresh water or closed-loop circulation mode.

Automatic cleaning of the mixer discharge is a more sophisticated process due to the complex geometry of the discharge door, drive shaft and sealing surfaces. A combination of static cleaning nozzles and a centrally located rotating spray ball as well as opening and closing the door in interval mode have proven successful for intense cleaning of all surfaces. Any waste water created by the cleaning process is discharged through a drainage cone installed at the mixer discharge.

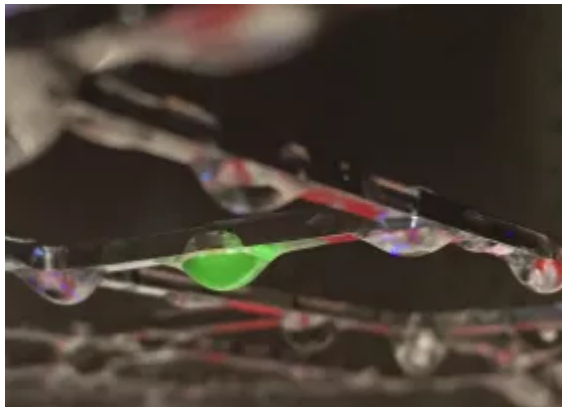


Schematic diagram of a WIP system with typical rinsing points on a horizontal Ploughshare Mixer. (Source: Lödige)

Depending on product solubility and the machine's degree of soiling, the cleaning process can be performed in multiple steps using cold, warm or purified water. Automatic metered addition of various cleaning agents as well as a final chemical disinfection step are also available. Thermal sterilisation by steam can also be performed, if the mixer is designed with the necessary equipment.

Final drying of the mixer with conditioned ambient air is possible, which can be supported by using hot water during the previous cleaning steps. As quicker alternatives, blowing out the entire system with heated compressed air or using blowers combined with air dehumidifiers, also referred to as absorption dryers, have proven useful.

Modular Structure of the Cleaning Systems



The light of the UV lamp exposes all potential for optimisation. (Source: Lödige)

All WIP, CIP or SIP systems for horizontal mixers have a modular structure, which enables them to meet any customer and product-specific task requirements. Each cleaning process is defined based on the mixer design and product properties and is saved as a recipe in the machine control system, making it reproducible.

A riboflavin test is used to ensure correct functionality of the cleaning system (e.g. number and positioning of the nozzles) as well as correct parametrisation of the cleaning process (e.g. water volumes, rinsing times, etc.). Riboflavin glows if it is illuminated with ultraviolet light. It's used as tracer for visual inspection.

However this test is only an indicator of cleaning effectiveness. It cannot be used to validate the cleaning process.

Conclusion

Cleaning horizontal mixers with semi-automatic WIP systems is a complex process. Modular solutions cover such a wide range of tasks that they can reliably fulfill any industry-specific requirements in pharmaceutical production as well as those in the food, cosmetics and chemical industries.

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