Cleaning in Place advances

Cleanability precondition for CIP

BY LUCIEN JOPPEN

Cleaning in Place is advancing in the food industry. Cost savings due to less down time and automated cleaning procedures have facilitated this advance. Critical for the effectiveness of CIP is hygienic design, i.e. the cleanability of the processing equipment.

In Hygiene in food processing*, CIP is defined as 'the circulation of chemical solutions and/or water through a processing plant that remains assembled in its production configuration so that all product contact surfaces are cleaned (..)'.

Thus CIP makes dismantling of processing equipment unnecessary, which brings significant advantages for manufacturers, such as cost savings and improved hygiene. Down times are significantly reduced and manual cleaning can be reduced or eliminated entirely. The latter is not only cheaper, it is also better from a hygienic standpoint as cleaning procedures are more standardised due to elimination of the human factor.

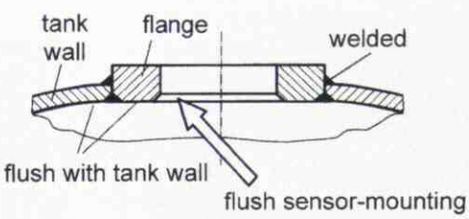
Other side of the coin

There is also another side of the coin. CIP systems are custom-designed, which makes them costly. Another disadvantage is that ideally CIP should be designed into the production line from the start. Attempts to fit in CIP systems afterward have proven to be expensive and have led to less effective solutions.

Apart from the money factor, CIP is more vulnerable to flaws in the processing and the CIP circuits. As cleaning takes place in a closed system, eliminating dead spaces or crevices becomes more important.

Jürgen Hofmann, engineer at the Technical University of Münich-Weihenstephan, studies how hygienic design of processing equipment facilitates optimum cleaning procedures.

"Until five or six years ago, equipment suppliers were not too concerned about the cleanability aspects of processing equipment. Due to more stringent requirements from the industry, suppliers are developing more and more hygienically designed equipment", he says.



Unlike flange connections - which are more expensive - pipe connections lead to dead spaces within the tank.

No failures

Hofmann mentions storage tanks or vessels. At the moment, most tank suppliers have gotten rid of relatively simple failures such as out-

Cost saving

When it comes down to saving water, the dispensers (spray balls or jets) can play a major role. Some suppliers, such as Breconcherry, highlight the cost-saving advantages of their products.

Ian Wynn-Williams, European manager for Breconcherry: "A typical 3" spray ball has a flow rate of 30 cubic metres/hour, which results in a running cost of €30 per hour. The Breconcherry Clip-Disc 150, which has a flow rate of 15 cubic metres/hour, cuts these costs in half: €15 per hour.

This comparison is based on a price of 1 euro per cubic metre. Wynn-Williams says that in most European countries the cost per cubic metre is more in the region of €3.5 to 5 for the total process (pumping, cleaning, waste etc.).

lets which are not placed at the lowest level. As for CIP procedures, it is important that vessels be emptied completely in between cleaning and rinsing steps. If floating fat or foam remain in the tank, the separation of different cleaning steps becomes more difficult and chemical losses will increase.

Hofmann: "If you have a lot of residue in a tank, you use the pre-rinse to wash the product out. Here it is important to empty the tank, so that no fat or foam is floating in the tank. After the pre-rinse, caustic cleaning can take place. If you have a lot of residue remaining in the equipment, you need to have a 'lost' cleaning in the beginning (i.e. the cleaning fluid is not re-used). After a certain time you will change to circuit cleaning. During cleaning it is important to have fluid in the tank, as this improves the cleaning of the tank wall."

Bottleneck

Despite the advances in storage tanks/vessels, there are other hot spots in other equipment parts which need to be improved from a hygienic design standpoint. Hofmann mentions pumps as a potential bottleneck.

"The commonly installed centrifugal pumps have the inlet at the centre and the outlet at the top of the housing. This means these pumps are always half-filled with water, which can lead to microbial growth and to contamination of the finished product. Another critical point is the way sensors are mounted onto tanks/vessels. In most cases, tank suppliers use domes/pipe connections at the top on the tanks. Unlike flange connections - which are more expensive - pipe connections lead to dead spaces within the tank. Sensors which are mounted in pipelines are generally OK in terms of hygienic design."

Finally, gaskets should be designed free of crevices. Again there are numerous solutions on the market, says Hofmann. "The ones with an EHEDG certificate, listed on the website www.ehedg.org, are good in terms of cleanability."

Dead spaces

The problems mentioned above with different processing equipment mostly come down to the occurrence of dead spaces or shadow areas. The same applies to CIP equipment. Especially for pipelines, this means that crevices and obstructions should be eliminated. If certain obstructions are necessary, they should be placed in relation to the flow direction, both of the product and the CIP flow.

As regards the layout of pipelines, there are still some improvements to be made by the industry. In his article in Hygiene in food processing, Mr Majoor from Unilever R&D mentions upward-pointing T-pieces in pipes for the installation of valves. This construction leads either to cleaning fluid bypassing certain areas altogether or to a decreased velocity of cleaning fluid, which reduces the effectiveness of the cleaning procedure.

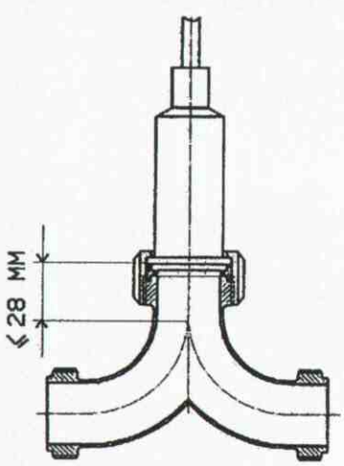
Hofmann adds: "It depends. Short T-connections, which have the same length as the diameter of the pipe, are easy to clean. Longer connections are not. There are other constructions on the market, such as a swept-tee connection with a 'bent stem', which prevent shadow areas. Important is that no threaded connections for sensors are used."

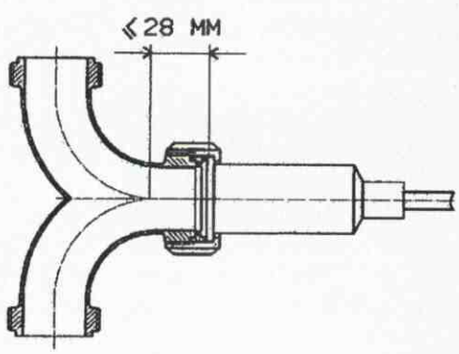
Save on water

Hofmann does not see any major improvements which could be made in other cleaning parameters. "In the formulation of cleaning agents, caustic soda for organic and acids for non-organic foodstuffs and liquids, there have not been any significant changes lately. Both substances are effective, provided temperature, time, velocity and concentration are sufficient. As regards cleaning temperature, 80 degrees Celsius should be the maximum, as too high temperatures lead to the caking of proteins on interior surfaces."

Nowadays, many cleaning agent suppliers offer additional services, such as advice on how manufacturers can optimise their cleaning procedures. This is not so much a hygiene as a cost saving issue. Especially water, which has become increasingly costly, can be saved if cleaning and rinsing procedures are optimised (see cost saving). Obviously these optimums differ from one manufacturer to another, as products and processing configurations differ. ■

* **Hygiene in food processing (2003), Woodhead Publishing ISBN 185573 4664**





Short T-connections, which have the same length as the diameter of the pipe, are easy to clean.

Three types of CIP

CIP systems are either single-use, re-use or multi-use. The first system uses cleaning solutions only once.

Single-use is suitable for relatively small units which are heavily soiled, or for processes where cross-contamination is strictly forbidden. Re-use systems are more common in larger units which are not heavily soiled. Multi-use systems, which combine features of both single- and re-use systems, are designed for cleaning pipelines, tanks and other storage equipment. Multi-use systems function through automatically controlled programmes that involve various combinations of cleaning sequences.