AUTOMATED CIP CLEANING ADAPTED TO WASTE WATER DEMANDS

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Our old friend and chief Swedish correspondent, Uwe Leibfacher, contributed to our recent (No. 3/2019) Sweden theme issue with an article describing the establishment of a new production plant for health drinks by the Swedish company Wellnox. As a kind of spin-off from this article, Uwe has submitted the article below on the unique features of CIP systems installed at two Swedish drinks producers, Herrljunga Cider and Wellnox Health AB. These units automatically adapt the CIP processes so as to ensure that the effluent conforms to set requirements - a convenient and reliable way to secure compliance with the requirements from environmental authorities.

Wellnox CIP unit

Automated CIP units are used at most of the companies that produce food and beverages. The benefits are low operator costs as well as defined and repeatable cleaning cycles with constant parameters – flow, concentration, time and temperature. Some companies even need logged and proven cleaning according to the requirements of food standards that they are certified according to.

Today, more and more food and beverage producers meet rising demands regarding the content from the treatment plants to where they send their waste water, with limits to what is allowed to send and what is not. The configuration and the working principle of an automated CIP unit can help to fulfil these requirements. In the following, two examples of CIP units will be shown, in which the configuration that was chosen had been influenced by different demands for the waste water. In both cases, the CIP unit should be able to handle different cleaning objects such as tanks, pipe systems, fillers and pasteurizers over a wide range of flows.

Basic configuration for the CIP unit:

- Insulated CIP tanks for hot caustic/acid with temperature, volume and conductivity control, equipped with stirrer or possibility for circulation via a plate heat exchanger, automated dosing pumps that are controlled via conductivity
- Cold water tank with volume control and automated filling
- Disinfection tank with volume and conductivity control, equipped with stirrer or possibility for circulation, automated dosing pump that is controlled via conductivity and supply via Ecolab Connexx equipment
- Frequency controlled pumps with dry run protection, both for distributing liquid to the equipment to be cleaned, and for liquid return back to the CIP unit
- CIP panel with integrated plate heat exchanger
- Automated valves, optional leakage safe valves for CIP tanks inlets and outlets
- Piping system where the return flow goes back to the CIP unit and distributes to three possible addresses CIP tank, sewer and external (waste water) tank; possibility for internal cleaning of the CIP tanks
- Flowmeter and pressure control after the pressure pump
- Conductivity control in the return pipe with further options brix etc.
- PLC Control with an individual recipe structure where all parameters can be adapted to the object cleaned

This configuration combines the use of hot caustic/acid without the need for a hot water tank. As a consequence, there is only cold water available. In order to get a smooth temperature course when running water after hot caustic/acid, the heat exchanger needs to be of big capacity. In order to heat up quickly via circulation through the heat exchanger, it is necessary to have an internal piping of the CIP unit in big dimensions.

As an alternative for dosing via conductivity, disinfection might be controlled via a flowmeter. This depends on the type of disinfection product, as not all of these can be measured by conductivity.

FIRST EXAMPLE: CIP UNIT TAKING CARE OF BOD

In this case, two older manual CIP units at Herrljunga Cider AB should be replaced by a fully automated one. This should →

Dosing pumps CIP Wellnox

also be able to clean additional equipment at two new processing areas that were to be installed. As the new processes might have a negative impact on BOD, product residues from the cleaning of tanks and pipe systems should be let transferred to a 40 m3 tank. The tank had been in use before in order to be filled from the bottling hall where product residues were pumped to the tank via an inline conductivity/brix control. An additional pipe was built from the automated CIP unit to the 40 m3 tank. The idea was to collect fluids with high BOD in this tank for delivery to a producer of biogas. On the other hand, the remaining BOD, which was to be sent to the local effluent treatment plant, should stay within the level restrictions.

At the beginning of 2016, Leibfacher CBB Consulting AB got the order to deliver and install an automated CIP unit that fulfilled the requirements above. At the same time, the brewery Paulaner in München built their new plant and offered equipment from the old plant for sale. We were very lucky to find an excellent fully automated CIP unit there, consisting of four CIP tanks and high quality components. The major benefit was that the CIP tanks with the internal piping could be set up identically at the area in Herrljunga that was prepared for it. The disadvantage was that we got equipment without control as Paulaner had a central control for several CIP units. We were forced to construct a new one (which was done by the German company Hormes as one of the main suppliers for Herrljunga Cider) and to equip the plant with additional valves and measuring according to the chosen configuration. Paulaner had operated the heat exchanger with hot water; we had to adapt it to steam instead. We also exchanged both pumps, as we had different flow requirements. As we clean equipment at different places in the Cider plant, we have a total of three CIP Alfa Laval MR return pumps as part of the CIP unit. The return pipe was equipped with a conductivity control. We installed an additional Anton Paar L-SONIC 5100 inline brix control unit, as had been installed in the bottling hall. In addition, we established communication with different panels and controls at the different objects cleaned. CIP cleaning cannot be started without correctly connected pipes and correctly chosen internal CIP programs at the objects cleaned.

Within the individual recipes, we are able to control the return pipe valves to CIP tanks, sewer and external (waste water) tank by brix or conductivity, depending on what we are cleaning. At the beginning of cleaning, we flush with water and pump the product residues from tanks and piping systems to the 40 m3 tank. The system gets drained via the CIP return pump before caustic follows. From there, conductivity control is relevant for the remaining sequences of the actual CIP recipe.

We have very consistent cleaning cycles with this CIP unit, with almost the same volumes for water and cleaning agents used when cleaning the same object several times. This CIP unit handles flow rates from 40 hl up to 250 hl per hour depending on what is to be cleaned.

SECOND EXAMPLE: CIP UNIT TAKING CARE OF PH

In this case, a CIP unit for a new production plant, Wellnox Health AB, had to be designed. Wellnox has restrictions regarding pH; they are not allowed to send waste water with a pH lower than 6.5 or higher than 11 to the local treatment plant. It was necessary to install a waste water tank in order to buffer volumes with "out-of-spec pH". The CIP unit should be equipped with a piping system by which the return flow goes back to the CIP unit and distributes to three possible addresses – CIP tank, sewer and the waste water tank. AB Maseco, which got the order for all equipment for the Wellnox plant, asked Leibfacher CBB Consulting AB and Hormes to construct the CIP unit.

As the requirement was a fully automated CIP system, we based the project on the good experiences with the Herrljunga CIP unit. Wellnox had no need for two different caustic tanks as in Herrljunga, where caustic with 80 respectively 45 degrees C are run. Therefore, three tanks for hot caustic, cold water and acid/disinfection should be sufficient. We had three second-hand tanks (one of them insulated) with 2000 litres volume each and two second-hand dosing pumps (out of the 4 needed) available; everything else had to be built with new equipment. Hormes did that with almost the same type of components as were used in the bigger Herrljunga unit. For instance, Alfa Laval LKH/MR pumps and an Endress & Hauser flowmeter. As the unit with the internal piping was built up completely at Hormes in Germany and again taken apart before the transport to Norrköping, we were able to mount the unit again within two days at Wellnox.

Even the Siemens S 7 control was designed according to the Herrljunga experiences. There are some practical differences. One example is the exchange of detergent. At Herrljunga, we wanted to keep the content in the 40 m3 tank within a constant range of pH. Therefore, we cannot send concentrated detergent to the tank. The emptying programs send the detergents to other tanks instead. At Wellnox, we send concentrated detergent to the waste water tank and neutralize it with the caustic or acid dosing pump of the CIP unit. We have no brix control at Wellnox as we can divide between product and water via conductivity. There are CIP panels at both units for the distribution to different pipes in different directions. At Herrljunga, we use that, and the operators have to change the swing-bends at the CIP panel. At Wellnox, we started with only one line of piping so that there is no need to change bows. As we will complete the plant with more equipment in a second investment step, more lines of piping will be installed and swing-bends must be changed then.

The experiences with the Wellnox unit are similar to those from Herrljunga: Consistent cleaning cycles over a wide range of flows in which the correct liquids are sent to the correct addresses.

CIP unit Wellnox under installation

ABOUT THE AUTHOR

Uwe Leibfacher is an experienced brewmaster (graduated Diplom-Braumeister at TU München-Weihenstephan in 1988) who worked in leading positions in several breweries in Germany and Sweden until 2002. Since 2003 he has been running his own company, Leibfacher CBB Consulting AB who is based in Halmstad/Sweden. Uwe Leibfacher has been involved in many smaller and bigger beverage projects in Scandinavia just as the delivery and start-up of the Nørrebro bottling-line at Baldersbrønde in 2005, relocating and enlarging the craft brewery Nils Oscar in 2006 and 2013/2014, preparation of Herrljunga Cider for BRC certification 2010 and several piping layouts for process equipment in breweries and soft drink plants.