For longer shelf life and higher quality products

CIP – An important ally

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Food and beverage industries have followed through time different policies confronting the necessity of a CIP system. Initially, regulatory mandates where formed and EC Directives were issued undertaking the role of the base for allowing inspection of conformity to the essential requirements of high level hygiene in the production environment. After a long period of harmonization trials food processing companies show evidence of CIP usage appreciation, as they start to consider such a cleaning unit as a non-extractable cornerstone in the foundation of the production line.

(photo: Automation System Hellas)

The common mistake that industries make during the chase of achieving higher quality products and longer shelf life, is that they focus on production machinery and network equipment, excluding the CIP system. Precluding the cleaning parameter and degrading the importance of it can lead to serious malfunctioning and financial loss. The CIP unit should be considered as an important element of the production process and thus one of the most effective spearheads of the industry's artillery at the battle against fouling and product contamination.

This holistic approach has been enhanced due to the fact that industries have realized that a proper functioning CIP system offers a return on investment in cost savings as well as in the extension of product shelf life. Higher cleaning efficiency leads to better hygienic conditions and subsequently to shorter downtimes between product runs.

Community Directives have proved not only to impede any risks arising out of the design and construction of food machinery but also acted as the base for better studying, measuring and in-depth understanding of the cleaning mechanisms. In following this method and at the pursuit of optimizing the CIP performance, predictive growth and inactivation models have been used in order to manipulate production data and determine microorganism growth rates, temperature and cleaning agents' impact. The collection of such information can

help discover any process bottlenecks and thus propose actions for fouling confrontation.

Most importantly, a successfully enforced CIP unit relies on the optimal controlling of the parameters of the extended Sinner circle. According to this model, the cleaning effectiveness is influenced differently by the product type, the time, the chemicals, the mechanics, the temperature and the plant design. These six variables interact with different percent gravity in each case, so a CIP fine-tuning in situ is essential to be carried out by experts who will handle each application with different perspective.

Product type

Depending on the type of the product one can stipulate the possible presence of organic and inorganic matter. The chemical cleaning media should cover the need for removal of sugar, fat, protein, mineral as well as thermo resistant and thermophilic microorganisms.

Time

The time that a circuit has to be cleaned depends on the product type, the piping length and its diameter. There are predefined time set points for each case but laboratory evidence should also be taken into account when running the fine tuning process of adjusting the set point values.

Chemicals

In most cases the cleaning process can be effectively enforced with the help of water, alkaline and acid solutions enriched with surface active, calcium binding and oxidizing agents.

Advised chemical concentration for common liquid food industry:

- Alkaline solution (NaOH): 1,5 – 2,2%
- Acid solution (HNO_3): 1 – 1,5%

Higher concentrations of cleaning solutions may lead to improper cleaning and excessive water consumption.

Mechanical Action

Advised velocity:

- Turbulent flow: 1,5 m/s up to 2 m/s. A higher value of velocity is not recommended as it will only lead to short-time equipment wear and increased energy costs.

Temperature

Advised cleaning temperature for common liquid food industry:

- Water T_{max} = 18 – 45°C

A higher value of temperature is not recommended as it will only lead to energy loss. Warm water will remove a substantial contamination load and will prepare the circuit to be cleaned effectively by the base solution. Inadequate volume of water or low temperature can result to insufficient rinsing and foam creation during the soda recirculation.

- Alkali T_{max} = 65 – 80°C

A higher value of temperature is not recommended as it will only lead to the addition of mineral deposit. This phenomenon can result over time to mechanical wear or flow blockage in sensitive equipment as plate heat exchangers and filling machines.

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- Acid T_{max} = 50 – 60°C

A higher value of temperature is not recommended as it will only lead to the addition of mineral deposit. Again, this can be the reason of insufficient flow velocity and poor cleaning results.

Plant design

A properly designed production plant respecting the hygienic international standards is of the same importance as all the above parameters. Design features as the material type (stainless steel 304, 316L), the surface finish, the type of joints, weldings and couplings can form a sound design that will avoid fouling and leave no dead ends or non-drainable equipment.

Conclusions

Cleaning of food industry process lines and equipment is an issue of balanced strategy. Different issues have to be considered and various parameters have to be controlled. It's a matter of achieving the best cleaning results whilst controlling all the influencing parameters. CIP should not be dealt with as an isolated unit but as an element of the whole process line. In a few words, follow these steps: Understand the process, identify your needs, design and validate your CIP tool.