How to Get Tanks Cleaner in Less Time and Lower Operating Costs (4208)

By Christine Pagcatipunan

Process improvement and cost reduction are key motivators for any plant. As a result, automated tank cleaning is increasing in popularity. A change in tank cleaning methods can result in better, more consistent cleaning, dramatic increases in production uptime, a reduction in the amount of labor required for cleaning, and cost savings on water, cleaning chemicals, energy and wastewater disposal. There are other benefits as well – improved worker safety and elimination of the need for Vessel Entry Permits required by OSHA.

Nearly all totes, tanks, vessels and vats contain product residue that must be removed between batches or at routine intervals in continuous operations. Historically, two methods have been used for tank cleaning:

1. The Manual Method. A worker physically cleans a tank and may actually enter it to do so. This raises safety concerns and often results in inconsistent cleaning, as well as the use of more cleaning chemicals and water than is really necessary.

2. The Fill & Drain Method. Tanks are usually hosed down and then filled with water and cleaning/sanitizing agents. This method is time-consuming and utilizes significant amounts of water, cleaning chemicals and energy, while also keeping tanks out of production for several hours.Many plants find they can save tens of thousands of dollars annually by automating tank cleaning processes. Determining if you could benefit similarly through automation begins with a close look at your cleaning objectives.

Establishing Objectives

The first step in setting objectives requires an evaluation of the product residue to be cleaned. A product residue is defined as any material left behind which should be washed away before another batch of product arrives.

The second step is to identify a cleaning liquid. The cleaning liquid will react with the product residue to physically wash it away or dissolve it. Once the cleaning liquid is identified, consider temperature and material compatibility requirements. This will be important when selecting the tank wash nozzles/system for your application.

The third step is to determine what level of cleaning is required. Once you've established your cleaning objectives, you can begin the process of selecting the right automated solution for your operation.

CIP Nozzles/Systems

CIP systems usually consist of spray balls or spray nozzles permanently mounted on pipes over a tank. They usually operate at low pressures and offer economical and reliable performance.

CIP systems can be configured with a wide variety of spray balls or nozzles, so it is important to understand the various operating methods and resulting performance.

CIP Or Portable Motorized Tank Washers

Another option is high-pressure motor-driven tank washers. These units are typically used to clean tanks ranging in size from 8' to 86’ (2.4 to 26 m) in diameter that require more thorough cleaning.

Motor-driven tank washers use solid stream nozzles and operate at pressures from 100 to 4,000 psi (6.9 to 276 bar) to remove stubborn residue. The motor, air or electric, drives the nozzle assembly with two to four nozzles revolving around the central axis of the nozzle assembly. Motorized tank washers offer independent control of the liquid pressure for cleaning, and the rotational speed (cycle time) to optimize the cleaning process.

Motorized tank washers can be taken from tank to tank or permanently installed. The distance between tanks, cleaning cycle frequency, the number of tanks, the flow system design and labor availability are key considerations when choosing between portability and permanency.CIP or portable motorized tank washer advantages include:

- High-impact force for cleaning even the toughest residue.
- Requires less water for effective cleaning.
- Accommodates a wide variety of nozzles for use with multiple tanks.
- The units are lightweight and can be moved from tank to tank if desired.
- If CIP is preferred, multiple mounting options are available, including a sanitary tri-clamp flange.
- The spray head fits through small diameter tank openings.
- Multiple shaft lengths are available to accommodate a wide range of tank sizes.

Disadvantages of these units are comprised of:

- As with any mechanical device, maintenance is required.The need for a separate motor instead of using only the cleaning liquid to rotate the nozzle.

- Debris in the water is a hazard, so filtration may be required.
- These units are usually priced higher than fixed spray nozzles, fluid-driven reactionary force, and constant speed nozzles.
- Some motorized tank washers offer a higher level of automation if the units can be permanently installed in the tank. Designed for use with tanks up to 40’ (12 m) in diameter, these units include a pneumatic retraction mechanism that lowers and raises the tank washer from the tank. Manual lifting of the unit is eliminated, as is clogging that can result from the nozzles being left in the tank when not in use.

Easy-to-use control options are available that allow multiple stopping points between full insertion and full retraction to position the nozzles where more impact is required or to clean around obstructions. The control panel is often located away from the tank for safety or convenience. Retractable tank washers offer a range of operating pressures, a choice of two or four-nozzle hubs and optional features such as explosion-proof designs and isolation valves to ensure liquid cannot escape from the tank when the tank washer is retracted.

Fully Automated Cleaning Systems

Fully automated systems optimize the performance of spray nozzles and motorized tank washers. Available for a wide variety of flow rates and operating pressures, turnkey systems include a control panel, pumps and valves bundled into an efficient package. Some of these systems can also be placed on mobility casters for added portability.

Automated tank cleaning systems offer many benefits:

- Standard pump/motor sets are sized for best operating efficiency and optimal performance of tank cleaning nozzles.
- Repeatable tank cleaning performance that facilitates regulatory compliance and ensures operator safety.
- Precise control of cycle times ensures cleaning objectives are achieved in the shortest cycle time, conserving energy and water.
- Pushbutton system management. Cleaning cycles and multiple cleaning routines can be adjusted and activated more quickly and easily. Labor requirements for system set-up, operation and maintenance are minimal.
- Automated chemical injection. The correct amount of chemical is injected consistently, ensuring cleaning effectiveness and preventing the waste of costly chemicals.

Cleaning Validation Options

The newest technology for monitoring and documenting the performance of tank wash nozzles uses an acoustic sensor. The sensor mounts to the exterior of the tank. No modification of the tank is required. The sensor “listens” to nozzle performance and identifies any changes.

Rotation speed and frequency, spray loss, nozzle clogging and pressure variation are monitored using diagnostic software, and audible and visible alarms notify operators when changes are detected. Detailed documentation is sent from the monitoring device to a PC for quality control and record-keeping purposes.

Acoustic monitoring devices are typically compatible with pressurized and non-pressurized tanks of all sizes, and can be used with a wide range of tank wash nozzles and motorized tank washers.

In some instances tank cleanliness is validated by coating the tanks with proteins or other substances that fluoresce under UV light. Taking cultures with swabs to verify tank cleanliness is another common approach.

Less typical is measuring the conductivity/resistivity of the water/cleaning agents or analysis of the final tank wash effluent in order to determine if contamination is present.

Automation Can Pay Off Quickly

Automation results in cleaner tanks, repeatable cleaning, decreased risk of product contamination and reduced cost of consumables, but at what price?Automation is often associated with the words “expensive” and “costly.”

However, low-pressure CIP systems are quite economical since the cost of spray balls and nozzles is very reasonable. Motorized tank washers and automated tank cleaning systems are more costly but typically offer a quicker return on investment.

Many users of automated tank cleaning products and systems report a payback period of just a few months. The gain in production uptime and the reduced labor cost comprise most of the savings. The reduced cost of chemicals, water, energy and wastewater disposal also add up quickly and contribute to the short payback period.

Is automated tank cleaning for every manufacturer? In most instances the answer is yes. However, it is important to thoroughly research all the automation options available to ensure you will achieve your tank cleaning objectives as efficiently and economically as possible.

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