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HOW TO GET TANKS & TOTES CLEANER IN LESS TIME & LOWER COSTS

BY ANTHONY WOOD

INTRODUCTION

Most people understand and appreciate the benefits of automated tank cleaning – cleaner tanks in less time, reduced chemical and water use and improved worker safety. But, when it comes to comparing tank cleaning equipment options and techniques to optimize performance, a general understanding isn't enough. You need to dig a bit deeper to ensure you're using the best equipment available for your operation and getting the best results.

There are many tank cleaning devices that have comparable specifications and provide similar performance. The differences between similar units may be the time required for cleaning, the amount of water and chemicals consumed, maintenance requirements and/or total cost of ownership. Using the information that follows should prove helpful as you take steps to ensure your tanks are cleaned thoroughly, in the shortest amount of time and at the lowest possible cost.

GETTING STARTED

The first step is to take a moment and review why you're considering a change. Of course, if you have a contamination or quality problem, you know you need to take action. **But, there are many other factors that could be driving a change such as:**

- ☐ Cleaning level isn't adequate or consistent
- ☐ Cleaning takes too long
- ☐ Water/chemical use and waste water disposal costs are too high
- ☐ Using too much hot water
- ☐ Energy cost is too high
- ☐ Current tank cleaning equipment requires too much maintenance

If more than one of these factors is prompting you to make a change, prioritize them. For example, if reducing cleaning time is your motivation, understand you may not be able to cut cleaning time by 50% and eliminate hot water use. However, you may be able to cut cleaning time by 25% and reduce hot water use by 50%. It helps to have a clear understanding of your goals.

Gathering all the facts early in the process will be very helpful as well.

How many tanks require cleaning?

What's the tank size and geometry?

Are there internal obstructions?

What residues are being cleaned?

What cleaning chemicals are used?

What temperature is the cleaning solution?

What flow and pressure are used/available for cleaning?

What size are tank openings and where are they located?

How much water, chemicals, energy and labor are currently used to clean each tank?

How much is your waste water disposal cost per tank?

How do you evaluate tank cleanliness? Visual inspection, swab test, riboflavin test or other method?

Impact is an important selection criteria when evaluating tank cleaners. However, it is important to understand impact data and to consider other factors as well.

KEY CONCEPTS IN TANK CLEANING

When evaluating tank cleaning equipment, one important consideration is impact, the amount of force the cleaning liquid applies to the tank surface.

BUT, THERE ARE SOME THINGS YOU NEED TO KNOW ABOUT IMPACT.

- **When manufacturers provide impact data, ask if it is based on theoretical calculations or test data**
  - Theoretical calculations are inherently inaccurate because it is assumed that all nozzles used in tank cleaning devices provide the exact same performance. Nozzle performance varies greatly by type and by manufacturer so theoretical impact calculations have limited value – especially when used for comparison purposes.
  - Test data is more accurate than theoretical calculations, however, it is collected statically – measured while nozzles are in a fixed position spraying on a surface. When tank cleaning nozzles are actually used for cleaning, they rotate in order to provide full coverage of tank surfaces and impact is reduced. Even when nozzles rotate slowly, impact will be decreased at the wall surface.
- **There is no industry standard for measuring impact.** Each manufacturer does it differently, making it impossible to accurately compare products from different suppliers.

Impact is important, even though it is difficult to measure and compare. But, there are other very important factors to consider when selecting tank cleaning equipment. **If you make a purchase decision based on impact alone, you may regret it. Here's why.**

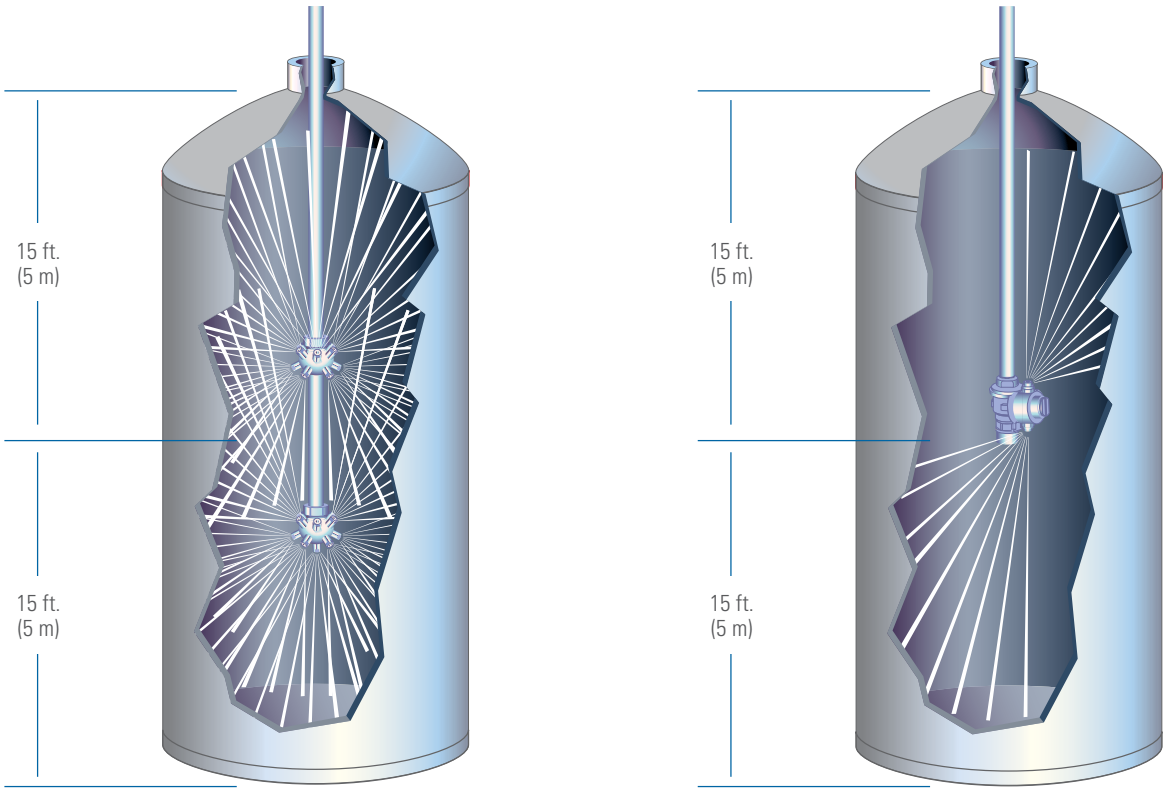
Not all nozzles are equal. Nozzles that produce the same type of pattern, such as a solid stream, will perform differently depending on how they are designed and machined. A nozzle that produces a solid stream that holds together from its tip to the tank, will provide better cleaning than a nozzle that produces a stream that begins to break up before it reaches the tank. The nozzle that delivers a continuous solid stream without any liquid breakup has a higher cleaning efficiency. The difference in nozzle efficiency from different manufacturers can be as high as 20%, so ask your supplier for this information. **Look for nozzles with a 98% to 99% efficiency rating.**

In addition to understanding the differences between tank cleaners, be sure to understand the performance differences between the solid stream nozzles being used.

OTHER FACTORS TO CONSIDER:

SPRAY DISTANCE:

Be sure you ask about effective spray distance. Once you exceed the recommended distance, impact will be reduced.



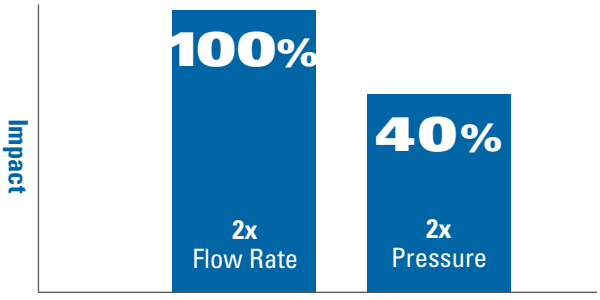
Spray distance is usually expressed in terms of tank diameter. If your tank is 15 ft. (5 m) in diameter and 30 ft. (9 m) tall, you will need two tank cleaners that can clean 15 ft. (5 m) or one that can clean up to 30 ft. (9 m).

ROTATION SPEED:

Rotating tank cleaners use less water and chemicals than stationary tank cleaners. Rotating tank cleaners also provide more impact than stationary devices. However, there are many kinds of rotating units. The faster the unit rotates, the faster it will complete a cleaning cycle. However, it is important to understand that as rotational speed increases, dwell time decreases and the integrity of the spray, impact and overall cleaning effectiveness may be reduced. Take some time to evaluate the trade-offs if you are considering a high-speed, rotating unit.

FLOW RATE AND PRESSURE:

Operating at lower flow rates conserves energy, water and chemicals. When additional impact is needed, increasing flow rate is more effective than increasing pressure. Doubling flow rate increases impact by as much as 100% while doubling pressure increases impact by just 40%.



The Effect of Flow Rate and Pressure on Impact

WAYS TO SHORTEN CLEANING TIME

To reduce cleaning time and return tanks to service more quickly, you have a few options:

- Increase impact by increasing flow and/or pressure
- Increase temperature of cleaning liquid
- Adjust chemical/water concentration
- Reposition the tank cleaning equipment in the tank
- Use multiple tank cleaners instead of a single unit
- Use a more efficient tank cleaner

The best way to reduce cleaning time will depend on your application. Here are a few examples of the methods used by others to achieve dramatic time reductions.

TOTE CLEANING TIME REDUCED FROM 45 MINUTES TO 10 MINUTES

Before: Turbine-driven rotating nozzle spraying hot water at 10 gpm (37.8 lpm) at 100 psi (6.9 bar). Wash cycle was often repeated a second time for complete removal of residue.

After: Motorized tank cleaner with two rotating nozzles spraying hot water at 20 gpm (75.7 lpm) at 500 psi (34 bar). Residue is completely removed with one cycle.

RIBBON BLENDER CLEANING TIME REDUCED FROM 12 HOURS TO 45 MINUTES

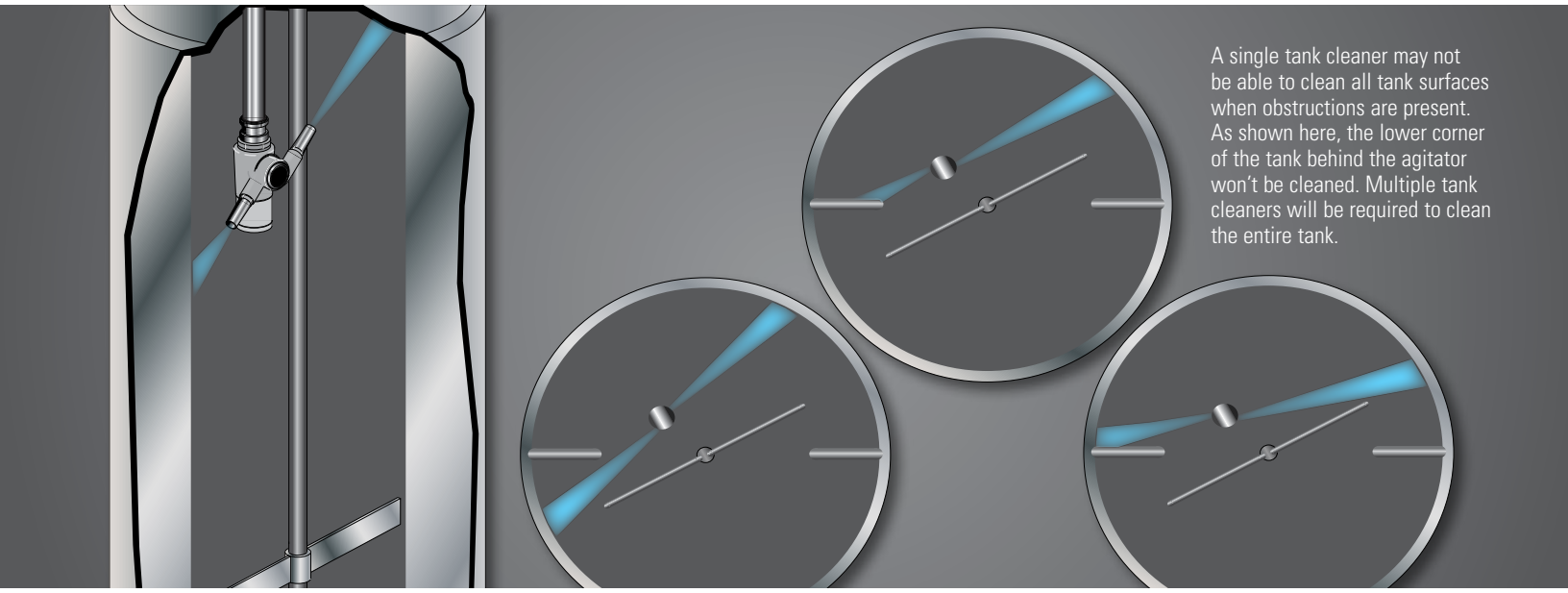
Before: Manual cleaning with high pressure hoses required up to 12 hours. Obstructions in the blender made cleaning tedious and time-consuming.

After: Motorized tank cleaner spraying hot water at 20 gpm (75.7 lpm) at 100 psi (6.9 bar). The shaft of the tank cleaner is equipped with an adjustable ball fitting so the spray turret can be repositioned during the cleaning cycle to clean around the ribbon blade.

FERMENTER CLEANING TIME REDUCED FROM 45 MINUTES TO 20 MINUTES

Before: Tank cleaning nozzle operating at 40 psi (2.8 bar) wasn't able to provide effective cleaning in one cycle. A second cycle was required, extending cleaning time and increasing use of water and chemicals.

After: A fluid-driven tank cleaner with a two-nozzle hub operating at 90 psi (6.2 bar) provide thorough cleaning of the fermenter in less than half the time previously required.



A single tank cleaner may not be able to clean all tank surfaces when obstructions are present. As shown here, the lower corner of the tank behind the agitator won't be cleaned. Multiple tank cleaners will be required to clean the entire tank.

IMPROVING CLEANING EFFECTIVENESS

Internal obstructions like agitator shafts/blades, coils, etc., block the spray from hitting the tank wall. The obstructions make it more difficult to achieve complete cleaning but it is certainly possible. It becomes a matter of optimizing the location of the nozzles and keeping operating costs in mind.

A powerful tank cleaning machine may be able to provide enough impingement to get around the obstructions and reach tank walls, but it will take longer to clean the tanks and/or require higher flow rates and pressures than other solutions. While higher flow/pressure operation is needed to clean certain areas of the tank, it is overkill for the majority of the tank surfaces.

A more efficient approach would be to use two to three smaller, less powerful tank cleaners in different locations to ensure complete coverage. Tanks will be cleaned in less time using less chemicals and water.

If the tank only has a single entry opening, special lances and flanges can be used so the nozzle turret can be easily moved to multiple locations in the tank. Using special lances and flanges can be an effective way to remove skim lines as well.

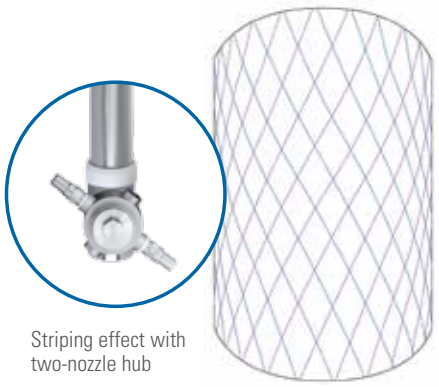
Tank cleaning lances are available in different lengths for precise nozzle positioning.

Adjustable flanges are a cost-effective way to ensure proper placement of the spray turret.

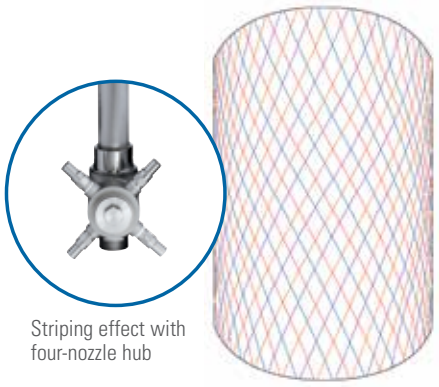
IF YOU DETECT A STRIPING PROBLEM, YOU NEED TO TAKE IMMEDIATE ACTION TO PREVENT CONTAMINATION.

Motor- and fluid-driven tank cleaners provide 360° coverage. However, the solid stream sprays do not overlap as they rotate so there is a small distance between the sprays. The greater the distance the nozzles are from the tank walls, the greater the distance between the sprays. This distance between the sprays causes a "striping" effect. **Options to address striping include:**

- Increase pressure and/or flow to provide more impact on the tank walls and increase the impingement on the tank walls
- Select a tank cleaner that has better resolution between passes. There are many different types of rotating solid stream tank cleaners and they differ in the angle the nozzle indexes per revolution. The smaller the index per revolution, the closer the distance between passes. Keep in mind the smaller the index, the longer it takes to make a complete cycle and cover the full tank, increasing overall cleaning time
- Another method to improve resolution is to increase the number of nozzles. A four nozzle unit will have a better resolution than a two nozzle unit. This should eliminate the striping problem but requires more overall flow to provide the same impact per nozzle
- Using a nozzle with a high impact efficiency transfers more energy to the tank walls. Less loss of energy results in a larger footprint on the tank wall and reduces striping



Striping effect with two-nozzle hub



Striping effect with four-nozzle hub

AVOID OPERATIONAL PROBLEMS LIKE COSTLY CLOGGING

When tank cleaners fail to work properly, you're facing several problems simultaneously:

- Contamination due to tanks that are not clean
- Unscheduled downtime/loss of production time
- Costly repairs and rebuilds

Fortunately, with a little planning you can avoid most operational problems.

Some tank cleaners require very clean water. If there is debris in the cleaning solution or the cleaning solution is being recirculated, a strainer or filter should be used. Filter mesh size can vary, so be sure to match the mesh to your tank cleaning unit.

If you think you can skip the strainer or filter, reconsider that decision. When there is no strainer, the tank cleaning unit is acting as the filter. Debris can clog nozzles and become imbedded in bushings and gears, reducing the service life of the unit. Even if you are just cleaning with water, rust or scale from piping may accumulate in the unit.

When filtration isn't an option, a motor-driven tank cleaner is preferable to fluid-driven units. That's because motor-driven units use simple internal components. The external motor generates the necessary torque to overcome debris. Fluid-driven units that generate enough torque to overcome debris have gear trains that interact with the fluid. Debris will escalate wear on the gears.

Use of strainers removes contaminants from liquid to ensure continuous rotation and minimize clogging.

PURCHASE PRICE VS. COST OF OWNERSHIP

Before you finalize a decision about new tank cleaning equipment, be sure to consider maintenance and repair costs.

- How frequently will the unit need to be rebuilt?
- What parts are required and how much do they cost?
- How much downtime is associated with the rebuild?
- Can the unit be rebuilt on-site or does it have to be returned to the supplier?
- Is preventive maintenance required or can the unit run until it stops working?

Units with gear trains typically last a bit longer than direct drive units but they require more expensive and more complex repairs – typically by trained professionals at the supplier's facility. In addition, preventive maintenance is required so only wear components need to be replaced when the unit is rebuilt. If preventive maintenance is not performed regularly and the unit stops rotating, the cost of repair typically quadruples. That's because the gear train is damaged and needs to be at least partially replaced.

This type of repair is far more costly than replacing wear parts. Tank cleaning equipment with gear trains typically provides the best cleaning, but the cost of ownership is quite high. If the tank cleaner is used regularly, you should purchase two units so you always have a spare.

Motor-driven and direct drive tank cleaners are good alternatives to units with gears. Motor-driven units require an additional utility to drive the motor, but are quick and easy to repair. Typically, these units can be used until they start to leak or stop working. Once the wear components are repaired, the unit will work again. In some cases, additional components will need to be replaced but the repair is much easier and less costly than repairing gear train units.

Direct drive units are fluid-driven units but don't have a gear train. When the unit stops working, it can usually be repaired on-site using an inexpensive repair kit. Repair time is typically less than 20 minutes.

CONSULT WITH EXPERTS TO ENSURE OPTIMAL PERFORMANCE

Even if you believe your application is straightforward, you should contact a tank cleaning expert. The guidance they can provide is invaluable and will help ensure tanks and totes are cleaned as effectively and efficiently as possible for the lowest possible cost.

A phone consultation is good, but an on-site visit is even better. While evaluating your operation, an expert will look for things that can affect installation and performance such as head space available outside the tank, distance from pump to tank, plumbing, worker safety issues and residue conditions. It is very difficult to convey all the relevant information over the phone.

The leading tank cleaning manufacturers typically provide this service at no cost. Be sure to look for a company with representatives in your area so you can be assured of good service and support once you invest in new tank cleaning equipment. Also, ask about trial programs so you have time to evaluate the equipment prior to making a commitment.

Anthony Wood is a Tank Cleaning Specialist at Spraying Systems Co. He is involved in the development and design of the company's tank cleaning product line and works with customers in a variety of industries to automate and optimize their tank/reactor cleaning operations. Mr. Wood earned an engineering degree from Ohio State University and has been with Spraying Systems Co. for several years. **He can be reached at 630-665-5000 or Anthony.wood@spray.com**

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