CHEMICALS
Success Story

ULTRASONIC TANK CLEANING

Ultrasonic Tank Cleaning Now a Viable Alternative to Solvent Cleaning

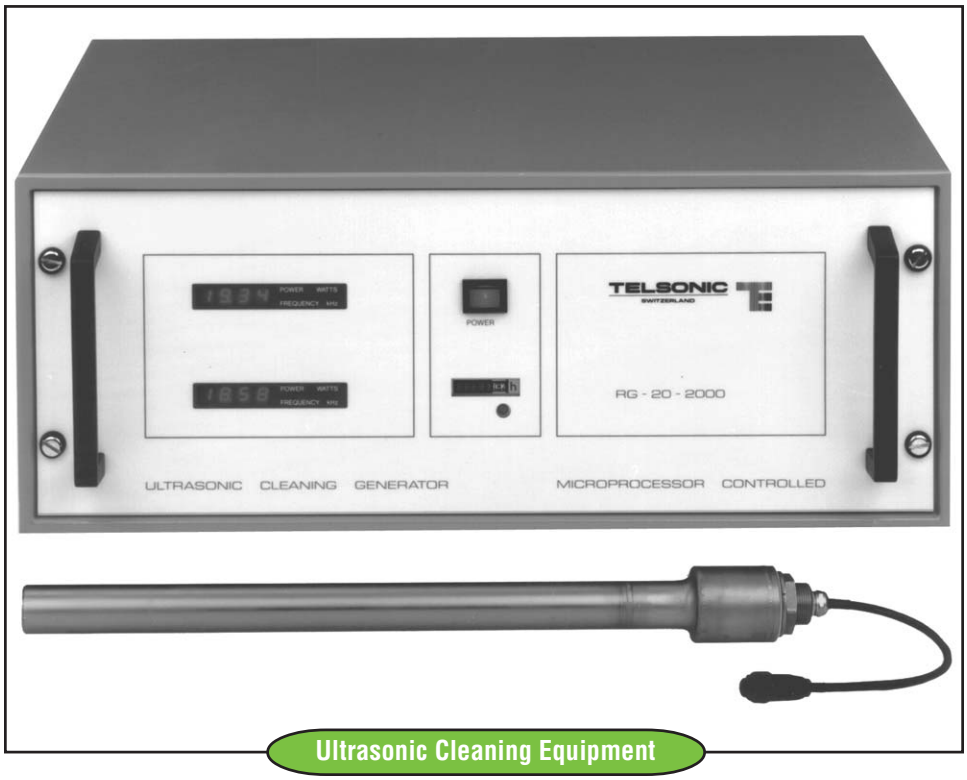
Benefits
- Elimination of VOC-emitting cleaning solvents such as methanol, ethanol, and methylene chloride, and their associated hazardous waste streams. Eliminated VOC emissions from the incineration of the spent solvent
- Reduced cleaning time from about 1 day to 1 hour
- Conservation of the petroleum feedstock otherwise needed to produce cleaning solvents
- Energy savings of 225 million Btu/year for 200-gallon tank system
- Cost savings of $350,000/year for 200-gallon tank system

Applications
Ultrasonic tank cleaning can be used for cleaning residue from tanks used in chemical and pharmaceutical processing. Additionally, it can be used for cleaning paint tanks such as those used in automotive painting operations.

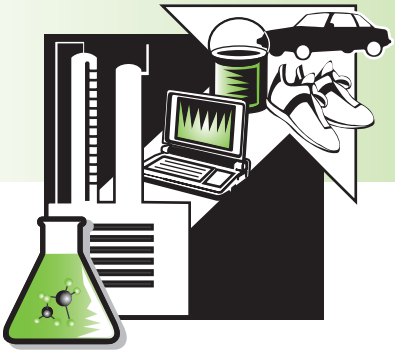
Chemical and pharmaceutical companies have long used solvents to clean tanks. Conventional cleaning techniques depend on dissolving or emulsifying contaminants in a solvent to provide the cleaning action. These conventional techniques use solvent rinsing or multiple solvent distillations to clean the process tanks and reactors. Some of the solvents used include methanol, ethanol, methylene chloride, and isopropanol, all which emit volatile organic substances both during the cleaning process and during subsequent incineration of the waste.

Now, companies have another option. They can put the power of sound to work in big industrial tank cleaning jobs and avoid toxic solvents.

This article contains information on TELSONIC's partnership with the NICE^3 Program, information on the process design and benefits, and energy savings and pollution prevention associated with the innovative process.



Ultrasonic Cleaning Equipment



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Partnership with the NICE^3 Program

Thanks to a cost-shared demonstration project sponsored by the Department of Energy's NICE^3 (National Industrial Competitiveness through Energy, Environment, and Economics) Program, an innovative firm has adapted ultrasonic technology to generate bubbles in fluid-filled tanks cleaning inner surfaces without solvents, emissions, or manual labor. The purpose of the NICE^3 program is to champion technological advances that don't receive the encouragement and visibility they should because of low energy prices that offer little motivation to innovate among many industries. The NICE^3 program works with the most waste- and energy-intensive industries in the U.S. to effect savings and efficiencies that improve competitiveness, productivity, and environmental quality.

Increasing disposal costs, raw material prices, and energy requirements led the DuPont-Merck Pharmaceutical Company to work with TELSONIC Ultrasonics to develop an ultrasonic cleaning process that eliminates the need for solvents, using patented, off-the-shelf equipment manufactured by TELSONIC.

Process Design and Benefits

A tube resonator uses an integrated ultrasonic transducer and rod-shaped tubular ultrasonic resonator that enters the water-filled tank via a top opening. The ultrasonic transducer and tubular resonator vibrate 20,000 times per second, creating high- and low-pressure zones that in turn cause tiny bubbles to form in the water. These cavitation bubbles grow to a specific diameter and then implode violently, providing an intense scrubbing action on the inside surfaces of the tank, as well as on agitator blades and bottom valves. The bubbles are small enough to penetrate even microscopic crevices, so the cleaning process is superior to conventional methods. This technology eliminates the need to buy cleaning solvents and to dispose of solvent waste. Also, because the cleaning cycle is faster (typically three hours) substantial savings can be realized in both energy and labor costs.

Ultrasonics takes the guesswork out of getting equipment clean, explained Angelo C. Piro, president of TELSONIC. "Anything immersed in liquid is going to be cleaned," as opposed to manual cleaning or pressure washing, both of which are "hit or miss," he pointed out.

"Not only is it a dollars and cents kind of thing, but it's obviously just good business to reduce the amount of hazardous waste you're creating."

– Angelo C. Piro
President
TELSONIC Ultrasonics

OFFICE OF INDUSTRIAL TECHNOLOGIES

ENERGY EFFICIENCY AND
RENEWABLE ENERGY
U.S. DEPARTMENT OF ENERGY

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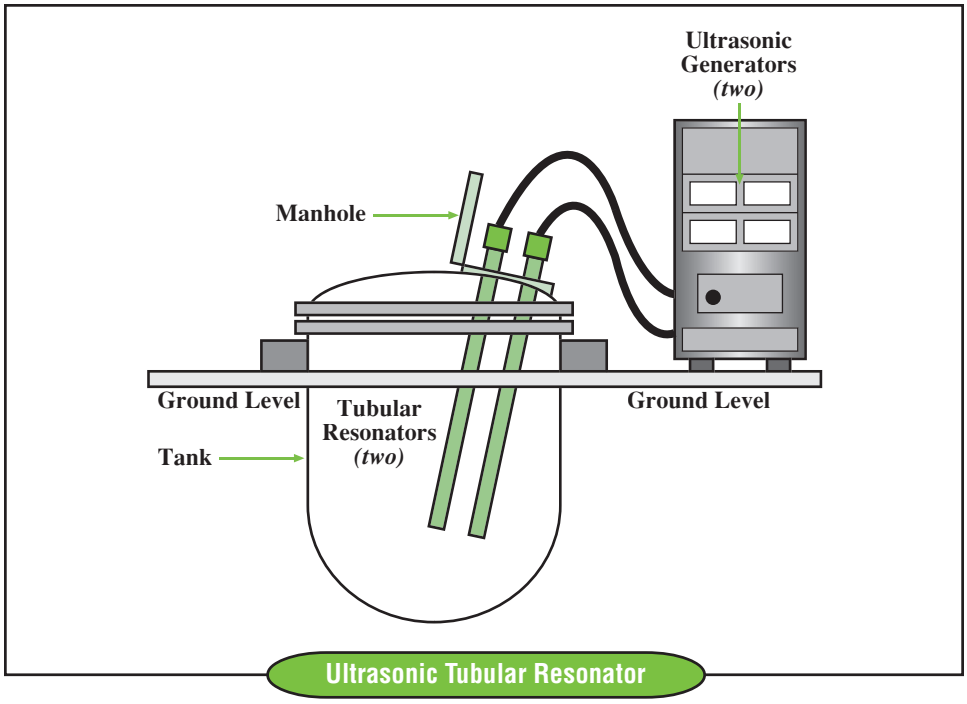
Project Partners

- DuPont-Merck Pharmaceutical Co.
  Deepwater, NJ
- New Jersey Department
  of Environmental Protection
  Trenton, NJ
- TELSONIC Ultrasonics
  Bridgeport, NJ



Ultrasonic Tubular Resonator

A tremendous advantage ultrasonic cleaning presents is the ability to clean hollow equipment that was not accessible with existing technology. “Standard immersible transducers won’t fit through the access ports of much equipment like gas cylinders,” said Piro. “Ours are only 2 inches in diameter; plus, the resonator tube includes the transducer in a configuration patented by the company.”

“Using the tube resonator is a drop-in, off-the-shelf technology,” Piro continued. Installing it can make an immediate impact on labor costs, energy costs, and environmental operating costs. Those savings will be realized immediately as well as in the long term.

“Not only is it a dollars and cents kind of thing, but it’s obviously just good business to reduce the amount of hazardous waste you’re creating. With all the current and pending regulations regarding environmental control, it’s just sane business to cut down on toxic waste production,” Piro added.

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Ultrasonic cleaning has been most successful in applications to remove insoluble particulate matter from hard substrate surfaces. It has been used for more than 50 years in small-scale operations such as laboratories. Because of its superior cleaning abilities, ultrasonic cleaning has become the standard for critical cleaning in medical applications. The use of ultrasonic technology in larger-scale operations wasn't considered possible because most ultrasonic transducers produce a uni-directional energy wave, propagating in a single direction. TELSONIC's tube resonator solves this problem by producing an omni-directional ultrasonic vibration from the entire rod-shaped surface, producing radial ultrasonic vibrations from the resonating surface. The diameter and length of the tube resonator can be varied from 3/4 inch in diameter to as long as 70 inches in length. This variety of sizes makes the tube resonator applicable to functions such as cleaning pipes and gas cylinder interiors.

In the DuPont-Merck application, the first U.S. application and the demonstration site for the NICE^3 grant, solvent waste generated was reduced by 80 percent. Likewise the amount of hazardous chemicals handled and transported, as well as the amount of vapor emissions on site were reduced by 80 percent leading to increased worker safety.

Energy Savings and Pollution Prevention

TELSONIC has since sold 20-30 systems for tank cleaning ranging in size from a two-gallon tank to a 950-gallon tank. A typical tank cleaning system is sized for a 200-gallon tank and averages three tube resonators per tank. The average time per cleaning cycle is three hours and there are typically two tanks cleaned per week. This results in energy savings of 1.175 million Btu per cleaning, when comparing the ultrasonic cleaning method to a typical distillation cleaning method. There are additional energy savings resulting from reduced methanol used for tank cleaning. For a 200-gallon tank, 100 gallons of methanol would be used for each cleaning. With this reduction in methanol, an additional 987,000 Btu per cleaning would be saved. In an average system, the resultant energy savings are 224.85 million Btu per year.

Cost savings associated with an average system would include the energy savings as well as the reduced use of methanol, and reduced downtime, as the cleaning method is less time-consuming than the traditional solvent cleaning method. This translates into a savings of approximately $350,000 per year for a 200-gallon tank. With the cost of the cleaning system, it takes only eight cleaning cycles (about four weeks) to pay for a system for a 200-gallon tank.

TELSONIC Ultrasonic's unique cleaning system cleans tanks, cylinders and pipes used in manufacturing without using polluting solvents.

NICE^3 – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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