EnviroCare

Patented Technology

MicroMist Scrubbing Systems

US Patent Nos. 5,279,646, 5,512,085 & 5,759,233

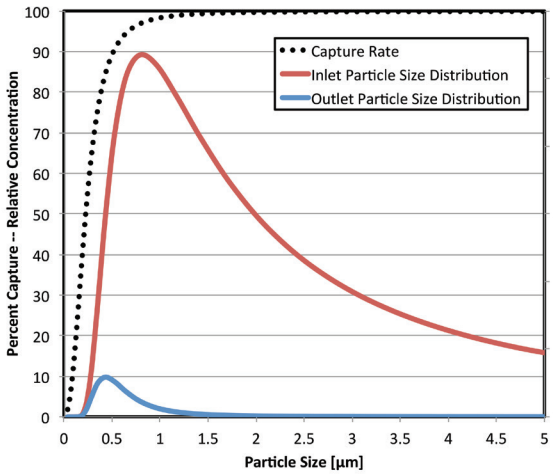
Breakthrough Technology Replaces Conventional High Energy Scrubbers and Wet ESPs.

Venturi scrubbers have traditionally been utilized as particulate control devices on various process gas streams. However, these devices have relatively low collection efficiencies, mainly on small size particulate, even where high fan energy is applied to atomize the collecting liquid.

Developed and applied by experienced process engineers, the EnviroCare MicroMist Scrubber was specifically designed to collect sub-micron particulate at very high efficiencies with low energy input. It removes condensables, such as trace metals, while reducing liquid effluent waste streams, making it the logical choice when evaluating gas cleaning options for a variety of applications in many process industries.

Benefits of MicroMist Scrubbers

- Proven Performance
- Lower Energy Consumption
- Easy Retrofit/Minimal Outage Time
- Lower Equipment Cost
- High Efficiency on Submicron Particulate
- Acid Gas Control
- Maximum Collection of Condensables
- Stable Fan Draft Control
- Minimal Waste Stream Effluent



"Achieve compliance well into the future with revolutionary air pollution control technology from EnviroCare—the MicroMist Scrubber. Its performance eclipses that of high energy venturi scrubbers and rivals that of Wet Electrostatic Precipitators (WESPs) without the high cost or the sensitivity to high particulate loadings."

MicroMist
Engineered Systems

MicroMist Scrubber Theory

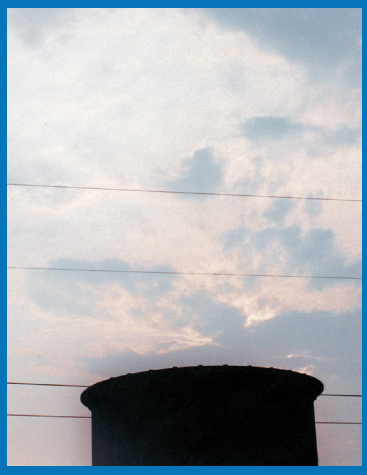
Industrial smokestack emissions are generally composed of fine dry particulate and of condensed solids and liquids resulting from cooling of the exhaust gas. These fine particles pose a challenge because they are difficult to capture, greatly affect stack opacity, and can contain significant concentrations of heavy metals and other toxic compounds.

The MicroMist Scrubber is a patented combination of various collection and separation technologies that resulted from a need for higher efficiency scrubbing of microfine particulate with low energy requirements. It is specifically designed to collect submicron particulate (<1.0 µm), condensables, and acid or noxious gases at high efficiencies (>99.5%).

More than a single technology, the MicroMist Scrubber is actually comprised of multiple novel gas cleaning devices, staged in series and in various combinations to achieve the required collection efficiencies on these various toxic and nuisance substances.

BEFORE

AFTER



The left photo shows the emissions of a traditional high energy venturi scrubber. That same stack (right) displays no emissions after a MicroMist Scrubber upgrade.

MicroMist Scrubber Typical Efficiencies

Particulate	>99.5%
Condensables	≥99%
Heavy Metals	95-99+%
Acid Gases	>99%

Conventional Scrubber Deficiencies

Because conventional scrubber designs were developed at a time when little attention was given to the smaller sized particulate and when the harmful nature of gaseous emissions was little understood, it is no wonder they exhibit low efficiencies in the control of these pollutants.

Conventional venturi scrubber designs are deficient in three major areas: *collection, turndown and energy efficiency.*

First, the venturi, the primary particulate removal device, comes before the condensing section, allowing condensables to transform into submicron aerosols after they have passed through the primary collection mechanism.

Second, because venturi scrubbers rely on high differential energy related to gas velocity for collection of particulate, variations in the gas flow affect particle collection efficiency.

Third, inefficient venturi geometries limit the energy recovery potential of converting velocity pressure back to static pressure.

Elements of MicroMist Scrubber

The Enviro
Typical

The MicroMist Scrubber addresses the deficiencies of conventional scrubbers by dealing with their basic design flaws. The result is a patented technology that exhibits high collection efficiency on submicron particulate and condensables, with high turndown capabilities and excellent energy recovery.

Separate Scrubber Effluents

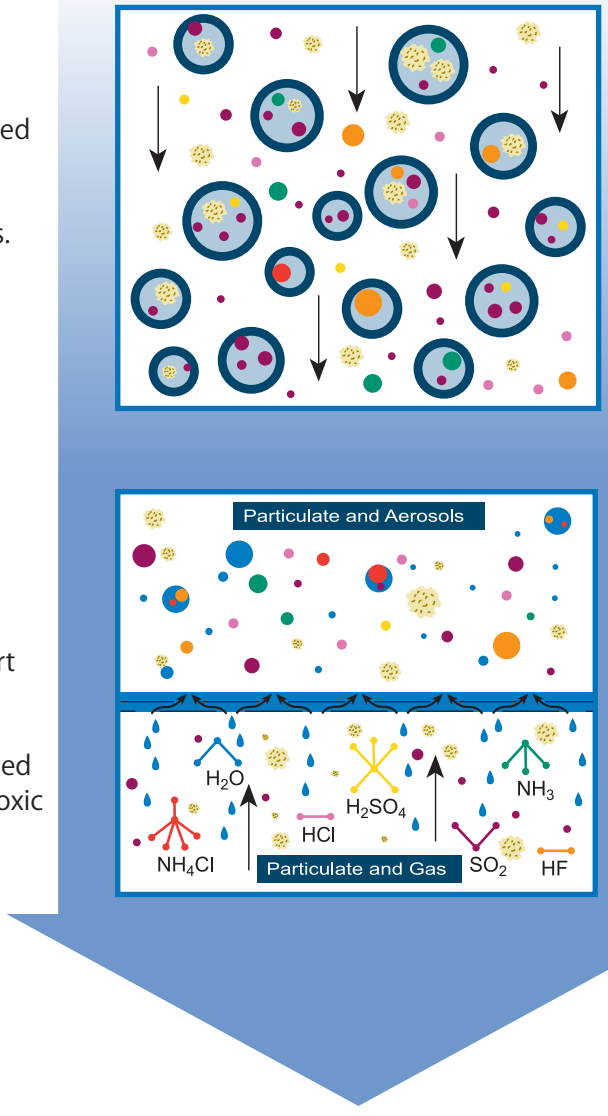
The MicroMist Scrubber differs from conventional designs in that it segregates the various stage effluents. In a very practical way, the system is designed with separate drains for the quencher, the subcooler and the collection stages, allowing for greatly reduced water treatment requirements, efficient re-use of effluents, selective alkali scrubbing, and reduced toxic effluent processing.

STAGE ① Quenching

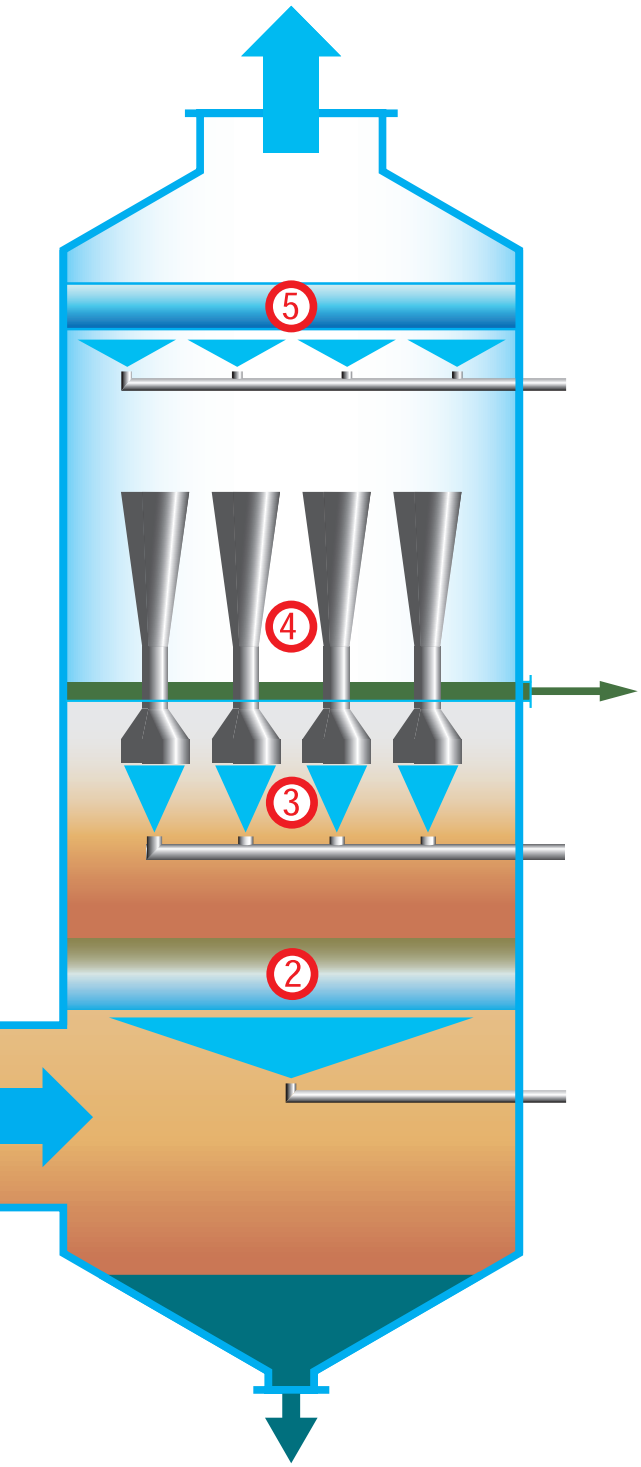
Gases are quenched to saturation with energy efficient atomizing nozzles. Eliminates bulk (95 percent) of particulate.

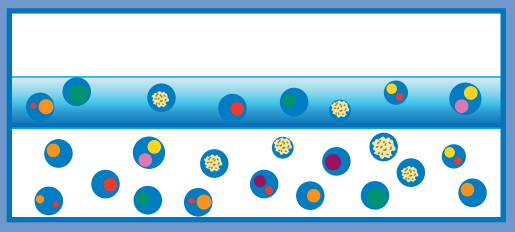
STAGE ② Subcooling (Optional)

Subcool to convert condensable components into aerosols. Often used for acid gas and toxic metals control.

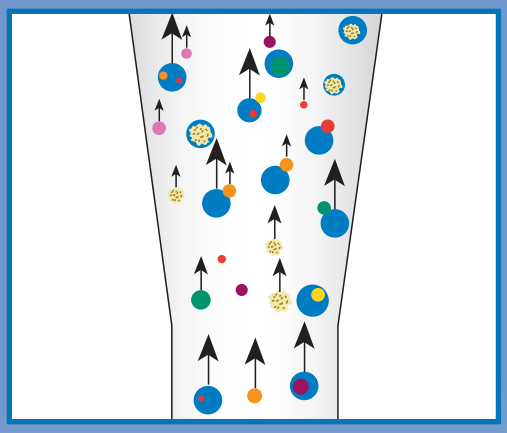


oCare MicroMist Scrubber
General Arrangement

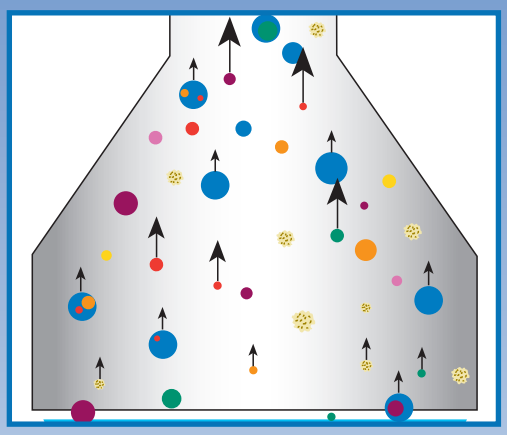




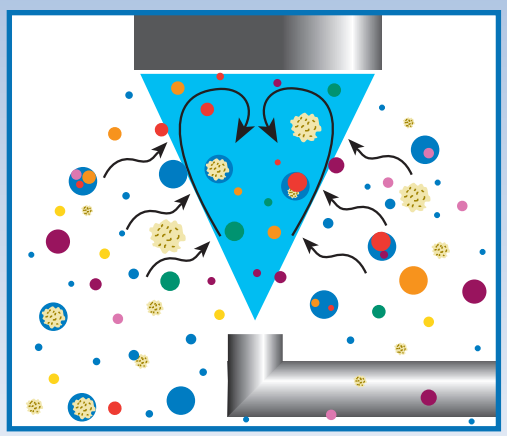
STAGE ⑤ Separation
High efficiency separator removes dirty droplets from the exhaust gases.



STAGE ④B Collection element outlet
After reaching equilibrium, scrubbing droplets shoot past aerosols and fines, causing further collisions and completing the collection process.



STAGE ④A Collection element inlet
Gas entrained aerosols and fines move faster than liquid scrubbing droplets, causing collision and particle capture.



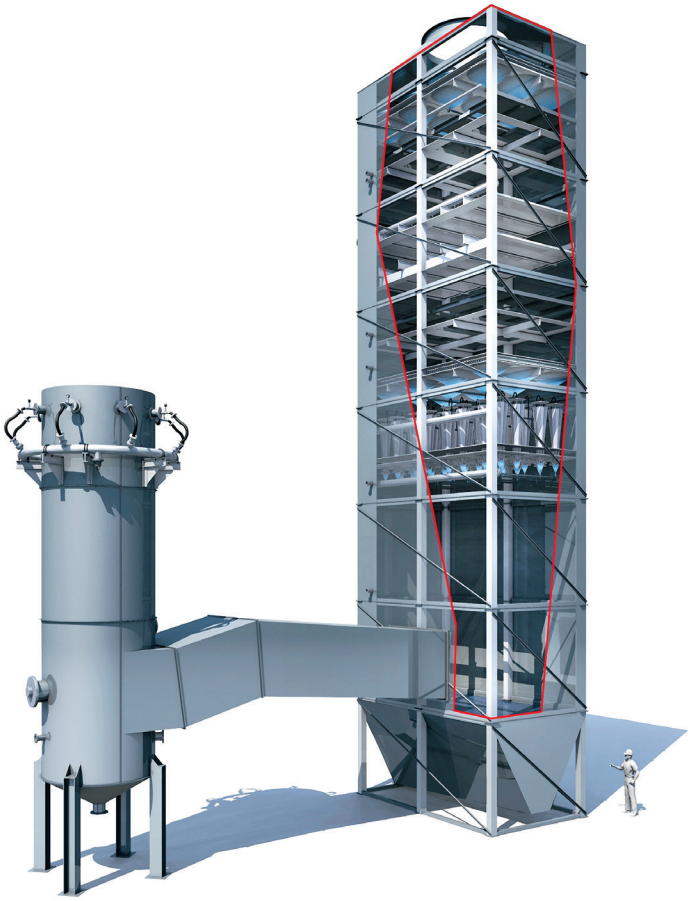
STAGE ③ Atomization
Aerosols and particulate are induced into negative pressure flow field formed by the HydroMist nozzle.

Scrubber Retrofit Options

Venturi Throat Modifications

In many cases, a simple retrofit can achieve high particulate removal efficiencies by affecting the cooling and the scrubbing in a single step in an existing scrubber Venturi stage.

This modification utilizes the existing Venturi throat and MicroMist spray nozzle combination to create high relative motion between the injected scrubbing droplets and the submicron particles, resulting in higher capture efficiency at lower energy requirements.



Multiple Element Upgrade

Where higher capture efficiencies are desired, a more extensive retrofit may be required. In these cases, the most practical method is to replace the Venturi stage with a simple quencher stage, and install a new subcooler/collector/separator unit in the existing separator shell section.

The retrofit is comprised of field-modification of the primary quenching or cooling stage, with the rest of the equipment typically shipped in one section for ease of on-site installation. The new section is shipped with a solid diaphragm plate carrying multiple, parallel collector tubes, mounting ports for nozzle lances and a pre-installed separator stage for field installation in the existing separator section. The retrofit components are shipped preassembled to the largest extent possible to minimize installation time.

Control System

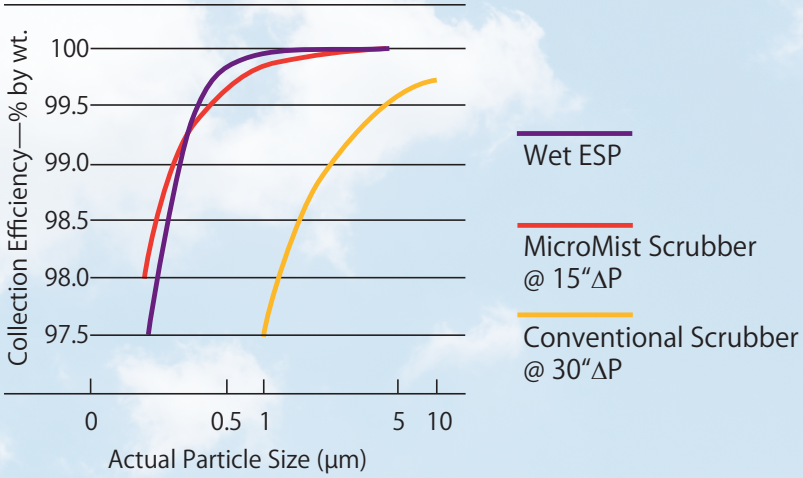
The collection efficiency of the MicroMist Scrubber is precisely controlled and automatically maintained by a proprietary control system, designed to anticipate small changes in process gas flow and respond quickly with appropriate changes in liquid injection rates and droplet size.

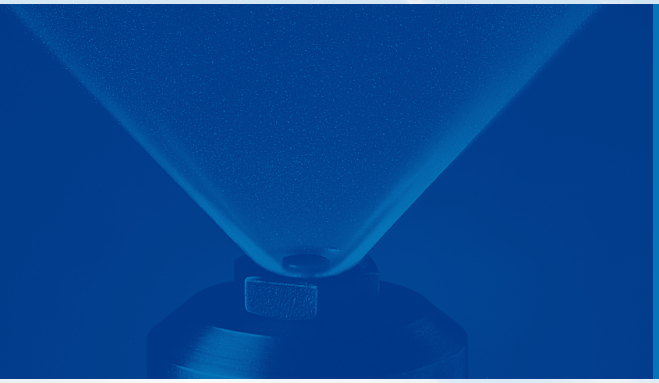
As gas flow through the collection elements changes, the liquid injection flow rate is varied, modifying the available cross sectional area and optimizing gas velocity, even at low gas flow rates. By accurately regulating the scrubbing liquid, the liquid droplet size is characterized to match particle size and other process parameters, increasing the droplet population density. This results in higher probability of fine particle/water collision, and optimum collection efficiency.

Energy Savings and Maintenance Reduction

The geometry of the MicroMist Scrubber is carefully designed using converging/diverging nozzle flow calculations so that energy recovery is maximized. Typical MicroMist Scrubbing systems utilize a mere 30-40 percent of the fan horsepower and barely 50 percent of the total horsepower required by a conventional scrubber. Also, because it maintains stable process draft operation, the wear and tear on the balance of plant equipment is minimized, and fuel, energy, and maintenance savings are maximized.

Collection Efficiency Comparisons on Particulate





Typical MicroMist Scrubber Applications

Processes that benefit from the application of MicroMist Scrubbing technology include: Incineration, Pulp & Paper, Sewage Sludge Processing, Power, Mining, Metallurgical, Smelting, Ore Roasting, Semiconductor, Fertilizer, Steel, Gasification, Food & Beverage, and other process related industries.

To learn more about MicroMist Scrubber technology, contact:

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