

Cleaning and Sanitizing with Superheated Steam

Superheated vapor is a term, which describes steam created at temperatures far above 212 degrees Fahrenheit. It has incredible cleaning and sanitizing properties and many other peripheral benefits, such as dramatically reducing the cleaning chemicals used. It is now being accepted as an alternative to the traditional methods of cleaning with lots of water, lots of chemicals and excessive pressure.

Sometimes we don't seem to know what "steam" really is. Think about how many ways we use the word. We *steam* our eyeglasses to clean them. We get *steamed* over irritating things in life. We *steam* our vegetables (but not our meats). We develop a full head of *steam* when we're going really fast and we *steam* clean our carpets without using steam (more about that later).

Scientists say steam is simply water heated past the point where it becomes a gas. The boiling point – 212 degrees Fahrenheit, right? *Wrong...unless you're at sea level.*

Atmospheric pressure determines the actual boiling temperature. For example, high in the mountains there's less atmospheric pressure, so water boils well below 212 degrees, requiring longer cooking times. A car cooling system operates at *twice* sea level atmospheric pressure, ensuring the water won't boil until it's around 240 degrees. (That's because an engine runs more efficiently at higher temperatures.) In fact, steam can be pressurized and *superheated* to well over 500 degrees Fahrenheit and is used under these conditions in many types of industrial settings, such as petrochemical plants.

For the cleaning industry, two significant things happen to steam when it is pressurized; the temperature goes up and the steam gets drier.

Cleaning with superheated vapor has powerful natural forces at work: Heat, Moisture and Pressure.

The most obvious is the heat. Heat weakens the bond between dirt and surfaces. Heat also makes chemicals react faster, so that the quantity of cleaning or sanitizing agents in use doesn't have to be so much or left on surfaces so long. And heat kills bacterial, spores and other undesirable microorganisms that make our lives miserable.

Steam at any temperature is still water...It just become water vapor even when it becomes *superheated* vapor, it still has the natural solvent power of water, but it also has the cleaning power of high temperature and becomes a powerful cleaning medium in its own right.

In fact, the medical profession has been using autoclaves – which use superheated steam to sterilize instruments for a long time.

The second factor at work is moisture. Water is the nearest thing to a universal solvent – it even dissolves mountains. Since superheated vapor is still water, the microscopic steam droplets separate dirt and other particles from surfaces and holds them in suspension long enough to be removed.

The final factor at work is pressure. Superheated vapor is created under pressure. Although pressure is not the primary cleaning force (as in pressure washers), it helps in the cleaning action.

Designing a cleaning system that meets our requirements...

Naturally, we don't want *too* much heat, water pressure.

The optimum combination of heat, moisture and pressure for most interior cleaning is around 200 degrees F at the surface, 5 percent moisture content and 60 psi maximum pressure.

At 200 degrees F, the temperature is well below the melting point of synthetic materials, but high enough to kill bacteria and other microorganisms quickly. Moisture content of 5 percent is low enough to do its job without leaving residual heat behind and without creating a mess and 60 psi of pressure is low enough not to be destructive.

How do we achieve that combination in a single cleaning system? Easily, it turns out. Of all three conditions, the only one we don't have absolute control over is the moisture content because it's an automatic result of the temperature of the steam which is an automatic result of the pressure under which the steam is produced.

When carpet cleaners say they're "steam cleaning" with hot water that's only in the 140 degrees range, it stretches the imagination a bit. It isn't really steam.

Many environmental bacteria thrive at that low of a temperature and mildew spores love the warm moist condition it leaves in the carpet.

More true would be to say they're giving the carpet a hot water shampoo without a rinse. True also in other environments such as food service!

Superheated vapors moisture content drops to about 5 percent when the pressure in the boiler is around the desired 60 psi point, so this already meets two of our three objectives. The final pressure at the surface can be controlled by valves, the same way we control the pressure when we water our yards, without affecting the temperature or moisture content.

Controlling the Heat

The temperature could be a problem since at 60 psi the boiling point of water—and the temperature of the steam produced—is almost 300 degrees F, way above our objective and definitely in the destructive range for many materials.

We're in luck here because steam is a gas and any gas cools very quickly once it starts expanding—*as in air conditioning or refrigeration systems*. So to lower the temperature at the surface being cleaned to 200 degrees F, we only have to design our tools to make the steam expand the right amount before it reaches the surface. It cools so fast that a fraction of an inch is enough.

Another factor in our favor is the low moisture content. It does not induce residual heat at the surface because it evaporates quickly. Another way to see this phenomenon is to look at a hot tub and a dry sauna—a hot tub is limited to around 108 degrees F, while a dry sauna is operated at much higher temperatures. The water in the hot tub creates *residual* heat, while the hot dry air in the sauna does not.

The Entire Concept is Simple...

Heat water to about 60 psi of pressure and maintain it there and design the right tools to deliver the superheated vapor to surfaces to be cleaned or sanitized.

Of course, put in lots of safety devices to monitor pressure and use materials that insulate against the heat. Also the tools have to be tough enough to stand up to constant use and exposure to high temperatures.

Okay...We've designed the perfect universal cleaning and sanitizing system. Quiet. Water only. Non-polluting. Promotes fewer cleaning chemicals. Easy to maintain. Long life span with few moving parts.

But don't get out the drawing board because we're not the first ones to think of this.

The story goes in Europe that the technology was discovered years ago by an Italian bartender who used the steam vent on his espresso machine to get lipstick off bar glasses. Since that fabled beginning, it has become the most popular cleaning technology in Europe.

Why is the technology just now being accepted here?

No one in America manufactures anything like it and it's not likely they will until they are forced to by competition and customer demand.

Recent conversations with cleaning equipment manufactures here reveal that they don't want to build a system that replaces several of their existing machines. It makes sense if you're a manufacturer, but it doesn't if you're wanting the best equipment for cleaning.

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