

Monolith/Structured Media vs. Random Packed Media

Choosing a heat recovery media for an RTO is not as simple as meets the eye. There are numerous misconceptions to overcome and many variables to consider in choosing a heat recovery media; especially in regard to thermal efficiency and VOC destruction efficiency.

Thermal efficiency and destruction efficiency do not necessarily go hand in hand. Paradoxically, in a typical 2-chamber RTO, higher thermal efficiency often means lower VOC destruction efficiency. Here is the paradox: stretching the cycle time to improve destruction efficiency lowers thermal efficiency, but the stretch also generates larger and larger temperature swings in the heat recovery media as the elongated cycle time depletes the media of stored heat.

That being said how do these media types differ and what does one need to know in order to choose?

Heat Recovery Media and Valve Cycle Time

While monolith and structured media have a greater contact surface area to absorb heat, the thickness of the surface is only 1/6th the thickness of random packed media.



So, while monolith and structured media may absorb heat quickly, the amount of heat it actually absorbs and **holds** per unit area is far smaller than what random packed media will hold.

During RTO operation, one must remember that while one chamber is absorbing heat, its counter chamber is depleting heat.

With limited heat storage on the exhaust cycle, the heat stored in the monolith or structured media is quickly depleted to the incoming process air entering on the inlet cycle.

Unfortunately, to achieve the touted thermal efficiency with monolith, the length of time the process fume enters a particular chamber before chambers are transferred must be kept short; approximately every 3 minutes, reduced further to 1-1/2 minutes when using high efficiency structured media.

Why are longer cycle times desirable?

Most 2-chamber RTOs have a generic slug of unburned VOC that is left unoxidized within the RTO's valve housing, inlet plenum and voids within the combustion chamber. Every time a chamber transfer takes place, there is an unoxidized amount of VOC, commonly referred to as the 'peak or puff', which is emitted into the atmosphere via the unit's stack.

Simply put, the more frequently regenerative chambers are transferred, the greater the amount of unoxidized VOC entering the atmosphere.

Unfortunately, there is no foolproof method of eliminating the puff, however longer recovery chamber cycle times and minimizing entrapment areas, reduce peak or puff emissions thus increasing the overall removal efficiency of the RTO.

Media Evolution: Saddles Get a Makeover

By the end of the 20th century, many RTO manufacturers had switched from random packed saddle type media to monolith and structured media. Why? At that time, monolith and structured media offered slightly higher thermal efficiencies, lower pressure drop and less particulate plugging over the old generation saddles.

Since then, saddles have undergone a dramatic makeover. The new generation of random packed ceramic saddles combines new shapes and bold configurations specifically designed for use in RTOs.

This new, well traveled media has been in use since 2002 in both Europe and the United States. On an equal velocity basis, it has a pressure drop equivalent to that of structured/monolith media, and offers superior destruction efficiency. It has 50% the pressure drop of 1" Flexisaddles™/Intalox™, 55% lower than the generic 25mm saddle and 30% less pressure drop than Koch's 1" LPD®. At 9.93" inches of water column (w.c.) @ 250 fpm flow velocity, it is a direct replacement for 1" or 25mm saddle media without efficiency loss.

In addition, the new generation saddle's heat storage capacity allows cycle times to be maintained for up to six minutes without excessive media temperature or efficiency loss. In contrast, the new high efficiency structured medias require chamber transfers as often as every 1-1/2 minutes.

Cell Stone® Ultra

Of the new breed of random packed heat recovery media, one product stands out: Cell Stone Ultra®. Ultra ceramic heat recovery media is an exclusive, patented ultra-low pressure drop media specifically designed for use in Cycle Therm's RTOs.



Its unique combination of high heat recovery with very low pressure drop results in significantly lower gas and electric usage, reducing your overall carbon footprint.

Need a retrofit? It is also perfectly suited to replace your existing RTO media.

Benefits of Cell Stone® Ultra

✓ Ultra Low Pressure Drop

Ultra reduces the pressure required to move process flow through the heat recovery sections of an RTO by 50%; therefore, 33% less fan horsepower is required and less energy is used for operation.

✓ Turbulence

Unlike structured medias, the bold new shape of modern saddles and its increased surface area creates a higher flow turbulence, thereby improving destruction efficiency.

✓ No Thermal Shock

Individual Cell Stone® Ultra pieces are random packed, providing unrestrained ability to move as they are heated and cooled from preheat to reheat. You can bring the RTO up to operating temperature as fast as the burner system will allow without worry of thermal shock to the heat recovery media.

✓ Faster Installation and Removal

Unlike structured media where each piece must be individually hand placed, random packed media can be quickly deposited in the chambers. The faster installation and removal yields a much more attractive retrofit expense.

✓ Reduced Particulate Plugging

While Ultra cannot prevent RTO particulate plugging, numerous installation replacing 1" saddles, has proved that the product lasts at least twice as long before complete plugging occurs.

✓ Reduced Valve Cycling

Fewer chamber transfers mean less wear and tear on the RTO's valve system.

✓ **Compression Strength**

The patented Cell Stone Ultra® product, because of its configuration, cannot be manufactured by typical ceramic extrusion process. The media must be hand stamped. This gives the product complete uniformity and 20% more compression strength than the generic 25mm first generation saddle.

✓ **Superior Warranty**

Cell Stone® Ultra's patented configuration carries a 2 year warranty against thermal decomposition.

Conclusion

Remember that thermal efficiency and destruction efficiency are not inclusive of each other and that it is up to the RTO supplier -- not the media supplier -- to pick a media that will interface properly with the many other components in an RTO. Final and correct design results are, and always will be, subject to the RTO manufacturer's understanding of the relationship between the design parameters and the components.

No one media can be considered a panacea; each application's heat recovery media must be based upon its ability to interface with the specific industrial process, the type of RTO, and its mandated VOC-destruction efficiency.

About Cycle Therm

Cycle Therm is an international leader in the design, fabrication, and installation of Regenerative Thermal Oxidizers (RTO). The RTO we bring to market today is the genesis of over 30 years of design experience focused on a single product.

In addition, Cycle Therm provides turnkey installation services, repair and refurbishment and is a distributor of Cell Stone heat recovery media and tower packing.

For More Information

For more information on Cell Stone® Ultra or other Cycle Therm products, please call 570-839-8836 or visit us on the web at www.cycletherm.com.

<p>Contact Information Cycle Therm LLC E4803 395th Avenue Menomonie, WI 54751</p> <p>Phone: 570-839-8836 Fax: 570-839-8837 Web: www.cycletherm.com</p>
