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**Abstract Title**: THERMAL VENT OZONE DESTRUCTOR TECHNOLOGY USING HEAT RECOVERY PROCESS IMPROVES RESISTANCE TO HARSH PROCESS AND OPERATING CONDITIONS

**Abstract**:

INTRODUCTION

Vent gases from processes where ozone has been used invariably contain residual amounts of un-reacted ozone. In most countries it is illegal to discharge even low concentrations of ozone. Before this gas can be released to the atmosphere, it is necessary to destroy the remaining ozone.

There are various methods available to treat vent gas but two types of methods are used in commercial scale ozone systems. Thermal Vent Ozone Destruct (VOD) products raise the temperature of the vent -gas to a level where the half-life of the ozone is reduced to milliseconds and can be destroyed efficiently and very reliable. Catalytic VOD products use a catalyst to accelerate the ozone molecule decay rate on the surface of the catalyst by converting the ozone to oxygen.

METHODS

This paper analyzes Thermal and Catalytic type ozone destruction process efficiency, energy efficiency, and full-scale implementation lifecycle of systems used to destroy ozone in vent gas streams to below internationally recognized safety limits (< 0.1 ppm).

RESULTS

Ozone Destruction Efficiency

In Thermal VOD systems, gases are heated to between 350-380°C which radically reduces the half-life of the ozone molecule and accelerates its decomposition rate. The half-life of ozone at 350°C is less than 10-2 seconds. By comparison, the half-life of a catalytic VOD operating at 50°C is 88000, an increase of 8,800,000%. Thermal VOD processes provide on average less than 0.01 ppm ozone to atmosphere while Catalytic processes can release up to 0.1 ppm and higher based on the age and degradation of the catalyst.

Ozone Destruction Process Contamination

Thermal ozone destruct units are suitable for all types of water processes. Thermal VODs are less susceptible to process degradation over time since system components are designed to operate for the lifetime of the VOD system. Catalytic type VOD systems are very susceptible to catalyst contamination and ozone destruction process degradation especially when corrosive gases are present in the vent -gas. Many manufacturing and wastewater processes including municipal wastewater and reuse, and the chemical, petrochemical, pulp & paper, and pharmaceutical industries can be effected by trace levels of contaminants which are corrosive to catalysts, and destroy it irreversibly within a short time. Special

features and the combination of higher degree material allows also the use of thermal VOD's, in industrial Pulp Bleaching processes. These units were used very successfully on many projects for long term operation, permanently at full load in very harsh condition, all around the world.

Another important factor in ozone destruction process efficiency are operating parameters. If gas quality parameters are not within the specified range, the catalyst lifetime can be reduced to weeks. Table 1.1 outlines the different operating parameters effecting VOD performance.

Full Scale Implementation

Both Thermal and Catalytic VODs have been implemented in full-scale ozone applications for many years. In 2016, an ozonia® XF ozone system was installed with a capacity of 600 kgO3/h. The system included two (2) ozonia® RB-250 Thermal Vent Ozone Destructor units capable of treating 2 x 2750 kg gas/h each. The footprint of the Thermal VOD system was 85 m2. The customer chose the Thermal VOD for two reasons, the ability to operate under any process conditions with catalyst contaminants, and the reduced footprint compared to catalytic VODs. For the 600 kg/h system, four (4) catalytic VOD units would be required with a footprint of 100 m2, over 18% larger than the Thermal VOD system.

Catalyst based VODs require replacements of catalyst and the catalyst's lifetime depends on several factors. If the operating parameters are not within the specified range, the catalyst lifetime could be reduced to several weeks. Thermal VODs, in comparison, are designed with robust components for a 25 year service life and are virtually maintenance-free. Thermal VODs service lifetimes are 25% longer than the typical Catalytic VOD system service life of 20 years.

Power Consumption and Heat Recovery

The power consumption of catalytic and thermal VODs using heat recovery are very similar. Catalytic VODs efficiencies range between 0.01- 0.03 kWh/kg gas treated while Thermal VODs range between 0.02-0.05 kWh/kg gas treated. The Thermal VOD heat recovery process provides up to an 80% reduction in electrical energy consumption by reducing the amount of heat required for operation. Depending on the system operating conditions, Catalytic VODs may require more energy per kg of gas treated compared to Thermal VODs.

CONCLUSIONS

Thermal ozone destructor technology is robust allowing systems to withstand the extreme processes that contain contaminants which would damage Catalytic systems and are suitable for all types of municipal and industrial processes including wastewater, and chemical, petrochemical, and pharmaceutical processes where trace levels of compounds which are corrosive to catalysts are present in the vent-gas.

Thermal ozone destruction processes have higher process flexibility due to their resistance to a larger range of operating conditions. Thermal VODs have an innovative heat recovery feature for improved energy efficiency for the ozone destruction process and provide overall savings to clients with up to 18% reduced footprint requirement and lower maintenance costs.