

CLEAN AIR FOR INDUSTRIES

Removing VOCs and air pollutants
with the CLIMATIC technology.

Clean air for all.

The paradox of VOCs in clean known Wind Energy

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While the overall purpose of using wind-power is the production of clean energy, the production of wind power systems in themselves, are paradoxically problematic, from a pollution point of view. The manufacture of wind power turbine blades and nacelles include the processes of moulding and painting of glass reinforced plastics (GRP). These processes require the use of composite materials and solvents such as volatile organic compounds (VOCs), and hazardous air pollutants including

styrene, epoxides and isocyanates: Pollutants which poses a significant risk for human health and the environment.

National governments are setting increasingly stringent operational exposure limits (OEL) for styrene ranging down to 10ppm in Sweden for new built facilities. Currently OEL ranges from 20 to 100 ppm across different countries. Harmonization of OELs across Europe is likely to adopt the lower levels. Do you know the levels and limits for your facilities?

How to remove VOCs?

To protect the human health and environment, it is particularly important to combat emissions of pollutants at their source and identify and implement the most effective emission reduction measures. There are many methods available to control VOCs emissions, all with their advantages and limitations.

The conventional technologies for removal of VOCs from low concentration emission profiles such as those from manufacturing of blades for the wind turbines, are adsorption by activated carbon and combustion by a recuperative thermal oxidizer (RTO). The major cost drivers for these technologies are frequent replacement of the activated carbon and the consumption of natural gas respectively. Moreover, both technologies are pronounced with pressure drops in the range of 3000-5000 Pa, imposing high demands on fan and fan power.

CLIMATIC, the industrial branch of INFUSER Aps, a privately-owned company with its headquarters located in Copenhagen Science City, is now meeting the challenge of offering ground-breaking air cleaning solutions for the wind turbine industry.

The CLIMATIC technology harnesses, enhances and accelerates the self-cleaning processes of the atmosphere,

in a series of sequential process, in which the combined action of hydroxyl radical and photolysis processes effectively breaks down and eliminates the vast majority of air pollutants. This include styrene, epoxides and isocyanate, important pollutants from wind turbine blade and nacelle manufacturing processes.

Why CLIMATIC?

Compared to conventional technologies, CLIMATIC presents several advantages:

Modular system:	Gives flexibility and can be built to match future changes in VOC load.	Savings in your future investments.
Sequential treatment:	Can have 2 or more air cleaning steps, not only accommodating each other but also be placed close to the source of emission.	Often cheaper and more efficient (in terms of cleaning pct.) compared to existing technologies.
Standard modules:	Easy to assemble, transport and test – at the same time accommodating your specifications.	Lower production cost.
Dimming function:	Via the control system; lamps or sections can be turned on/off enabling the kW to fit the exact VOC concentration at any given level during production cycles.	Less kW/h (lower operational cost).
Low pressure drop:	The airflow is only interrupted slightly over the UV-lamps and the catalyst beds.	Less kW/h (lower operational cost).
No mechanical parts:	Means long service/maintenance intervals.	Less downtime (lower operational cost).
Scada monitoring system and sensor package :	Performance of Climatic unit is monitored and analyzed by Infuser, enabling quick error response while pre-emptive service can be assessed.	Assure that efficient removal is achieved at all times.
Less waste generation:	Only little waste water is generated.	Lower production cost.

Total Cost of Ownership

When investing on a new industrial equipment, in general, the amount of the CAPEX represents less than 10% of the total cost over its lifetime. In fact, energy costs and OPEX are predicted to have at least five times more relevance than the up-front cost. In order to aide your decision process, we have developed a Total Cost of Ownership (TCO) model, which is an estimation of all the collective expenses associated with purchasing and operating a piece of equipment. For accessing our complete TCO model, please contact us. And please be aware: Infuser offers a variety of financing solutions for your investment.

The CLIMATIC technology

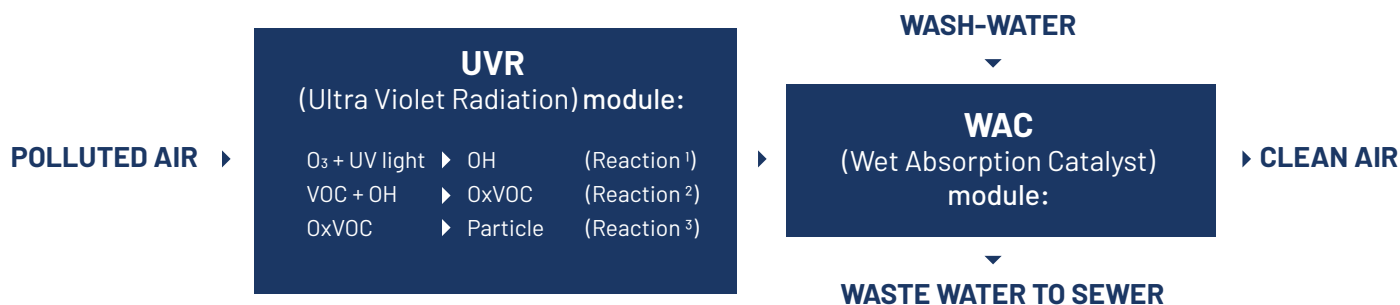
In nature, photochemistry is the reason that our atmosphere does not become increasingly more polluted since it has the ability to clean itself when emissions cease. At INFUSER, we apply the nature's self-purification processes for removing pollutants from industrial resources.

Significant improvements in the application of photochemistry to air purification in combination with catalytic technologies have enabled INFUSER to achieve efficient removal of persistent pollutants.

In the atmosphere, the most important oxidant that is responsible for breaking down and oxidizing gaseous pollution is the hydroxyl radical. After reaction with a VOC (volatile organic compound) the reaction products are chemically and physically transformed such that they are much less volatile and much more water soluble.

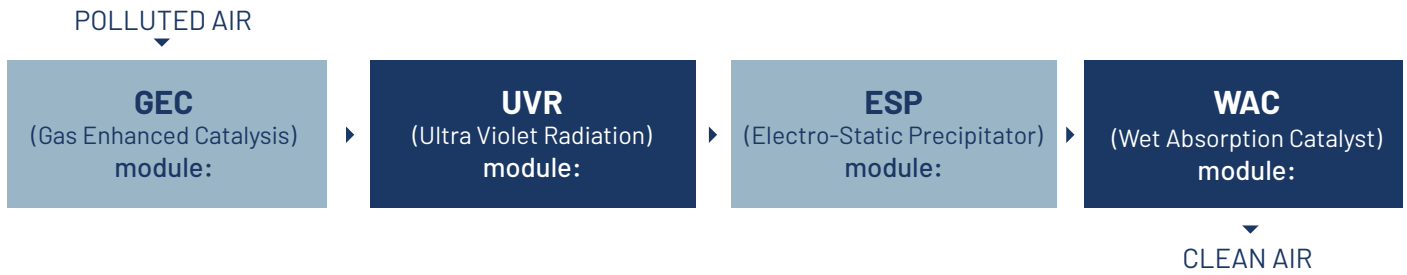
The CLIMATIC system is designed to apply these principles into a sequential gas-phase treatment: The polluted air stream is exposed to UV radiation in the UVR module, where the hydroxyl radical oxidizes the pollutants. The oxidised VOCs and the formed particles are then captured and washed away in the WAC module.

The CLIMATIC system is a custom designable modular system, enabling virtually any pollution type and profile to be tackled. For removal of VOC from dilute air streams, installation of UVR and WAC module is sufficient; whereas the air streams with high VOC and/or particle concentrations would require additional modules. In the illustration below, please find an overview of the application where the different modules are presented.



The polluted air stream is exposed to UV light to generate ozone and other reactive oxygen species which partially decompose the volatile organic compounds (VOC). After oxidized, VOC are turned quickly into particle phase.

By-products from the UVR module, such as ozone and semi oxidized species are captured and broke down in this module. At regular intervals, the catalyst beds are washed with water, thereby prolonging lifetime of the catalyst. The air leaving the WAC is free of pollutants.



GEC Module is ideal for placing upstream in the production to tackle high concentration emissions at the point source. A specially developed noble-metal catalyst and temperature range of 250 to 400°C is required for operation.

After the UVR treatment a substantial amount of aerosol particles has been created, which must be removed before the air can be emitted. The ESP module is especially designed for situations where the particle load is too high for the WAC module alone, and in such situations, an ESP module will be used in between the UVR and WAC modules. The ESP module contains a self-cleaning electrostatic precipitator specially designed to withstand the harsh environment directly following the UVR module.

CLIMATIC references – Wind Energy Sector



Infuser recently completed a 210.000m³ CLIMATIC installation at a leading wind turbine OEM factory in Europe. The installation has now been in operation for more than a year and is continuously reducing emissions with removal efficiencies upto 90%, while maintaining a favorable Cost of Ownership by saving the client significant costs of replacing activated carbon and filters. This installation shall set the scene for a further launch of the CLIMATIC technology into styrene and polymer industries. For more details on INFUSER® and CLIMATIC™ technologies please visit www.infuser.eu and/or contact the author. We look forward to hearing from you.

Need more details? Get in touch

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