

**viledon®**

## **INCREASE OPERATIONAL RELIABILITY – PROTECT AGAINST CORROSION**

**GAS PHASE FILTRATION FOR THE PETROCHEMICAL INDUSTRY**

This brochure provides a brief overview of our services. We are certain that we will be able to create an individual solution for your requirements for reliable protection against the negative effects of contaminant gases.

Please contact us:



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# MODERN ELECTRONICS INCREASE THE EFFICIENCY OF YOUR PROCESSES

## WE PROVIDE CORROSION CONTROL TO INCREASE OPERATIONAL RELIABILITY

Crude oil is an important raw material, from which numerous intermediate and end products are made using complex procedures. In the process, unwanted components need to be removed. These include sulfur, nitrogen and oxygen, salts, trace metals and water. In some of these processes, contaminant gases are released which, depending on their concentration, can cause corrosion damage to critical components.

Particularly at risk are sensitive areas such as switchgear, control rooms or process control systems. Any build-up of corrosion on the conductive copper and silver components of technical devices threatens process efficiency, increases maintenance costs and results in expensive repairs and unplanned downtime.

Freudenberg Filtration Technologies develops customized solutions to meet the specialist needs of the Petrochemical Industry, including the processing of coal into liquid or gaseous hydrocarbons. Our solutions ensure effective and efficient gas phase filtration, permanently removing contaminant gases from the air. We offer you a complete spectrum of essential services from a single source: from on-site pollutant analysis to the selection of filter pellets and filter units, right through to ongoing system monitoring.

Our Viledon® solutions ensure reliable protection against corrosion resulting from the harmful gases released during the key process steps of petrochemicals:



Distillation



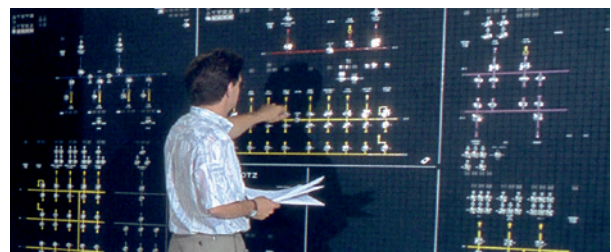
Catalytic cracking



Desulfurization



Coal to Liquid (CTL)





# YOU SEPARATE LIGHT FROM HEAVY

## WE SEPARATE CORROSIVE FROM NON-CORROSIVE

In the distillation process, crude oil is separated into various fractions. Depending on the sulfur and nitrogen content of the oil, different amounts of hydrogen sulfide gas, sulfur oxides and nitrogen oxides are formed during distillation. Together with the hydrocarbons that are already present, these gases (especially in combination) are the main cause of corrosion of electronic components. We provide effective protection against these risks. Depending on the amount and concentration of the contaminant gases, we use different combinations of Viledon® filter pellets to reliably remove them from the air.



CONTAMINANT GASES IN THE PETROCHEMICAL INDUSTRY		
CONTAMINANT GASES	SOURCES	VILEDON CHEMCONTROL PELLETS
Sulfur dioxide (SO <sub>2</sub> )	Boilers Cracking unit regeneration Treating operations Flares	CCP 104, CCP 108, CCP 210, CCP 310, CCP 810, CCP 840
Nitrogen oxides (NO <sub>x</sub> )	Flares Boilers	CCP 104, CCP 108, CCP 210, CCP 810
Hydrogen sulfide (H <sub>2</sub> S)	Sour crudes Liquid wastes Pumps Crude tower Cracking operations Rearranging and combining processes such as reformers and alkylation units Hydrogeneration	CCP 104, CCP 108, CCP 210, CCP 310, CCP 810, CCP 840
Chlorine (Cl <sub>2</sub> )	Caustic unit	CCP 310, CCP 510, CCP 610, CCP 840





## YOU MAKE HIGH-VALUE END PRODUCTS FROM CRUDE OIL

### WE MAKE HARMLESS SALTS FROM CONTAMINANT GASES

During catalytic cracking, long-chain, branched or aromatic molecules are converted into short-chain compounds in large installations. To regenerate the catalysts used in this process, the carbon deposits are oxidized to carbon monoxide, creating sulfur oxides as a by-product. A particularly large number of sulfur compounds are released during the processes employed in FFC (Fluid Catalytic Cracking) plants.



Gaseous sulfur compounds are considered the main cause of corrosion on electronic components. We safely remove these acidic gases from the air using specially

developed Viledon® filter materials, thus protecting the electrical control centers and therefore the processes that you employ in your plants.



# YOU REMOVE SULFUR FROM YOUR PRODUCTS

WE REMOVE IT FROM THE AIR



Sulfur is a natural but undesirable constituent of crude oil. The proportion of sulfur in the oil varies depending on its origin. In crude oils from North Africa, Southeast Asia and the North Sea, it is relatively low. In crude oils from Arabia, Russia, South America and Mexico, however, it can be significant.



To meet the high quality standards on mineral products, the desulfurization of crude oil is a necessary process. In the course of this activity, the sulfur compounds react with a hydrogen catalyst to form hydrogen sulfide gas ( $\text{H}_2\text{S}$ ). This already contaminant gas is funneled into a further process step and transformed into pure sulfur in Claus plants. About one third of the hydrogen sulfide gas

is burned with air and forms the similarly contaminant gas sulfur dioxide ( $\text{SO}_2$ ). With our Viledon® solutions, we have the appropriate filter pellets to reliably remove sulfur gases without causing damage to the surrounding devices, thus enhancing your process reliability.



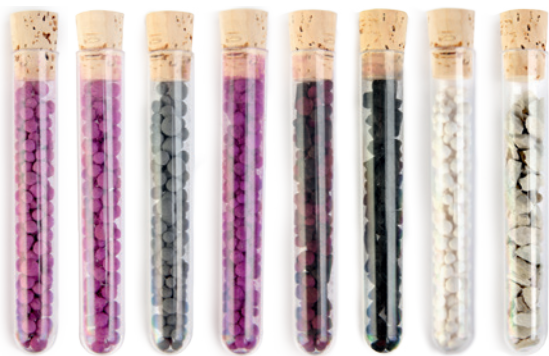
As is the case with crude oil, sulfur is also a natural component of coal. To make liquid fuel out of solid coal (CTL), the coal is reacted at very high temperatures with steam and air or oxygen to create synthesis gas. For the subsequent production of fuel, this synthesis gas needs to be free of sulfur dioxide.

During cleaning of the synthesis gas, larger amounts of hydrogen sulfide are typically released. This particularly corrosive gas can be extremely effectively removed from the supply air by using Viledon® gas phase filters. In this way, you protect electronic components from corrosion and remove the risk of damage to your processes.



# A GLOBALLY UNIQUE PORTFOLIO

## PELLETS, MODULES, SYSTEMS AND SERVICES



### Viledon® ChemControl pellets

The basis of our offering is the quality of the ChemControl pellets used in our systems. We supply a comprehensive range of pellets that reliably eliminate all major contaminant gases.

### Viledon® ChemControl modules

Viledon® ChemControl modules are the rugged plastic housings that contain our pellets. Their practical design makes them easy to handle and exchange. They can be supplied pre-filled or refilled via their easy-access removable caps. The design of your system will determine which size of module you require. As with all Viledon® products, our ChemControl modules offer excellent airflow performance with low pressure drop.



### Viledon® ChemControl filtration systems

We develop and deliver exactly the filtration units you need, ensuring the maximum profitability of your system. Viledon® filter systems are ideally suited for the filtration of gas and particulate matter from supply air, protecting components from harmful gases that cause corrosion.

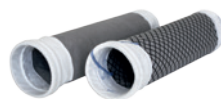


### Viledon® filterCair service: the individual comprehensive solution

We have developed a unique filter management system to ensure that you achieve maximum use from the high quality of our filters in your systems: Viledon® filterCair service. Proven to be highly effective in numerous applications, we also offer this service for gas phase filtration. For you, this means reliable corrosion control thanks to individually designed packages consisting of a comprehensive filter program plus service support and warranties at guaranteed fixed costs. This is how we provide you with innovative, high-performance, environmentally friendly and at the same time plannable, cost-efficient system solutions.



Air filtration



Liquid filtration



## FREUDENBERG FILTRATION TECHNOLOGIES

### Your partner for complete filtration concepts

Freudenberg Filtration Technologies is part of the Freudenberg Group. With over 1,700 employees worldwide, we are the technology leader in the filtration of air and liquids.

Our knowledge of gas phase filtration combined with our expertise in air filtration enables us to develop optimized solutions for our customers. We provide a complete spectrum of services and products, from system specification through product manufacturing to a complete design and installation program for the upgrading and construction of air filtration plants, including ongoing operational support.

You can find more information on our website:

[www.freudenberg-filter.com](http://www.freudenberg-filter.com)



# NUMEROUS CONTAMINANTS CAUSE CORROSION



WE HAVE THE SOLUTION FOR  
EVERY CONSTELLATION

FOUR LEVELS TO ASSESS CORROSION SEVERITY ACCORDING TO ANSI/ISA-S71.04				
CLASS	SEVERITY LEVEL	COPPER REACTIVITY*	SILVER REACTIVITY*	COMMENTS
G1	Mild	< 300 Å	< 200 Å	An environment sufficiently well-controlled that corrosion is not a factor in determining equipment reliability.
G2	Moderate	< 1,000 Å	< 1,000 Å	An environment in which the effects of corrosion are measurable and corrosion may be a factor in determining equipment reliability.
G3	Harsh	< 2,000 Å	< 2,000 Å	An environment in which there is a high probability that corrosive attack will occur. These harsh levels should prompt further evaluation, resulting in environmental controls or specially designed and packaged equipment.
GX	Severe	≥ 2,000 Å	≥ 2,000 Å	An environment in which only specially designed and packaged equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier.

\*Normalized to a 30-day exposure; 1 Å = 0.1 nanometers = 0.0001 micrometers

## Copper and silver reactivity levels measured on ChemDetect Coupons

ANSI/ISA-S71.04 „Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants“  
ISA = International Society of Automation

PREVALENT EXISTENCE OF CONTAMINANT GASES BY INDUSTRY	
INDUSTRIAL AND COMMERCIAL ACTIVITIES	CONTAMINANT GASES
Airports	H <sub>2</sub> S, SO <sub>2</sub> , HCN, VOCs, NO <sub>x</sub>
Aluminum smelting	HF, SO <sub>2</sub>
Fertilizers	HF, NH <sub>3</sub> , SO <sub>2</sub> , SO <sub>3</sub>
Food storage	Ethylene
Petrochemical	H <sub>2</sub> S, SO <sub>2</sub> , mercaptans, NH <sub>3</sub> , VOCs, HF, HCl
Ore calcining and furnacing	SO <sub>2</sub> , SO <sub>3</sub> , HF
Paint and ink	VOCs, formaldehyde
Pulp and paper	ClO <sub>2</sub> , Cl <sub>2</sub> , H <sub>2</sub> S, SO <sub>2</sub>
Semiconductor production	HF, NH <sub>3</sub> , SO <sub>2</sub> , NO <sub>x</sub> , VOCs, Acetic Acid, Arsine
Sewage treatment	H <sub>2</sub> S, NH <sub>3</sub> , VOCs, mercaptans, other sulfur compounds
Steel furnaces and pickling plant	H <sub>2</sub> S, SO <sub>2</sub> , HF, HCl
Thermal power generation	H <sub>2</sub> S, SO <sub>2</sub> , NO <sub>x</sub> , VOCs
Tobacco smoke	H <sub>2</sub> S, SO <sub>2</sub> , HCN

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# AT A GLANCE

viledon®

## VILEDON® CHEMCONTROL PELLETS

<b>CCP 104</b> 1 2 3 4 7 9 10		<b>CCP 610</b> 5 8 11	
<b>CCP 108</b> 1 2 3 4 7 9 10		<b>CCP 810</b> 1 2 4 8 11	
<b>CCP 210</b> 1 2 3 4 7 9 10		<b>CCP 830</b> 1 2 3 4 8 11	
<b>CCP 310</b> 1 2 3 5		<b>CCP 840</b> 1 2 5 8 11	
<b>CCP 510</b> 5		<b>CCP 903</b> 6	

ChemControl pellets are highly recommended for all contaminant gases highlighted in blue ●

- 1 Hydrogen sulfide (H<sub>2</sub>S)
- 2 Sulfur dioxide (SO<sub>2</sub>)
- 3 Other sulfur oxides
- 4 Nitrogen oxide (NO<sub>x</sub>)
- 5 Chlorine
- 6 Ammonia
- 7 Formaldehyde
- 8 Hydrocarbons
- 9 Thiolalcohols (Mercaptans)
- 10 Low molecular weight organic acids
- 11 Volatile organic compounds (VOCs)

### Please note

Other ChemControl pellets are available on request – especially custom formulations with impregnations. All information regarding application is subject to local conditions, specific application requirements and possible interactions due to the combination of several ChemControl pellets in multi-stage systems. Please contact your local Viledon® partner for more information.



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