



Sorbacal® Micro: the innovative solution
for micropollutants



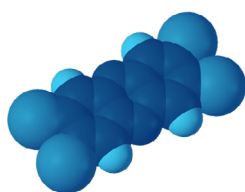
Breathe easy now



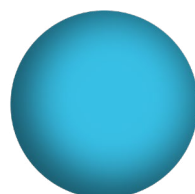
Your challenges

Some industrial processes can generate gaseous compounds harmful for the environment and human health called Micropollutants. Those micropollutants include organics, such as Dioxins (PCDD - Polychlorinated Dibenzodioxins) and Furans (PCDF - Polychlorinated Dibenzofurans), as well as Mercury which are present in very low concentrations (a thousand or a million times lower than acid gases in flue gases) and cannot be removed with lime reagents.

- **Dioxins and furans** consist of chlorinated biphenyl molecules linked with different oxygen bridges. They are generated in flue gases when both chlorides and organic matter are present at relatively low temperatures.
- **Mercury** is present in coal and various fuels. It is released by industrial processes, such as in Waste to Energy, coal power plants and cement plants. It is toxic through ingestion or inhalation.



**Dioxins & Furans
(PCDD & PCDF)**



Mercury (Hg)

To reduce the emissions of micropollutants into the air, new regulations have been implemented for many years in the United States (MATS - Mercury and Air Toxics Standards) and Europe (IED - Industrial Emission Directive / BREF). In Europe, they concern many industrial segments such as Waste to Energy, Iron & Steel and Large Combustion Plants.

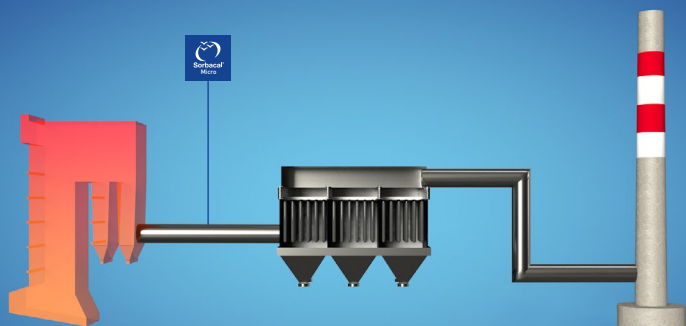
Various industrial segments have different abatement requirements depending on:

- The nature of micropollutants
- The specific flue gas conditions such as temperature and composition
- In the case of mercury, its speciation (ionic or elemental)



Our solution

Dry Sorbent Injection (DSI) process



Micropollutants can be efficiently removed by Dry Sorbent Injection (DSI) process or Circulating Dry Scrubber (CDS) process.

DSI process consists of a filtration unit combined with the injection of a dry sorbent. The abatement takes place in the duct and on the surface of the filtration elements.

Different abatement mechanisms can take place to remove different types of micropollutants from flue gases.

Organics such as: Dioxins (PCDD - Polychlorinated Dibenzodioxins), Furans (PCDF - Polychlorinated Dibenzofurans), PCB (Polychlorinated Biphenyls), PAH (Polycyclic Aromatic Hydrocarbons)

Physical Adsorption on sorbents with:

- > High specific surface area
- > Adapted porosity
- > Adapted sorbent composition & structure

Mercury: Ionic (Hg^{2+}) and Elemental (Hg^0)

- > Oxidation
- > Adsorption
- > Chemisorption

These abatement mechanisms can contribute differently depending on customer conditions such as temperature. They can be optimized through the specific design of sorbents.

Step 1: Diffusion to Adsorbent Surface

Step 2: Migration into Pores of Adsorbent

Step 3: Buildup of Adsorbate

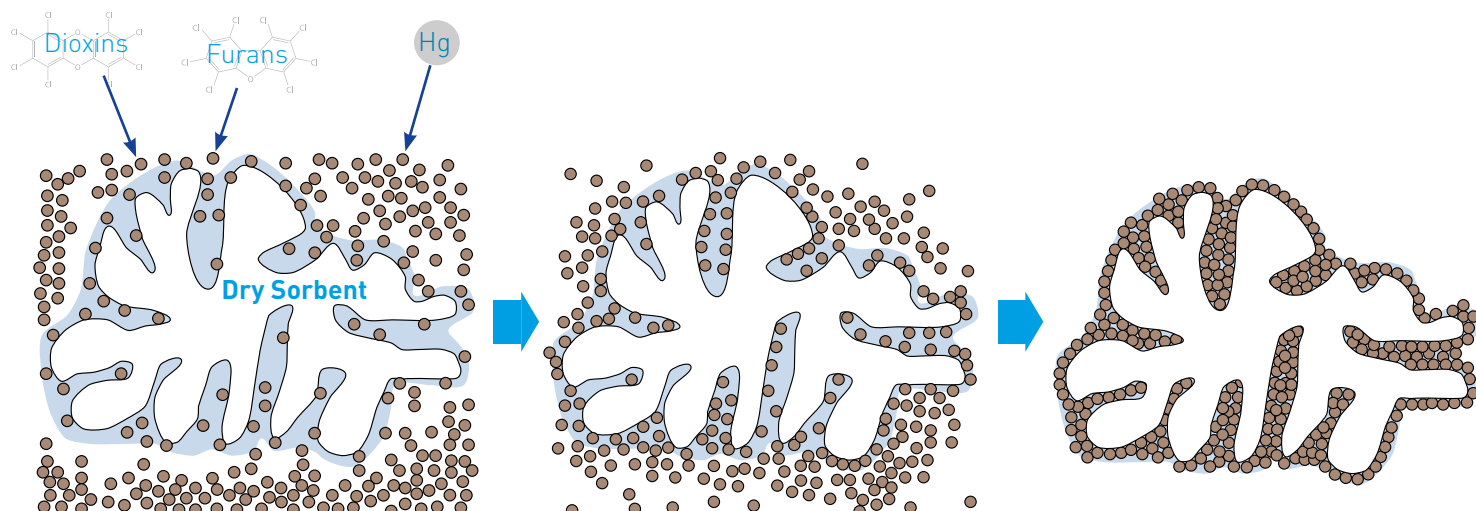


Illustration of micropollutant adsorption on sorbent

Our offer & expertise



Lhoist has developed a unique expertise, experience and offer for the capture of micropollutants for various industrial segments and operating conditions

We offer non-ATEX (ATmosphere EXplosible) Sorbacal[®] Micro sorbents designed to specific customer conditions and needs:

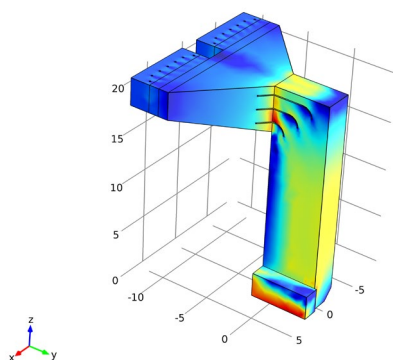
- For dedicated or combined Organics & Mercury abatement
- With possibility of simultaneous acid gas removal
- Combining specifically selected components

Supported by tailored customer service for solution design and implementation:

- Customer Technical Service (CTS)

Our unique innovation & technical capabilities include:

- Laboratory analysis & CFD capabilities (Business Innovation Center)
- Continuous improvement of our solutions



Our proven technical results

Lhoist has unique technical capabilities enabling the optimization of Sorbacal® Micro formulations adapted to market requirements in order to provide best value to customers.

Sorbacal® Micro sorbents are regularly benchmarked in our own Innovation facilities against alternative sorbents for mercury and organics removal.

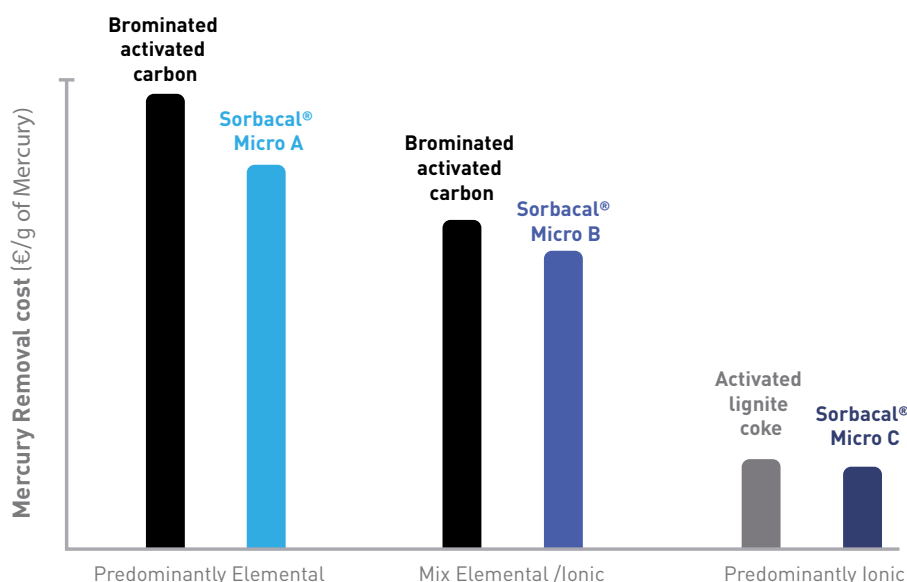
Benchmark tests have been performed in operating conditions representative of selected applications (Coal Power Plants, Waste to Energy, Electric arc furnaces...) and using competitive sorbents including activated lignite coke and activated carbon (brominated and non-brominated).

Mercury

Depending on the industry, repartition between ionic and elemental mercury speciation can be very different, linked in particular to SO₂ and HCl levels in flue gases. These differences in flue gas composition lead to different Sorbacal® Micro formulations adapted to mercury removal.

The laboratory test consists of a fixed bed containing the sorbent, where a controlled quantity of mercury is injected in the gas, together with typically 5-15 vol% H₂O, and 5-500 ppm of SO₂ and/or HCl at various temperatures. The tests are performed until saturation of the sorbent by mercury. The mercury removal capacity is measured over time.

The following graph illustrates an estimation of the comparative cost of abating the same quantity of mercury with Sorbacal® Micro versus typical competitive sorbents, at durations and speciations representative of different industrial applications.



This graph is based on typical market prices and confirms that the selection of the most cost-efficient sorbent is highly dependent on the gas conditions and mercury speciation.

Organics

Similar tests have been carried out to benchmark Sorbacal® Micro sorbents for removal of organic pollutants in different operating conditions.

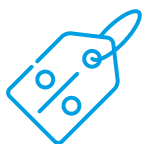
These tests enable us to further optimize our product range by delivering diverse benefits and value (sorbent cost, combined acid gas-micropollutant removal, non-ATEX...) to our numerous customers worldwide.



Your benefits

With global expertise acquired over two decades, our local experts support you both in designing your treatment solution and in using Sorbacal® Micro.

Economical



- Excellent price/performance ratio
- Lower CAPEX by using one product (blend) and one silo for combined acid gas and micropollutant abatement
- Custom services to optimize your consumption

Individual



- Customized product compositions and services
- Adapted to your individual requirements and process parameters

Convenient



- Option of combining acid gas and micropollutant abatement
- "Ready to use" quick and easy application
- Odorless & clean versus pure Carbon products

Safe



- No ATEX equipment required
- Low/no carbon content from sorbents in residues

Innovative



- Unique research and development capabilities
- Partnerships with established international industrial specialists
- Relationships with academia and research laboratories

Natural



- Sorbacal® Micro sorbents based primarily on mineral components

Reliable



- Wide sourcing and supply chain network
- Worldwide availability
- Delivered in Bulk or Big Bags

Effective



- As much as necessary – as little as possible
- High performance for a wide range of process conditions
- Reliable consumption estimates

Proven



- Hundreds of references worldwide
- Wide range of industrial processes (Waste to Energy, Iron & Steel, Non-ferrous, ...)

Lhoist, your global partner in flue gas treatment

Lhoist is a multinational company specialized in calcium lime, dolomitic lime, mineral products and micropollutant sorbents. The diversity of our product range along with the worldwide presence of our industrial sites enables our group to play a leading partner role across many economic and industrial sectors.

What Lhoist offers

EXPERTISE

providing reliable and effective solutions



SORBENTS

meeting your specific needs



SERVICES

offering customized technical assistance and logistics support



Discover more,
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