HOK® ACTIVATED LIGNITE
WASTE GAS TREATMENT

RWE
GROUP

THE LOW-COST
ADSORBENT AND CATALYST FOR ENVIRONMENTAL TECHNOLOGY

Activated Lignite HOK® from Rhenish lignite differs considerably from most activated carbons in both its production and its properties. The carbon activation of the lignite extracted in the opencast mines of RWE Power AG located near Cologne is done according to the so-called rotary hearth furnace process which gave Activated Lignite its brand name HOK® (German abbreviation for Herdofenkoks = rotary hearth furnace coke).

Production, distribution and logistics are based on a consistently implemented quality system in accordance with DIN EN ISO 9001.

Analytical references values	
Water content	0.5%
Ash content	9.0%
Volatile compounds (mainly CO & CO_2)	3.0%
Fixed carbon	87.5%
Sulphur content (total)	0.5%
Heating value	29.9 MJ/kg
Specific surface area	300 m^2/g
Pore volume	50%

HOK® products for use in waste gas treatment

HOK® GRAINED
(1.25–5 mm)

HOK® MEDIUM
(0.1–1.5 mm)

SEPARATING
POLLUTANTS WITH HOK®

Separation efficiency of HOK® adsorbers

	Raw gas values (mg/m^3)	Pure gas values (mg/m^3)
Hg, Cd, Pb...	0.05–0.7	< 0.004
SO_2	20–2,000	< 2
HCl	15–5,000	< 2
HF	1–20	< 0.001
Dusts	10–250	< 2
H_2S	10,000	< 0.015
Dioxins/furans -TE (NATO/CCMS)		< 0.1 ng/m^3

As a high-grade filtering material, Activated Lignite HOK® can separate all emission- relevant pollutants, such as sulphur dioxide (SO_2), hydrogen chloride (HCl), hydrogen fluoride (HF), hydrogen sulphide (H_2S), heavy metals (Hg, Cd, As, Pb, etc.), dioxins and furans and many organic components. The pollutants are removed from the flue gas or the waste air by adsorption, chemisorption or catalytic conversion. The retention capacity for these pollutants in many cases enables separation to a level below the limit of detection.

Numerous applications

Owing to its special properties, Activated Lignite HOK® is used as activated carbon for numerous applications in environmental technology, notably:

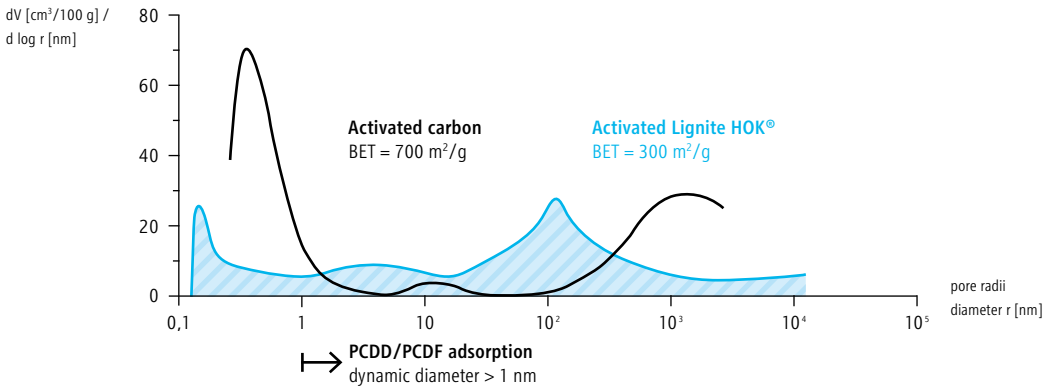
- as adsorbent for flue gas and waste air purification
- in biotechnology, e.g. in biological wastewater clarification
- as filter material in drinking water treatment
- as an adsorbent for cleaning waste dump seepage and industrial sewage water

HOK® PULVERIZED
(0–0.4 mm)

HOK® SUPER
(0–0.125 mm)

FOCUS ON HOK®

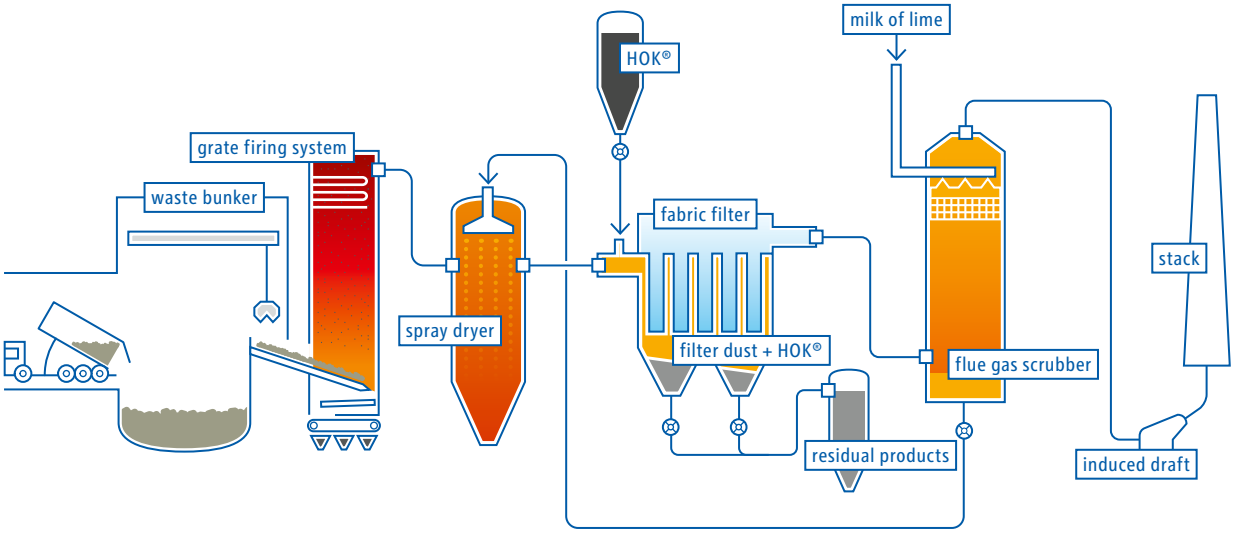
The activated carbon produced on the basis of Rhenish lignite in a pyrolysis and activation process has the pore structure characteristic of HOK®, resulting in high separation efficiency for a multitude of pollutants. The favourable pore structure present in HOK® with high mesopore and macropore portions (1 to > 50 nm) permits easy access to the inner surface area, which is decisive, among other things, for the adsorption of macromolecular compounds such as those of dioxins and furans. Using Activated Lignite HOK® with the technologies that are available on the market, even the strict emission standards for refuse and special waste incineration plants are satisfied with a large safety margin.



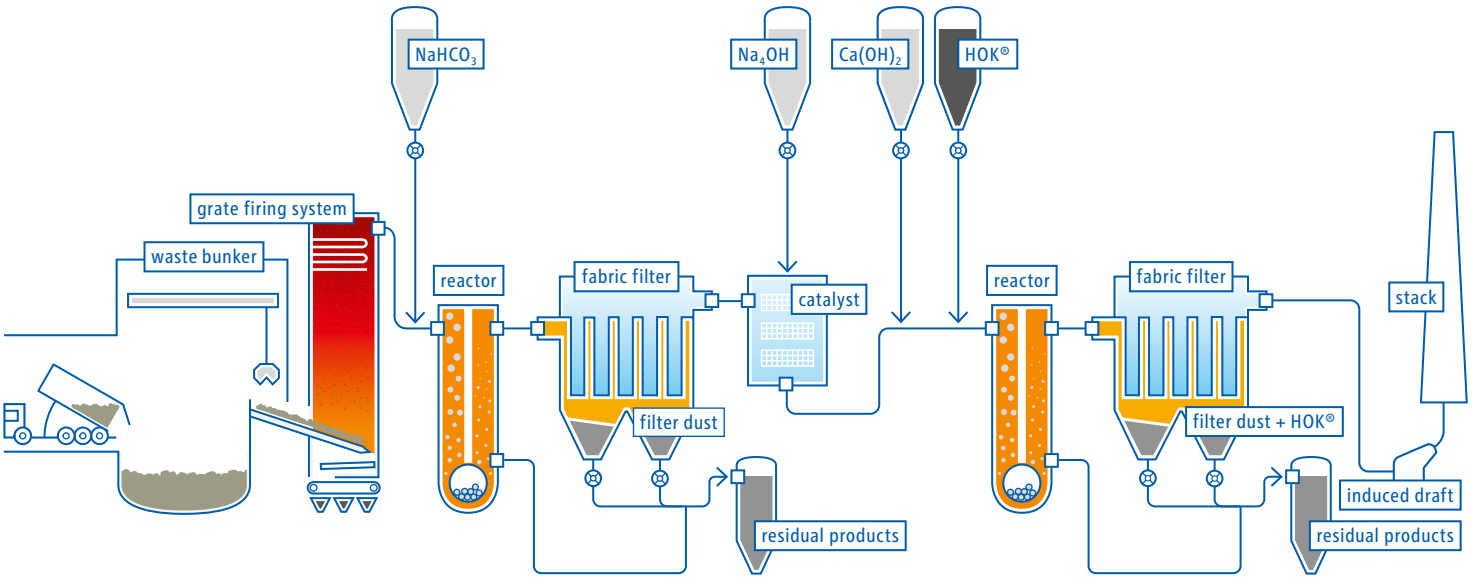
Pore radii distribution and mass transport

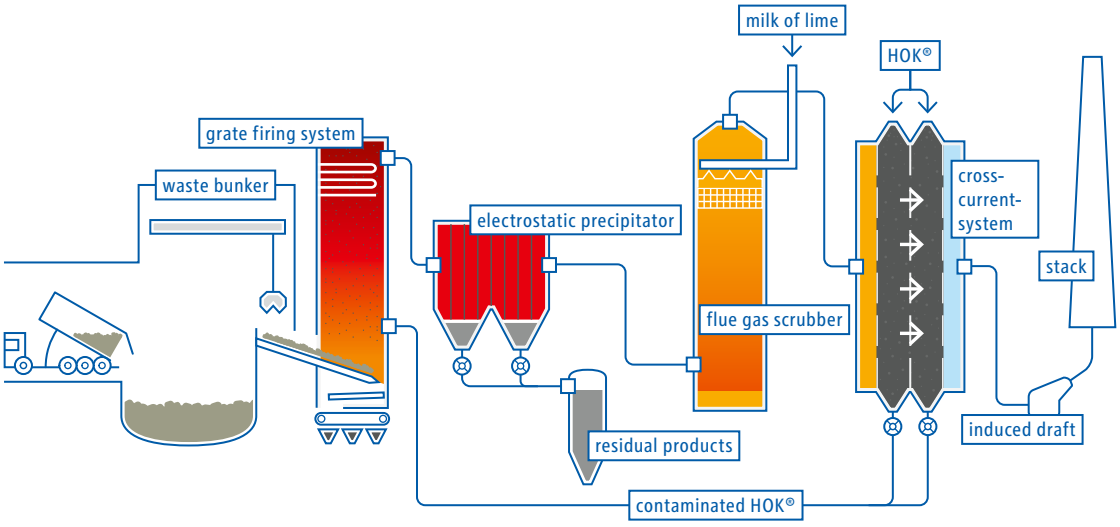
PROCESSES

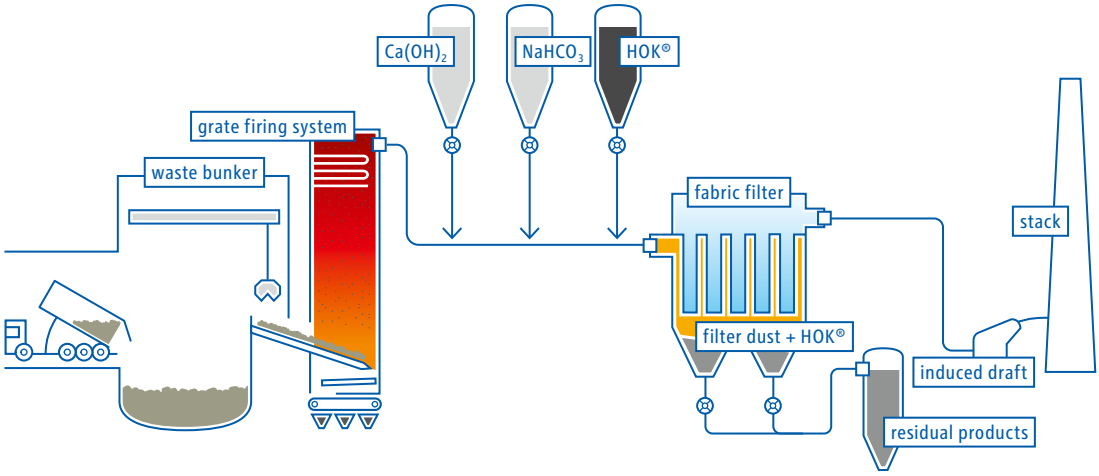
In order to purify the flue gases emitted from refuse and hazardous waste incineration plants, a number of processes using Activated Lignite HOK® were developed. These processes are used today in many different production processes for the adsorptive purification of flue gases and waste air. The choice of the appropriate process depends, among other things, on the pollutants to be separated and on their raw gas as well as the required clean gas concentrations. Their safety and integration in existing plants and processes have been tested on an industrial scale and are considered state-of-the-art due to the large number of applications currently implemented.

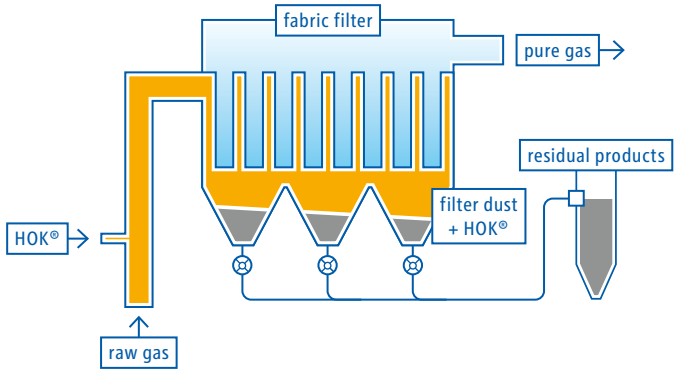


Examples of further processing concepts









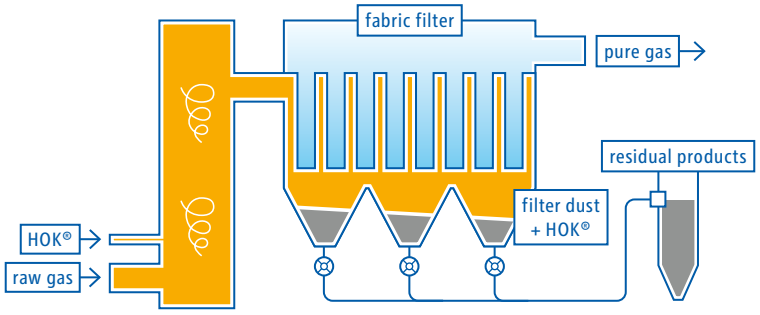
FILTER BED PROCESS

In the filter bed process, pulverised Activated Lignite (HOK® pulverized or HOK® super) in varying proportions is injected with, e.g. lime into the flue gas stream or fed into the gas stream with the milk of lime in the spray adsorber.

In the downstream fabric filter, a filter bed is formed from fly ash, gypsum and pulverised Activated Lignite. The filter bed separates out acidic components as well as mercury and dioxin/furans.

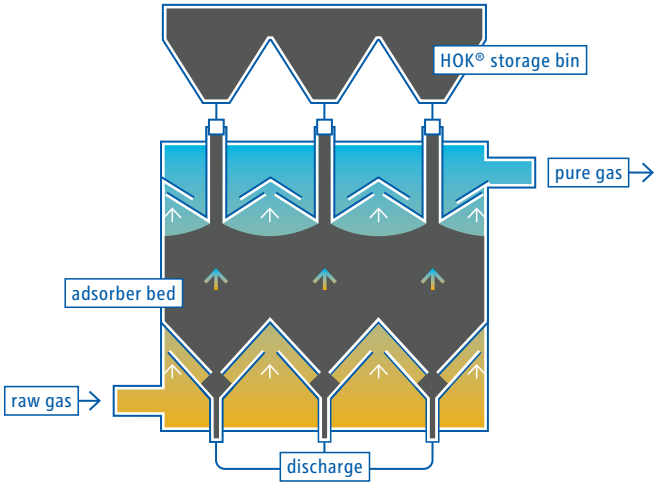
Some of the pulverised Activated Lignite deposited on the fabric filter is returned to the raw gas. The expelled pulverised Activated Lignite can be either subjected to thermal treatment or deposited at a refuse disposal site.

Given medium raw gas concentrations and little peak loading, the filter bed process satisfies the limit values of the German 17th Federal Emissions Control Ordinance. This process could therefore be an inexpensive means of lowering emissions, especially for older plants that already operate with a fabric filter.



CIRCULATING FLUIDIZED BED PROCESS

In this process the flue gases are directed through a circulating fluidized bed of Activated Lignite and, e.g. lime, in which the noxious gases are separated out. The separation of the adsorbents takes place in a downstream fabric filter, from where they can be recycled for maximum utilisation. The spent sorbent can be subjected to thermal treatment or taken directly to a refuse disposal site.



MOVING BED PROCESS

In this process the flue gases are directed through a bed of solid matter consisting of HOK®. The loaded sorbent is discharged more or less continuously and the corresponding quantity of fresh coke is added. Generally, the loaded sorbent batches are disposed of by incineration in the upstream furnace.

Depending on how the switching of the flue gas cleaning equipment is designed, the entire amount of coke or even just the Hg-free HOK® can be disposed of using this method.

The HOK® loaded with Hg resulting from the upstream dry or semi-dry waste gas treatment process can be freed from the Hg via thermal desorption and thus made suitable for combustion.

The moving bed process has been used on a large scale since 1988. Due to the high separation capacity of HOK® and the long residence times of the waste gases, this process offers the highest separation efficiency. Even short-term peaks in the level of toxic substances can be safely adsorbed.

PURIFYING
PROCESS WASTE GASES

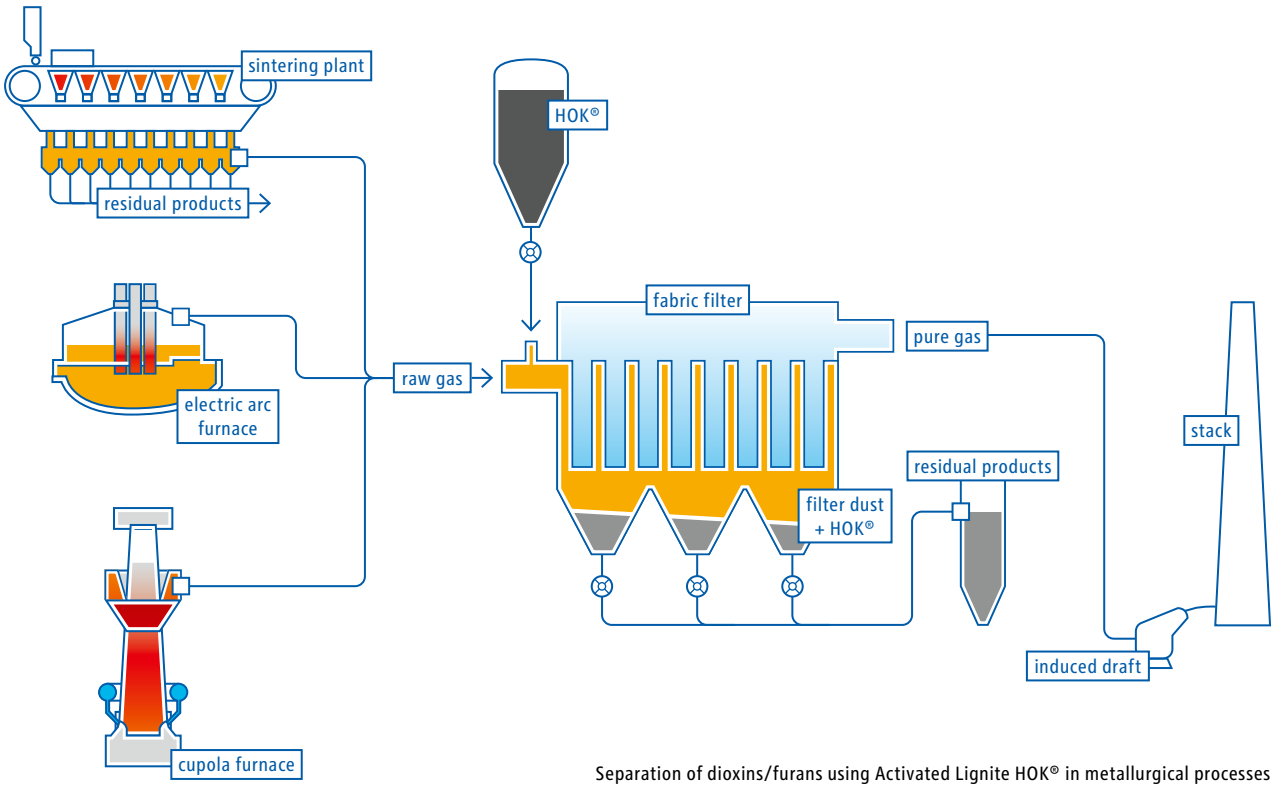
In addition to the fine purification of flue gases from refuse and special waste incinerators, Activated Lignite HOK® is also suitable for purifying process waste gases. Here too, the wide-ranging adsorptive pollutant retention capacity of Activated Lignite HOK® is utilised. The main components separated out during process gas purification are hydrogen sulphide, heavy metals, organic solvents, odorous substances, and various hydrocarbon compounds such as dioxins (PCDD), furans (PCDF), polychlorinated biphenyls (PCB), hexachlorocyclohexanes (HCH) and polycyclic aromatic hydrocarbons (PAH).

Waste gas purification can be fundamentally carried out with any of the processes already described. Applications currently being considered are residue co-combustion processes, metallurgical processes and process waste gases with components emanating a strong odour (e.g. matchwood driers, roughage and manure drying plants).
The spent sorbents can be taken back after examining the particular case.

Adsorptive process gas purification

- Heavy metals (e.g. Hg, Cd, Tl, As)
- Hydrogen sulphide
- Organic solvents (e.g. styrene, toluene, chlorobenzene)
- Odorous substances (e.g. pinenes, limonenes)
- Various hydrocarbons
  (e.g. PCDD, PCDF, PCB, HCH, PAH)

The production process is supported by IT systems in the control room of the rotary hearth furnace.



Separation of dioxins/furans using Activated Lignite HOK® in metallurgical processes

RELIABILITY, SUPPLY SECURITY
AND DISTRIBUTION WORLDWIDE

CONSULTING
AND DISTRIBUTION

CONSULTING

The experience RWE Power AG has accumulated over decades of handling Activated Lignite HOK® and the know-how acquired through close cooperation with its many customers are reflected in the service provided by an expert team of advisers. RWE Power AG's experienced engineers and businesspeople will select the right solution for your pollution control needs. Moreover, RWE Power AG provides you with a complete range of services throughout every phase, including developing concepts, planning systems, consultation during approval procedures and in matters of safety, personnel training, financing options and production cost analyses, i.e. a full range of convincing solutions, both now and in the future. Why not find out at first hand?

DISTRIBUTION

Activated Lignite HOK® is distributed by Rheinbraun Brennstoff GmbH. The company offers the necessary know-how concerning the preparation and use of the product. The Group's own logistics department is responsible for proper transportation and ensures accurate scheduling.

With Rheinbraun Brennstoff as a partner, your supplies of Activated Lignite HOK® are assured. RWE Power AG's past performance is a consistent demonstration of reliability and dependable delivery.

Activated Lignite HOK® is supplied in bulk by large-capacity dump truck or silo truck and transhipped mechanically or pneumatically in a sealed system at the customer's site. The sorbent is stored in simply designed sheet steel silos. Smaller quantities of Activated Lignite HOK® can be supplied in special units such as sacks, big bags or small containers.

Modes of transport and types of packaging

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