

**Benefits of FERRUM Scon application**

- The more cost-effective alternative to high-grade activated carbon products
- High loading rates due to selective purification
- Highly flexible with regard to specific technological requirements due to various grain sizes (e.g. pressure loss specifications)
- Easy handling
- Classified as fertiliser by the German Fertiliser Ordinance
  - Can be added to fermentation residues
  - No disposal costs

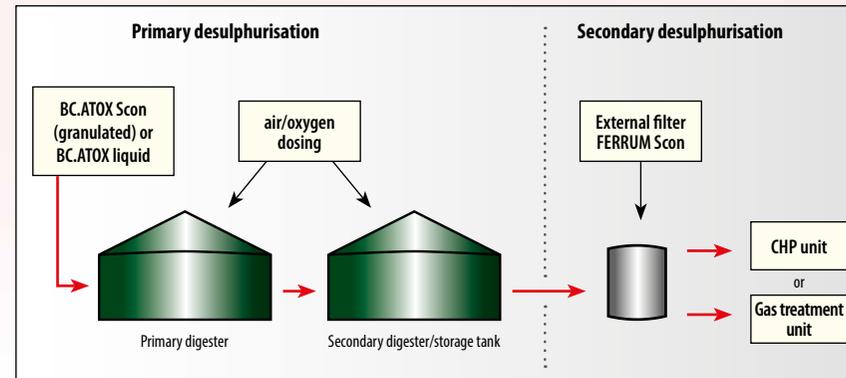
**Comparison between FERRUM Scon and activated carbon**

	Activated carbon	FERRUM Scon
Handling	+	+
Investment costs	+	+
Flexibility regarding particular technological characteristics (e.g. low gas pressure)	-	+
Continued desulphurisation after first H <sub>2</sub> S-saturation	-	+
Operating costs	-	+
Disposal costs	-	++
H <sub>2</sub> S-free clean gas (0–2 ppm)	++	++

Caption: ++ Very good + Good o Neutral - Poor -- Very poor

**A cascading concept for efficient and flexible desulphurisation**

1. Quantity-adjusted dosing of BC.ATOX Scon or BC.ATOX liquid directly into the digester with feeding
2. Distribution-optimised dosing of air/oxygen into the digester headspace (Caution: corrosion risk)
3. Granulated FERRUM Scon in filters upstream of CHP unit or gas treatment



**Elimination of hydrogen sulphide from biogas**





## Applying a new strategy to an old dilemma

Increasing legal requirements regarding biogas quality have led to a growing significance for biogas purification strategies. The increasingly flexible operation of CHP units alongside reduced emission limits and tightened specifications by CHP manufacturers relevant for warranty claims are currently leading to operators having to install up to three desulphurization stages.

In practice, it is predominantly activated carbon filters that have been deployed for external desulphurization, one of their disadvantages being the carbon's expensive disposal. Loaded activated carbon cannot be spread as fertilizer or soil improver and needs to be disposed of as hazardous material causing high additional costs.

## FERRUM Scon products

FERRUM Scon products for gas purification purposes offer a highly efficient and cost-effective alternative to activated carbon. They can be used in almost all currently available filter systems. Apart from two distinct product lines to respond to varying gas humidity levels, there are three grain sizes to choose from for perfect adjustment to existing technical conditions.

This, in connection with the high porosity of FERRUM Scon products ensures high loading rates for hydrogen sulphide and low pressure loss in the gas lines. FERRUM Scon D has been specifically designed for filter systems running on very dry biogas (< 50 %).

## Available grain and pack sizes

FERRUM Scon granules come in three different grain sizes. All three grain sizes can be combined as required and are available in 25 kg bags as well as in 550 kg bulk bags (FIBC). FERRUM Scon D is available in grain size 2–4 mm exclusively and comes in 25 kg bags as well as bulk bags.

Product	Grain size [mm]	Bulk density [kg/m <sup>3</sup> ]
FERRUM Scon	2–4	630 ± 50
	2–8	610 ± 50
	5–25	610 ± 50
FERRUM Scon D	2–4	530 ± 50



## High loading capacity as a basis for cost optimisation

The loading capacity of FERRUM Scon with hydrogen sulphide depends on a number of factors that need to be considered before application:

- Hydrogen sulphide concentration of the biogas
- Gas humidity
- Added amount of regeneration air or oxygen, respectively
- Pressure conditions in the gas system
- Gasflow velocity
- Retention time of the gas in the filter system

In practice, loading rates of 20–40 % by weight sulphur are reached resulting in potential loading capacities of between 230 to 600 g H<sub>2</sub>S per kg FERRUM Scon. At maximum loading, downstream H<sub>2</sub>S-contents will gradually start to increase allowing sufficient time to organise filter re-filling.

## How does FERRUM Scon work?

The precipitation of hydrogen sulphide from biogas by FERRUM Scon occurs in two steps:

1. Reaction of hydrogen sulphide with FERRUM Scon



2. Regeneration of FERRUM Scon by air addition



Both reactions are exothermic.

Therefore, to avoid uncontrolled regeneration and heat production triggered by abrupt oxygen entry, it is crucial to provide a continuous air/oxygen supply. A certain gas humidity level is essential for both the absorption process and regeneration of FERRUM Scon.

## Operational conditions for FERRUM Scon products

Hydrogen sulphide concentration in the biogas	Up to max. 15,000 ppm
Filling level of gas purification material	> 0.5m up to max. 12 m
Pressure loss in the filter filling	1 to ca. 15 mbar (depending on filling level, granulation and gas flow velocity)
Pressure range	Atmospheric pressure (unpressurised) up to 25 bar
Retention time of biogas within the filter	> 20 sec.
Gas flow velocity in the filter	< 15 m/min. (0.25 m/sec)
Relative gas humidity	60–80 % optimal for FERRUM Scon 40–60 % optimal for FERRUM Scon D (minimum 30 %)
Moisture content in the pellets	> 5 %, optimum 10–15 %
Required amount of oxygen for regeneration	min. 2–4 fold stoichiometric excess, recommendation: 0.2–0.4 % oxygen in biogas

## Legal requirements for the disposal of loaded FERRUM Scon

According to a recommendation by the German Fertiliser Transport Control, FERRUM Scon loaded with elementary sulphur after use in gas purification can be spread as fertiliser.

FERRUM Scon is not subject to any legally relevant storage or transport restrictions. During storage of FERRUM Scon avoid direct contact with water (e.g. rainwater). FERRUM Scon products have a virtually unlimited storage life if stored under optimal conditions.