



AxTrap™ 4000 Series

Axens
SOLUTIONS

AxTrap™ 4000 Series Sulfur Guard Scavenger

Hydrogen sulfide (H₂S) and light mercaptans are common contaminants that must be removed from various gases such as air, CO₂, natural gas, biogas and landfill-derived methane. Such Sulfur species are extremely corrosive and must be removed to meet fuel gas specifications, pipeline specifications and air quality regulations. Axens offers the AxTrap™ 4000 Series of dry, granular media scavengers to safely and effectively remove these common sulfur contaminants.

Based on iron oxide or engineered mixed metal oxides, AxTrap™ 4000 Series products are available for both dry and watersaturated gases. They are particularly effective when the feed stream is water saturated. The AxTrap™ 4000 scavengers can be water washed in place to extend their cycle length and increase total sulfur removal.

AxTrap™ 4000 Series products is based on patented, proprietary mixtures of iron oxides and/or mixed metal oxides - on an inert, inorganic carrier. The result is a particularly robust, granular material in which the metal oxide matrix provides a firmly bound active phase which is non-toxic, non-hazardous, non-pyrophoric and environmentally safe in both fresh and spent condition.

The adsorbents of the AxTrap™ 4000 Series work effectively in most gaseous streams. Diverse applications can be covered including natural gas processing, floating production storage and offloading (FPSO), offshore platforms, gas storage, oil production associated gas sweetening, refineries, vent gas treatment, odor and corrosion control, food-grade CO₂, biogas and landfill gas. AxTrap™ 4000 Series is particularly effective in purification to meet the copper-strip corrosion test on a wide range of light hydrocarbons and fuels.



BENEFITS

- Uniquely and effectively removes H₂S and light organic sulfur compounds without conversion of mercaptans to heavier disulfides (as with other iron-based media)
- Consistently low pressure drop over the entire media life
- No special handling, sock or confined space entry required during loading
- Spent material is extremely easy to remove: generally accomplished by dry vacuum with little to no water, making change outs and disposal much cheaper and faster (with no wastewater generation)
- Spent AxTrap™ scavenger has no risk of exothermic or pyrophoric events, and requires no special precautions, wetting, or handling for safe handling



↑ Figure 1: AxTrap™ 4000 Series Media

Cost-effective solutions, efficient operation

The AxTrap™ 4000 Series scavengers are very useful for fixed-bed processes that require ease of operation and minimal operator attention. Adsorbent consumption depends only on the amount of contaminants passing through the bed, so that the sulfur removal requirement can be matched with variations in system feed conditions without any process adjustments. A single vessel or multiple vessels in parallel flow configurations can be used but a lead-lag configuration provides the greatest operating flexibility, enabling continuous production while the adsorbent in one vessel is replaced.

Fresh and spent adsorbents are safe and stable. The spent product is most commonly disposed in nonhazardous landfills.

Landfill Gas and Biogas Processing

Among the many applications of the AxTrap™ 4000 Series, wastewater treatment and landfill gas or biogas upgrading are among the most effective. Purification of methane (as a renewable energy source) produced as “Biogas”, often requires removal of carbon dioxide, moisture and various other contaminants such as hydrogen sulfide, light mercaptans and more. Effective removal of the mercaptans (rather than conversion to heavier disulfides) improves the quality of the biogas or landfill gas for direct consumption on site or for sale; improving the efficiency and reducing the OpEx of downstream processes.

The simplicity of the AxTrap™ 4000 Series is ideal for a wide range of applications, as it is well-suited to the water saturated conditions typical of biogas, landfill and digester gas. AxTrap™ 4000 Series scavengers are effective in anaerobic conditions and achieve even higher sulfur loadings when sufficient oxygen is present.



↑ Figure 2: AxTrap™ 4012 natural gas treatment system

{ CASE STUDY }

The AxTrap™ 4000 Series is a specifically engineered matrix of various iron oxides designed to take advantage of their differing attributes and improve the overall performance and life cycle. The products have consistent properties, minimal fines, and low pressure-drop with no special loading or unloading requirements. The case study below shows the improvements and operation achieved after a Texas landfill gas treatment facility switched to the AxTrap™ 4000 Series. The benefits were an increase of the run length from 4 months to 5 months, a better vessel flow balance and an easier product change outs. AxTrap™ adsorbents are made in a consistent granular size with less fines generation to avoid potential pressure drop issues.

FEED GAS COMPONENTS	
CH ₄	55 VOL.%
CO ₂	44 VOL.%
O ₂	0.08 VOL.%
N ₂	0.9 VOL.%
H ₂ S	400 TO 600 PPMV

SYSTEM OPERATION	
5 FIBERGLASS VESSELS IN PARALLEL WITH DOWN FLOW	

OPERATING CONDITIONS	
FLOW RATE	8,000 TO 10,000 SCFM
PRESSURE	6 PSIG (0.4 BARG)
TEMPERATURE IN	90°F (32°C)
AXTRAP™ MEDIA LOADING	70,000 LBS. PER BED (31.75 TONS/BED)
PRESSURE DROP ACROSS BEDS	0.5 PSI (35 MBAR) IN CONTINUOUS DURING BED CYCLE LENGTH
NORMAL OUTLET H ₂ S	0 TO 4 PPMV
MAXIMUM OUTLET H ₂ S	<4 PPMV TO MAINTAIN SALES SPECIFICATIONS

› Benefits of using AxTrap™ Media in comparison with previous Iron-Based Product

PRODUCT NAME	BEFORE USING AXTRAP™ MEDIA	AFTER USING AXTRAP™ MEDIA
CYCLE LENGTH	4 MONTHS	5 MONTHS
PRESSURE DROPS	1 PSI (69 MBAR)	0.5 PSI (35 MBAR)

› A full range of adsorbents for different applications

PRODUCT NAME	DESCRIPTION	SULFUR TRAPPING CAPABILITIES	ATER SATURATED GAS REQUIRED	APPLICATIONS
AxTrap™ 4000	Iron-based	H ₂ S	Yes	Used selectively for natural gas treatment
AxTrap™ 4001	Iron-based copper promoted	H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used for natural gas, CO ₂ , and biogas treatment
AxTrap™ 4002	Iron-based non-copper promoted	H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used for natural gas, CO ₂ , and biogas treatment
AxTrap™ 4003	Iron-based copper and non-copper promoted	H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used for landfill gas with higher non-methane VOCs (Volatile organic compounds)
AxTrap™ 4003L	Iron-based	"Reactive" sulfur species (mainly H ₂ S and light mercaptans)	Yes	Used to remove "reactive" sulfur compounds from liquid hydrocarbons to pass copper strip corrosion tests
AxTrap™ 4011	Iron-based copper promoted	H ₂ S, mercaptans (MeSH, EtSH, iPrSH, nPrSH and some BuSH)	Yes	Used in natural gas and CO ₂ treatment
AxTrap™ 4012	Iron-based non-copper promoted	H ₂ S, mercaptans (MeSH, EtSH, iPrSH, nPrSH and some BuSH)	Yes	Used in natural gas and CO ₂ treatment
AxTrap™ 4101	Iron-based copper promoted	Higher capacity H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used for anaerobic natural gas, CO ₂ , and biogas treatment
AxTrap™ 4102	Iron-based non-copper promoted	Higher capacity H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used for anaerobic natural gas, CO ₂ , and biogas treatment
AxTrap™ 4503	Zinc-based copper promoted	H ₂ S, light mercaptans (mainly MeSH and EtSH)	Yes	Used when the gas is less than 100% relative humidity, can tolerate presence of O ₂ without interference or reduction in H ₂ S capacity
AxTrap™ 4513	Zinc-based copper and non-copper promoted	H ₂ S, mercaptans (MeSH, EtSH, iPrSH, nPrSH and some BuSH)	Yes	Used when the gas is less than 100% relative humidity, can tolerate presence of O ₂ without interference or reduction in H ₂ S capacity

Extensive supporting services

Axens can offer customized support ranging from simply supplying material to offering a fully engineered technical solution including a basic system design, media supply, detailed engineering, fabrication packages, equipment supply, and spent media handling.

Axens AxTrap™ 4000 Series key features

- Improved chemistry for an optimized sulfur removal efficiency:
 - Specifically created matrices of different iron oxides
 - Greater H₂S capacity to treat even weight percent inlet concentrations to ppm outlet specifications
 - Mostly inert elemental sulfur and stable iron sulfides formation
 - Efficient mercaptans removal, which reduces the total sulfur with no conversion to disulfides
 - Good resistance to non-methane VOC's and BTX contamination
 - Effective at any level of CO₂
- Lower stable pressure drop
- Safer, easier, and cheaper change outs