Technical Services & Process Technology

Hydrocarbon Desulfurization
Technical Services

- On-Site Performance Testing
- Troubleshooting
- H₂S, Mercaptans & CO₂ Analysis
- Current System Audit & Evaluation
- H₂S Load Calculations & Simulations
- Treatment Cost Analysis
- Technology Qualifications
- Independent Assessments
- Expert Consulting & Technical Training
- H₂S & Mercaptans Removal Process Designs

Process Technologies

EXION systems
Process Systems

IntelliChem
Chemical Technologies

www.NexoSolutions.com
H₂S

Mercaptans

Disulfides

Sulfides

Tiophenes

High Reactivity

Low Reactivity
More difficult to remove
Limited options
Copper – Redox reaction. Expensive, corrodes iron

Iron/Zinc – Redox. Induce precipitation, emulsification and downstream fouling

Peroxides – Redox. Explosive risk

Caustic – Acid-base. Corrosive, generates spent caustic and stabilizes emulsions.

Aldehydes – Acid-Base. Corrosive, unstable and dangerous to health

Iron Oxide Beds – Redox. High capital, maintenance and waste disposal costs

Liquid Redox - High capital costs; sulfur cake produced contains 30-40% water

Amine Gas Sweetening/Claus Process – Acid-Base. Very high capital costs
H₂S Processing Selection Chart

- 1,000,000 ppmv
- 100,000 ppmv
- 10,000 ppmv
- 1,000 ppmv
- 100 ppmv
- 10 ppmv

- 50 ton/day Sulphur
- 20 ton/day Sulphur
- Intermediate: Sulfatreat, SurFerox, Tiopaq
- Non-Regenerative: solids beds or liquids scavengers
- Amine Units or Physical Solvents
- Amine/Sulfinol + SulFerox/Thiopaq

Gas Flow Rate (10⁶ Nm³/d)
1) Liquid Chemicals
Slow & Reversible Reaction times
• Reaction is slow & inefficient
• Excess chemical needed
• 5-10 sec contact time
• Larger vessels, multi vessels

Fast & Irreversible Reaction times
• Reaction is instantaneous
• More effective reactions
• Smaller vessels

2) Solids Adsorbent/Chemical
• H₂S is captured by the solid bed
• Chemical or physical reactions possible depending on media material
• Solid materials that immobilize H₂S in its structure
1) Liquid Chemicals
Slow Reaction times (Exion GC system)
• Triazine, acrolein, glyoxal and other analogues
• Exion GC-200 (polyol-based)
• Potash

Fast Reaction times, in line mixing, small systems (Exion GT System)
• Exion GT-300 (polyol-based)
• Caustic

2) Solids Adsorbent/Chemical
• Iron based
• Zinc based
• Zeolites
• Activated Carbon (normal or functionalized)
• Exion GA-50 Adsorbent
The Next Generation of Process Systems
Hydrocarbon Desulfurization

EXION
systems

www.ExionSystems.com

Gas Treating | Liquid Treating

www.NexoSolutions.com
Exion GC Systems
H₂S Removal

- Formulated for Triazine and other slow reaction chemicals
- Non-nitrogen options
- Safe disposal
- Exact mol/mol reaction
- No solids formation
- No carry-over systems design
- H₂S Selective
- Skidded systems, fully automatic

South Texas Fractionation Plant

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Dithiazine polymers are a major cause of fouling, chemical poisoning, filter plugging, corrosion, waste water contamination in refineries, gas processing plants and NGL fractionation plants. This polymer is caused by a higher than 2:1 reaction mole ratio (H₂S/triazine).

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Solids in the inlet coalescer caused by H$_2$S scavengers and by products.
EXION systems

• Alternative to current H\textsubscript{2}S scavengers
• Can also remove mercaptans, COS and CO\textsubscript{2}
• Less Chemical Cost and less chemical injected
• Fewer and smaller vessels
  ✓ Short contact time
• **No foaming or fouling** - No solids formation
• No chemical odor
• No nitrogen containing waste
• No heavy metals. No aldehydes or formaldehydes
• No excess chemical use

www.NexoSolutions.com
• H₂S Removal
• Mercaptans Removal
• Sulfides Removal
• Disulfides Removal
• Thiophenes Removal
• Elemental Sulphur Removal
• COS Removal
• CO₂ Removal
• Natural Gas Treating
• Flare Gas, Flash Gas, Vent Gas
• NGL Treating
• LPG Treating
• LNG Treating
• Butane/Propane Treating
• Condensate Treating
• Finished Fuels Treating
Exion Systems features:

- Compete skidded packages (turn-key)
- Flexible designs
- Maximum efficiency internals
- Includes inlet separation
  - Coalescence and/or filtration
- Included post-treatment
  - Filtration and/or polishing
- 24 h technical support
- Technical training
- Remote monitoring
- On-Site performance analysis and troubleshooting
Triazine Scavenger v/s Exion GT-300 Removal

Exion GT-300 and Triazine Cost Comparison (1% H₂S)

- GT-300
- Triazine
- gal/d GT-300
- gal/d Triazine

Chemical Cost (USD/yr)

Gas Flow Rate (MSCFD)

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Exion GT-300 H$_2$S Removal Costs

Exion GT-300 Cost Chart

- 0.1% H$_2$S
- 1% H$_2$S
- 10% H$_2$S

Chemical Cost (USD/yr) vs. Gas Flow Rate (MSCFD)

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Mercaptans Removal

PPM WT Additive

Extracto Outlet (C1-C7)
Extracto Outlet (C1-C4)
Extracto Outlet (C1-C3)
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<th>Date</th>
<th>Time</th>
<th>Chemical Formulation</th>
<th>Chemical Injection Rate (ml/min)</th>
<th>Butane Flow Rate (LPM)</th>
<th>Treated Result (mg/kg) Inlet/outlet</th>
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H₂S, mercaptans and sulfides
• Customized Adsorbents
• No Chemical Injection
• 6-12 months bed life (single bed)
• Low operations costs
• Complete skidded systems
• Full system with inlet coalescing
• Maintenance support
• Guidance on media disposal

Example:
Fe₂O₃ + 2H₂S → Fe₂S₃ + 3H₂O
FeO + 2H₂S → FeS + 3H₂O
• USA Environmental Protection Agency (EPA) test protocol cited in 40 CFR Subpart C (Section 261.20 through 261.24) indicates that reacted iron sulfide media is not listed as a hazardous waste

• European Union Directive 32001D0119 indicates that reacted iron sulfide is considered non-hazardous

• Nexo has proprietary media deactivators to enable media disposal to be simple, environmentally friendly and safe
IntelliChem is a Nexo division that concentrates on chemical technologies for desulfurization. We custom design chemical products for most applications. Our products incorporate the latest generation of molecular designs and applications for improved effectiveness and lower costs. Our offerings include:

- $\text{H}_2\text{S}$ scavengers
- Mercaptans scavengers
- $\text{CO}_2$ scavengers
- COS scavengers
Shale Oil H₂S Removal

150 BPD of crude oil (West Texas)  
(4.375 GPM)  
18,000 ppm of H₂S (gas phase)  
Client injecting 10,000 ppm of triazine-based scavenger  
Injection = 63 GPD  
Estimated Cost = $183,960 / year

**SOLUTION: Intellichem HR INJECTION @ 1,200 ppm**

Injection = 7.53 GPD  
Costs: $37,667 / year  
SAVINGS OF $146,294 / year
Gas Oil $H_2S$ Removal

10,500 BPD of gas oil (New Mexico)
(306 GPM)

350 ppm of $H_2S$ (gas phase)

Client injecting 350 ppm of Triazine-based scavenger
Injection = 154 GPD

Estimated Cost = $449,680 / year

**SOLUTION**: IntelliChem HR INJECTION @ 60 ppm

Injection = 26.46 GPD

Costs: $131,830 / year

SAVINGS OF $317,849 / year

Higher $H_2S$ removal rates

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Nexo Solutions Video