Thioclear

Biological Control of Hydrogen Sulfide and Nitrates

PUT BIOLOGY TO WORK.

HYDROGEN SULFIDE + NITRATE CONTROL



PRODUCT PROFILE

Thioclear is a biological formulation for wastewater odor-control programs, combining sulfur-oxidizing and denitrifying bacteria with enzymatic agents. Its blend includes *Thiobacillus*, *Bacillus* and *Pseudomonas*. Select a treatment program for the actual sulfide, nitrate and operating conditions.

TARGET SULFIDE

Supports biological conversion of reduced sulfur compounds to less odorous end products.

ADDRESS NITRATES

Supports biological nitrate reduction when electron donors and suitable anoxic conditions are available.

SUPPORT TREATMENT

Apply in collection systems, treatment processes and compatible biological odor-control equipment.

WHERE IT FITS

Lift stations • force mains • interceptors • headworks • treatment plants • biofilters • biotrickling filters • compatible biological media.

Reducing sulfide exposure can help lower odor and corrosion potential. Verify dissolved sulfide and gas-phase H_2S; one measurement does not substitute for the other.

PACKAGING OPTIONS



55-GALLON DRUM (55 US Gallons) | **1-GALLON JUG** (1 US Gallon) | **5 x 1-GALLON CASE** (5 US Gallons Total) | **275-GALLON TOTE** (275 US Gallons) | **WATER-SOLUBLE POUCHES** (0.5 lb each)

PACKAGING & LISTED PRICING

Formulation	Listed viable count	Listed price
Thioclear 11X concentrate	3.04×10^{12} CFU/gallon	$250.00/gallon
Thioclear 37X concentrate	1.02×10^{13} CFU/gallon	$650.00/gallon
Thioclear RTU, 55-gallon drum	2.76×10^{11} CFU/gallon	$995.00/drum
Thioclear RTU, 275-gallon tote	2.76×10^{11} CFU/gallon	$4,950.00/tote
Water-soluble pouches	2.27×10^{12} CFU/pound	$575.00/ 50 pouches, 0.5 lb each

Confirm current quotation, freight, storage requirements and batch documentation before ordering.

ONE BIOLOGICAL PROGRAM. TWO KEY TARGETS.

Performance depends on formulation, acclimation, dose, retention, substrate supply and operating conditions. Establish a site-specific trial and measurable acceptance criteria.

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ODOR CONTROL PRODUCTS & EQUIPMENT

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TWO TARGETS. DISTINCT PATHWAYS.

Sulfide oxidation and nitrate reduction, engineered for the wastewater.

HOW THE BIOLOGY WORKS

Thiobacillus denitrificans can use reduced sulfur as an electron donor. It can oxidize sulfur compounds with oxygen under aerobic conditions, or couple sulfur oxidation to nitrate reduction under suitable anoxic conditions. Electron-acceptor availability and loading determine the pathway and products. [1,2]

SULFIDE OXIDATION

Dissolved sulfide is biologically converted toward elemental sulfur and/or sulfate, depending on conditions. Sulfur remains in the sulfur cycle; it does not turn into nitrate. Manage sulfate, solids and possible downstream sulfide rebound. [1,2]

NITRATE REDUCTION

Nitrate can be reduced toward nitrogen gas under suitable anoxic conditions. Monitor nitrate-N and nitrite-N to verify completion. Oxygen can compete with nitrate as an electron acceptor; nitrate removal is not assured in every aerobic zone. [1,2]

COLLECTION-SYSTEM APPLICATION

- Select a feed point that provides contact and retention before the odor release point.
- Allow acclimation and confirm that viable organisms remain in the treatment zone.
- Match the program to sulfide loading, nitrate availability, wastewater flow and temperature.
- Evaluate downstream treatment effects, gas management and hydraulic conditions.
- Coordinate with alkalinity and other chemical programs using separate, compatible feed systems.

OPERATING CONDITIONS TO VERIFY

- **pH and alkalinity:** Establish a biomass-compatible range; sulfur oxidation can change acidity and buffering.
- **Temperature and salinity:** Validate against actual wastewater and product requirements.
- **Substrate and contact:** Confirm sulfur supply, electron acceptors, nutrients and hydraulic retention.
- **Chemical compatibility:** Prevent concentrated oxidants or disinfectants from contacting the biological product. Do not mix concentrates.

TRIAL SCORECARD

Dissolved total sulfide (mg/L as S) • headspace H_2S (ppmv) • nitrate-N • nitrite-N • total nitrogen when relevant • DO/ORP • pH/alkalinity • flow • temperature • chemical use.
ORP alone is not proof of sulfide removal. Set baseline and treated acceptance criteria.

CONTROL THE CONDITIONS. VERIFY THE CONVERSION.

Published organism research supports these mechanisms; it is not a guarantee of Thioclear removal efficiency at every site.

REFERENCES

[1] Wang et al. (2005), simultaneeus desulfurization and denitrification by *T. denitrificans*. DOI: 10.1080/10934520500184590.
[2] Manconi, Carucci & Lens (2007), combined sulfur and nitrate removal in bioaugmented activated sludge. DOI: 10.1002/bit.21383.

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BIOFILTERS & BIOLOGICAL MEDIA SUPPORT

Build active treatment on a suitable support medium.



SUPPORT THE BIOLOGY INSIDE THE SYSTEM

Thioclear can be evaluated for startup, recolonization and biological support in compatible biofilters, biotrickling filters and bioscrubbers. The objective is to establish an active sulfur-oxidizing community under the equipment's actual operating conditions.

BIOFILTER PERFORMANCE

Sulfur-oxidizing organisms require the right moisture, nutrients, pH and electron acceptors. Contact time, distribution and loading govern gas treatment. Confirm compatibility with the existing microbial population and equipment design.

CARBON AS A BIOLOGICAL CARRIER

Research has demonstrated H_2S treatment using *Thiobacillus denitrificans* immobilized on granular activated carbon and other matrices. This supports the use of suitable media as a biofilm carrier; it does not prove that adding bacteria restores any exhausted carbon bed. [1]

BIOLOGICAL MEDIA REJUVENATION: WHAT TO VERIFY

A biologically active bed may convert accessible sulfur compounds and help extend useful operation when conditions are suitable. Demonstrate the benefit with breakthrough pressure-drop and media-condition measurements.

Biological treatment is different from thermal reactivation. It does not automatically restore carbon pore structure, remove inorganic scale or recover adsorption capacity lost to all contaminants.

FIELD IMPLEMENTATION

1. Confirm the vessel and media are designed for biological operation.
2. Check moisture, drainage, airflow and recirculation distribution.
3. Introduce product through approved nutrient ports or recirculation feed points.
4. Maintain equipment-specific pH, nutrients and electron-acceptor conditions.
5. Monitor inlet/outlet H_2S, loading, empty-bed residence time and pressure drop.
6. Manage sulfate, sulfur solids and biomass accumulation through approved operating procedures.

ACCEPTANCE CRITERIA

Set an outlet H_2S target and allowable pressure drop before the trial. Compare loading-normalized performance and operating cost with the baseline. Maintain required media replacement and maintenance when performance limits are reached.

BIOLOGY CAN SUPPORT MEDIA LIFE.

PROVE PERFORMANCE BEFORE CREDITING REGENERATION.

Cited research concerns organism/carrier performance, not a Thioclear regeneration guarantee.

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REFERENCE

[1] Ma, Yang & Zhao (2006), Removal of H_2S by *Thiobacillus denitrificans* immobilized on different matrices. Bioresource Technology 97, 2041-2046. PubMed PMID: 16289624.

SPENT CAUSTIC: BIOLOGICAL TREATMENT POTENTIAL

Evaluate contaminant removal and reuse through a controlled process.



TREAT THE CONTAMINANTS. VERIFY THE REUSE VALUE.

Biological treatment may reduce sulfur contaminants in selected spent sulfidic caustic streams. Consider Thioclear within an engineered pilot after stream characterization and compatibility testing. Waste treatment, chemical recovery and reuse acceptance are separate objectives.

PUBLISHED STUDY SPOTLIGHT

Hashemi & Heidarinasab (2012) reported laboratory treatment of spent sulfidic caustic with *Thiobacillus denitrificans*. Prepared samples received culture medium and trace elements and were shaken for 120 hours at 28°C; the reported test pH was 11.8. Sulfide and mercaptide levels decreased. [1]

This is a study-specific result, not a Thioclear field trial, a general operating range or proof that concentrated commercial caustic can be inoculated directly.

WHAT MAY BE ACHIEVABLE

- ✓ Reduce a treatable sulfur contaminant load.
- ✓ Support a reuse or waste-minimization assessment.
- ✓ Evaluate reduced downstream treatment demand.
- ✓ Measure chemical and disposal savings against the baseline.

WHAT MUST BE VERIFIED

- Sulfide, mercaptides and other inhibitory organics.
- Salinity, free caustic, pH and actual alkalinity.
- Biomass viability, nutrients and electron acceptors.
- Residence time, mixing, gas handling and materials.
- Residual salts, sulfate, solids and destination requirements.



REUSE IS A QUALITY DECISION

Lower sulfide does not by itself establish recovered NaOH strength, acceptable salts or suitability for a scrubber or industrial process. Oxidation may consume alkalinity; do not assume that all original chemical capacity is restored. Test the treated solution against the receiving process specification before reuse.



FROM BENCH TEST TO FIELD PROGRAM

CHARACTERIZE
Analyze the spent stream and identify the receiving process requirements.

PILOT
Use matched controls and a defined treatment endpoint; track sulfur, nitrogen, alkalinity and gas/solids balances.

VERIFY
Confirm product viability, treated-stream quality and compatibility with downstream treatment.

DECIDE
Compare total chemical, equipment, energy and disposal costs at the achieved endpoint.

A PRACTICAL PATHWAY TO EVALUATE. A MEASURED BUSINESS CASE TO PROVE.

Follow the SDS and site chemical-handling controls. Spent caustic retains its own hazards regardless of the biological product used.

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Reference:
[1] Hashemi & Heidarinasab (2012). Spent Caustic Bioregeneration by using *Thiobacillus denitrificans* Bacteria. International Journal of Biotechnology and Bioengineering 6(7). 417-419. DOI: 10.5281/zenodo.1058237.

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