PeroxiMag™

MAGNESIUM PEROXIDE

OXYGENATION + ALKALINITY

A solid-phase reservoir for a sustained treatment strategy.



PRODUCT PROFILE

PeroxiMag is a magnesium-peroxide-based treatment product for oxygen-limited wastewater environments. Water contact initiates peroxide release and magnesium hydroxide formation, combining oxygen delivery with acid-neutralizing capacity.

THREE ENGINEERING FUNCTIONS

SUSTAINED OXYGENATION

Provides an oxygen reservoir. Match release rate and retained solids to biological and chemical oxygen demand.

ALKALINITY SUPPORT

Magnesium hydroxide formed during reaction can neutralize acidity and support pH buffering.

MAGNESIUM SUPPLY

Released magnesium may support nutrient-recovery and solids-management objectives when process conditions are suitable.

WHERE IT FITS

- Lift stations
- Collection systems
- Long-retention wastewater
- Lagoons
- Industrial wastewater
- Selected remediation applications

PRODUCT DATA

Active chemistry	Magnesium peroxide, MgO_2
Forms	Powder or pumpable slurry
Available oxygen	Approximately 10–11% by weight of powder
Typical pH	Approximately 11 in a 5% aqueous preparation
Typical powder bulk density	Approximately 0.8 g/cm³
Packaging shown	25-kg (55-lb) bags; 275-gallon slurry totes

Values retained from OCPE product data. Confirm test methods, current COA, product SDS and delivered-slurry solids concentration. Powder assay is not the oxygen content of an equal mass of slurry. Product pH is not a wastewater operating setpoint.

DESIGN FOR USEFUL DELIVERY

Hydraulic retention time and active-particle residence time can differ. Solids may settle or leave the treatment zone. Verify useful oxygen recovery and downstream transport before crediting extended coverage.

REFERENCE

Chang et al. (2007), A method for controlling hydrogen sulfide in water by adding solid phase oxygen. *Bioresource Technology* 98, 478-483. DOI: 10.1016/j.biortech.2005.11.031.

Published chemistry research does not independently validate every PeroxiMag field outcome.

ONE PRODUCT. COMPLEMENTARY FUNCTIONS.

Select a program for oxygen demand, alkalinity demand and process compatibility.

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SULFIDE CONTROL: THREE CONTRIBUTIONS

Oxygen delivery. Oxidation. Alkalinity support.

1 BIOLOGICAL SUPPRESSION

Released oxygen can reduce favorable conditions for sulfate-reducing bacteria (SRB) where delivery meets demand. It may also support sulfide-oxidizing organisms. Oxygen addition does not guarantee aerobic conditions throughout a sewer or permanent elimination of SRB. [1,2]

2 CHEMICAL OXIDATION

Oxygen and released peroxide can participate in dissolved-sulfide oxidation. Products may include elemental sulfur and sulfate, depending on pH, oxidant demand and reaction conditions. Verify total dissolved sulfide reduction, rather than assuming an instantaneous gas-phase treatment. [2]

3 H_2S RELEASE MANAGEMENT

Alkalinity can shift dissolved sulfide toward less volatile HS^- as pH rises. This can lower H_2S transfer to the headspace without destroying all sulfide. Measure both liquid sulfide and headspace H_2S and check downstream rebound.

A 40-PLUS-DAY LABORATORY RESULT

Chang et al. reported that a 0.4% magnesium-peroxide oxygen-release formulation inhibited H_2S formation for more than 40 days in an SRB-enriched bench-scale study. [1]

This was a specific formulation and laboratory environment, not a universal single-dose PeroxiMag sewer duration or a recommended field dose. Release and persistence depend on formulation, temperature, demand, pH and particle retention.

WHAT EXTENDED CONTROL REQUIRES

- Enough active oxygen capacity and release rate.
- Contact between active particles and the treatment zone.
- Compatible pH and downstream biological conditions.
- A redosing strategy based on measured performance.
- Solids transport and deposition checks.

MEASURE THE ENDPOINTS

- Dissolved total sulfide (mg/L as S)
- Headspace H_2S (ppmv)
- DO
- pH and alkalinity
- Flow and temperature
- Sulfate
- Residual peroxide where relevant.
- ORP is supporting information, not proof of sulfide removal.

ENGINEER THE DURATION. VERIFY THE REACH.

Sustained release is a design opportunity; useful system coverage must be demonstrated.

REFERENCES

[1] Chang et al. (2007), *Bioresource Technology* 98, 478-483. DOI: 10.1016/j.biortech.2005.11.031.
[2] Chang, Chang & Hung (2008), inhibition of sulfate-reducing bacteria under anoxic conditions. *Journal of Industrial Microbiology and Biotechnology* 35. DOI: 10.1007/s10295-008-0450-6.

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PEROXIMAG™ vs. HYDROGEN PEROXIDE

Choose the delivery profile for the process need.



COMPARISON TABLE

Parameter	PeroxiMag (magnesium peroxide)	Liquid hydrogen peroxide
Physical form	Solid powder or solids-containing slurry	Aqueous liquid
Delivery	Gradual release from hydrated particles	Immediately available reagent
Typical role	Sustained oxygenation plus alkalinity support	Rapid oxidation and short-contact treatment
Persistence	Depends on grade, demand and particle residence	Depends on dose, wastewater demand and decomposition
Alkalinity	$Mg(OH)_2$ formation adds neutralizing capacity	No intrinsic hydroxide alkalinity source
pH behavior	Depends on dose, buffering and water chemistry	Depends on concentration, stabilization and reactions
Feed design	Suspension, solids transport and mixing	Liquid metering and compatible equipment
Handling	Oxidizing material; follow product SDS	Concentration-specific oxidant hazards; follow SDS

TWO FUNCTIONS. ONE COUPLED SUPPLY.

A validated PeroxiMag program may reduce separate magnesium-hydroxide and peroxide feeds where demand ratios, kinetics and retention align. Oxygen and alkalinity delivery are coupled; independently changing demands may still require supplemental treatment.

ENGINEERING SELECTION

Use measured **oxygen** demand, contact time, alkalinity demand and solids behavior. Do not assign a universal number of days to liquid H_2O_2 or promise a fixed pH ceiling for MgO_2.

THEORETICAL CHEMISTRY — PURE MgO_2

Net reaction:

$$2\ MgO_2 + 2\ H_2O \rightarrow 2\ Mg(OH)_2 + O_2$$

Per 1 kg of pure MgO_2:

- Up to 0.284 kg O_2
- 1.036 kg $Mg(OH)_2$ formed
- 1.778 kg alkalinity as $CaCO_3$ equivalent

These are stoichiometric ceilings, not delivered-product guarantees. Formulation ingredients may add neutralizing capacity; measure actual titratable alkalinity. Available oxygen does not equal recovered dissolved oxygen.

COMPARE USEFUL OXYGEN AND MEASURED ALKALINITY.

Evaluate total treatment cost at the required endpoint, not equal gallons of products.

BASIS Reaction stoichiometry; Chang et al. (2007), DOI: 10.1016/j.biortech.2005.11.031; Chang et al. (2008), DOI: 10.1007/s10295-008-0450-6. Current product SDS governs handling.

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FROM COLLECTION TO BIOLOGICAL TREATMENT

Track the value downstream. Verify each process benefit.

COLLECTION-SYSTEM OPPORTUNITY

Sustained oxygen delivery and alkalinity can change local redox and sulfide-release conditions. Confirm performance over representative flow cycles and at downstream release points. A solid-phase product can still settle, be consumed or wash out.



FOG & BIOFILM: MEASURE THE RESPONSE

Include grease accumulation, deposits, biofilm condition and hydraulic performance in a site trial when relevant. Continuous hydroxyl-radical generation, complete grease destruction, automatic biofilm sloughing, SSO prevention and pumping-energy savings are not established default outcomes of every MgO_2 program.



ALKALINITY & NITRIFICATION

Residual alkalinity may help buffer acid generation during ammonia oxidation, provided it reaches the biological process and oxygen and biomass requirements are met. Alkalinity is acid-neutralizing capacity; inorganic carbon availability is a separate design consideration. MgO_2 does not enforce a universal 8.5-9.0 pH cap.



RELATED RESEARCH: MAGNESIUM HYDROXIDE

A one-year laboratory study by Cen et al. used $Mg(OH)_2$, not MgO_2. Relative to the control, it reported: [1]

- 58.0% ± 4.9% lower methane concentration
- 13.9% ± 1.6% improved sludge settleability
- 10.7% ± 5.3% improved digested-sludge dewaterability

These are related magnesium-hydroxide results, not PeroxiMag performance percentages. Transfer of those benefits requires compatible magnesium availability, loading, retention and treatment conditions. Dewaterability improvement is not automatically the same percentage increase in cake dry solids.

WHAT TO VERIFY DOWNSTREAM

- Ammonia, nitrite, nitrate and biological activity.
- pH, titratable alkalinity and oxygen uptake.
- Magnesium partitioning between water and solids.
- Total and soluble COD, settling and solids capture.
- Methane concentration and emission flux if greenhouse-gas benefits are claimed.

FOLLOW THE MASS BALANCE, NOT JUST THE DOSING POINT.

Residual magnesium, alkalinity and oxidant can affect different treatment stages in different ways.

REFERENCE

[1] Cen et al. (2023), Multifaceted benefits of magnesium hydroxide dosing in sewer systems: Impacts on downstream wastewater treatment processes. *Water Research* 247, 120788. DOI: 10.1016/j.watres.2023.120788.

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NUTRIENT RECOVERY & SOLIDS MANAGEMENT

Magnesium value depends on where the solids form and how they are captured.

PHOSPHORUS RECOVERY OPPORTUNITY



With sufficient magnesium, ammonium and orthophosphate, suitable pH and supersaturation can support struvite formation:

$$MgNH_4PO_4 \cdot 6H_2O$$

Precipitation becomes net phosphorus recovery only when crystals or solids are captured and removed. Confirm soluble phosphorus, total phosphorus and product yield.

CONTROLLED RECOVERY vs. UNCONTROLLED SCALE



Slow magnesium release does not automatically prevent struvite scale. Evaluate formation in pipes, pumps, digesters and dewatering equipment.

Recovery reactors use controlled mixing, pH, residence time, seeding and solids separation to direct crystal growth.

RELATED FULL-SCALE EVIDENCE



Crutchik et al. demonstrated struvite pellet crystallization using an industrial-grade $Mg(OH)_2$ product in a full-scale plant. This supports magnesium-source selection for an engineered recovery process; it is not a demonstration of upstream PeroxiMag dosing or guaranteed struvite yield. [1]

FLOCS, SETTLING & DEWATERING



Magnesium can influence sludge chemistry and particle interactions. Assess floc strength, settling, filtrate quality, cake dry solids and polymer demand at the actual sludge composition. Magnesium-hydroxide research provides a reason to evaluate these endpoints, not a guaranteed benefit from MgO_2. [2]

BUILD THE SOLIDS BUSINESS CASE



- Account for added magnesium-containing minerals and all generated solids.
- Measure dry-solids mass and wet cake tonnage separately.
- Test polymer/coagulant demand at equal solids capture.
- Confirm any change in hauling, disposal and energy cost.

A universal 25% polymer saving or a sludge-free outcome is not established for PeroxiMag.

RESOURCE QUALITY



Recovered struvite can have fertilizer value when purity and applicable product requirements are met.

Magnesium is an essential plant macronutrient, but magnesium enrichment alone does not establish biosolids quality or authorize land application. Test contaminants and intended use.

RECOVER VALUE. MANAGE SCALE. VERIFY SOLIDS COSTS.

REFERENCES

[1] Crutchik et al. (2017), *Water Science and Technology* 75, 609-618. DOI: 10.2166/wst.2016.527.
[2] Cen et al. (2023), *Water Research* 247, 120788. DOI: 10.1016/j.watres.2023.120788.

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FEED DESIGN, HANDLING & FIELD ACCEPTANCE

Turn product capacity into verified treatment performance.

1 SIZE THE USEFUL OXYGEN SUPPLY

Product mass (kg/day) = required useful oxygen (kg/day) ÷ [available-oxygen mass fraction × useful recovery fraction].

Illustrative arithmetic:
10 kg/day O_2 ÷ (0.10 × 0.50) = 200 kg/day powder.

The 10% assay and 50% recovery are assumptions, not recommended field values. Verify that release rate also meets time-varying demand. Calculate slurry volume from actual solids fraction and density.

2 DESIGN FOR SOLIDS

Provide compatible mixing and suspension, pump and valve selection, flushing and deposition management.

Check particle-size distribution and residence time. Retained active particles may support longer delivery; uncontrolled deposits can impair operation.

3 SPECIFY BEFORE PURCHASE

- Available oxygen and assay method
- titratable alkalinity
- product pH test preparation
- slurry solids and density
- particle size
- release profile
- storage life
- packaging
- current SDS and COA

Confirm product-specific labeling and reporting requirements from current documentation.

4 OXIDIZER HANDLING

Magnesium peroxide is an oxidizing material, not an inherently non-hazardous powder. Protect from contamination and incompatible or combustible materials.

Use SDS-defined storage, dust control, PPE, slurry handling and transport provisions. Do not mix concentrates. [1]

5 SEPARATE COMPATIBLE FEED PROGRAMS

Where oxygen and alkalinity demand differ, supplemental treatment may be required.

Do not assume one product universally replaces all peroxide, alkali, nitrate or iron feeds.

Verify dilute-stream compatibility and use approved separate storage and feed arrangements.

6 FIELD ACCEPTANCE SCORECARD

- Baseline and treated dissolved sulfide and gas H_2S
- DO, pH, alkalinity and residual peroxide where relevant
- Flow, temperature, retention and active-solids behavior
- Downstream ammonia, phosphorus, settling and cake solids
- Chemical, polymer, energy, maintenance and disposal costs

Set numerical acceptance criteria before the trial.
Define redosing and operating changes from measured results.

DESIGN. PILOT. VERIFY. OPTIMIZE.

Engineering literature supports evaluation; the current formulation, SDS and site conditions govern use. This bulletin is not an SDS.

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REFERENCE
[1] NOAA CAMEO Chemicals, Magnesium Peroxide, chemical 3800: oxidizer classification and compatibility information. https://cameochemicals.noaa.gov/chemical/3800

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REACTION CHEMISTRY & HYDROGEN SULFIDE CONTROL

Balanced chemical equations connect oxygen release, sulfide oxidation and alkalinity.

1 PEROXIDE RELEASE AND OXYGEN GENERATION

$$MgO_2 + 2\,H_2O \rightarrow Mg(OH)_2 + H_2O_2$$

$$2\,H_2O_2 \rightarrow 2\,H_2O + O_2$$

$$\text{Net: } 2\,MgO_2 + 2\,H_2O \rightarrow 2\,Mg(OH)_2 + O_2$$

Water contact can supply peroxide and ultimately molecular oxygen. Peroxide may react with wastewater constituents before decomposing to oxygen. The reaction sequence does not imply a fixed intermediate-peroxide concentration or complete dissolved-oxygen recovery. [1]

2 ALKALINITY AND SULFIDE SPECIATION

$$Mg(OH)_2 + 2\,H^+ \rightarrow Mg^{2+} + 2\,H_2O$$

$$H_2S \rightleftharpoons H^+ + HS^-$$

Neutralizing acidity can raise pH and favor less volatile HS^-. This helps manage H_2S release, but shifting speciation is not destruction of total dissolved sulfide.

3 REPRESENTATIVE SULFIDE-OXIDATION ENDPOINTS

$$H_2S + H_2O_2 \rightarrow S^0 + 2\,H_2O$$

$$HS^- + 4\,H_2O_2 \rightarrow SO_4^{2-} + 4\,H_2O + H^+$$

$$HS^- + 2\,O_2 \rightarrow SO_4^{2-} + H^+$$

These balanced overall reactions describe possible endpoints, not a single elementary pathway or field dose. Product distribution and reaction rate depend on pH, catalysts, biology and oxidant demand. Sulfate-producing oxidation can consume alkalinity; elemental sulfur may require solids management. [1–3]

REFERENCES [1] Chang et al. (2008), DOI: 10.1007/s10295-008-0450-6. [2] Hoffmann (1977), Environmental Science & Technology 11, 61–66. DOI: 10.1021/es60124a004. [3] USP Technologies (2015), Sulfide Oxidation Using Hydrogen Peroxide, technical bulletin. Equations shown are ideal overall chemical balances.

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A CONTROLLED BOOST FOR AN ALKALINITY PROGRAM

PeroxiMag can be evaluated to augment AlkaMilk where oxygen and oxidation are also needed.

THE MARKET NEED: ADD OXYGENATION TO ALKALINITY

An existing magnesium-hydroxide program may meet its pH or alkalinity target while residual sulfide, low DO or long-retention zones remain. PeroxiMag adds a slow-release oxygen/peroxide source and forms magnesium hydroxide. This supports a targeted augmentation option; identical settling, safety and whole-system performance are not automatic outcomes and require site validation.

COMPARISON TABLE

Treatment function	AlkaMilk: $Mg(OH)_2$	PeroxiMag: MgO_2
Acid neutralization	Primary alkalinity role	Alkalinity through reaction products
Oxygen / peroxide source	No intrinsic source	Yes; release rate must meet demand
Selection priority	Alkalinity demand and pH	Oxygen plus alkalinity demand
Process verification	pH, alkalinity and solids	Those endpoints plus oxidant/DO response

ENGINEERED AUGMENTATION: KEEP PRODUCT FEEDS SEPARATE

1. **Establish the gap.** Profile dissolved sulfide and headspace H_2S alongside DO, pH, alkalinity, flow and detention. Confirm that extra oxygen or oxidation addresses the remaining problem.
2. **Evaluate the balance.** Use bench tests and current product assays to establish useful oxygen delivery, measured alkalinity and downstream compatibility. Oxygen and alkalinity supply from MgO_2 are coupled.
3. **Keep feeds separate.** Use reviewed storage, pumps, materials and injection locations. Evaluate interaction after dilution in wastewater. **Do not add MgO_2 directly to an AlkaMilk tote or premix concentrates without a validated formulation and handling review.**

HANDLING AND BUSINESS-CASE CHECKS

A solid-phase program may avoid maintaining a bulk liquid hydrogen peroxide inventory. It does not remove oxidizer hazards: MgO_2 still requires SDS-defined contamination control, compatible materials, dust/PPE controls and suitable slurry equipment.

Confirm the achieved sulfide endpoint, redosing interval, solids transport, downstream biology, polymer demand and total operating cost. A partial feed replacement or a supplemental program may be more appropriate than a complete switch.

OXYGENATION PLUS ALKALINITY. VALIDATE THE PROGRAM.

BASIS Magnesium-peroxide mechanisms: Chang et al. (2008), DOI: 10.1007/s10295-008-0450-6.
NOAA CAMEO Chemicals, Magnesium Peroxide, chemical 3800.

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