WATCHER®
WATCH WATER
a Water Company

FILTERSORB
FILTRATION
ADSORPTION
INSTANT PRODUCTS
OXY TREATMENT
SYSTEMS

REDOXY NANO

ADVANCED NANOBUBBLE OXIDATION & BENTHIC NUTRIENT SEQUESTRATION SYSTEM

INTRODUCING

MOLECULAR ARCHITECTURE & FUNDAMENTALS

RedOxy NANO™ is an engineered multi-component catalytic solid reagent formulated for targeted aquatic remediation, rapid cyanobacterial cell lysis, and permanent benthic nutrient immobilization. The composite material incorporates an active solid perhydrate crystalline matrix (950 g/kg) co-formulated with a stabilized iron(III) mineral catalyst core (50 g/kg).

Unlike conventional copper algaecides or passive peroxides, **RedOxy NANO™** initiates a cascading advanced oxidation process (AOP) coupled with in-situ orthophosphate (PO_4^{3-}) precipitation, operating without toxic heavy metal residue or persistent chemical bioaccumulation.

COMPOSITION PER KG

ACTIVE SOLID PERHYDRATE CRYSTALLINE MATRIX Stabilized iron(III) mineral catalyst core 50 g/kg	**950 g/kg**

Engineered catalytic solid reagent for aquatic remediation, cyanobacterial lysis, oxygenation and nutrient immobilization.

>99.4% Cyanobacteria Lysis (<12 Hours)	**14.0 g/kg** PO_4^{3-} Immobilization Yield	**100%** Non-Persistent / Eco-Neutral

IAPMO R&T WATER QUALITY PLATINUM SEAL
IAPMO RESEARCH AND TESTING

PREMIUM QUALITY
MADE IN GERMANY

ADVANCED OXIDATION KINETICS & RADICAL GENERATION

Upon aquatic dispersion, **RedOxy NANO™** dissolves rapidly, releasing hydrogen peroxide (H_2O_2) and localized alkaline buffer ions into the immediate micro-environment. In the presence of the integrated iron(III) catalytic catalyst, a heterogeneous Fenton-like catalytic reaction cycle is triggered at the solid-liquid interface:

$Fe^{3+} + H_2O_2 \rightarrow Fe^{2+} + HO_2\bullet + H^+$	(Initiation Cycle)
$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + \bullet OH + OH^-$	(Hydroxyl Radical Yield)
$\bullet OH + HCO_3^- \rightarrow H_2O + CO_3\bullet^-$	(Secondary Carbonate Radical)

The generation of highly non-selective hydroxyl radicals (•OH, E^0 = +2.80 V) and selective carbonate radicals ($CO3^{\bullet-}$, E^0 = +1.59 V) induces catastrophic oxidative damage to unshielded cyanobacterial thylakoid membranes, causing cellular collapse and halt of photosynthesis within hours.

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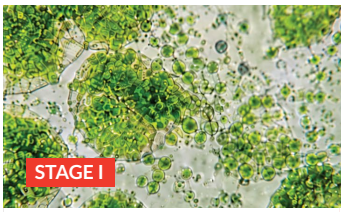
MECHANISM

FOUR-STAGE MECHANISTIC REACTION PATHWAY



RADICAL ATTACK

Fe^{3+} Fenton Kinetics
HO• Membrane Lysis
Toxin Breakdown

PO_4^{3-} LOCK

$Fe^{3+} + PO_4^{3-} \rightarrow FePO_4(s)$
Insoluble Mineral Cap
$K_{sp} = 1.3 \times 10^{-22}$

NANOBUBBLES

Nucleation of O_2 Phase
Benthic Oxygenation
Sludge Digestion

FLOTATION

Micro-Floc Coagulation
Surface DGF Separation
Effluent Clarity

BENTHIC PHOSPHATE SEQUESTRATION THERMODYNAMICS

The primary driver of recurring algal blooms is dissolved orthophosphate ($PO4^{3-}$) recycling from benthic sediments. **RedOxy NANO™** provides a permanent, irreversible solution by liberating free iron(III) cations that rapidly bind dissolved phosphorus species to form insoluble ferric phosphate ($FePO_4$):

$$Fe^{3+} + PO_4^{3-} \rightleftharpoons FePO_4(s)$$
$(K_{sp} = 1.3 \times 10^{-22}$ at 25°C)

STABLE pH WINDOW

Because the solubility product constant (Ksp) of $FePO_4$ is exceptionally low, the precipitated complex remains chemically stable across a wide pH window (5.5 to 8.2) and under continuous anoxic benthic conditions.

The dense precipitate settles into the sediment matrix, forming a permanent inorganic barrier cap that prevents the re-release of phosphorus into the photic zone.

PHOTIC ZONE	Phosphorus re-release prevented
$FePO_4$ BARRIER CAP	Permanent inorganic cap
SEDIMENT MATRIX	Benthic sediment

FOUR-STAGE MECHANISM FOR LASTING WATER RESTORATION

RedOxy NANO™ combines radical oxidation, phosphate sequestration, nanobubble oxygenation, and flotation to break down algal contaminants, immobilize phosphorus, and support long-term water quality restoration.

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OXYGENATION PHYSICS

NANOBUBBLE HYDRODYNAMICS & OXYGENATION

During the controlled catalytic decomposition of the active oxygen carrier, sub-micron oxygen gas phase bubbles (100–300 nm diameter) nucleate in-situ within the water column. Unlike macro-bubbles (>2 mm), which exhibit rapid buoyant rise velocity (>20 cm/s) and collapse at the atmosphere interface, oxygen nanobubbles exhibit distinct physical behavior:

MACRO-BUBBLE
> 2 mm • > 20 cm/s rise

NANOBUBBLE
100–300 nm diameter

WEEK

3-6 WEEKS
EXTREME RESIDENCE TIME

Brownian motion dominates buoyant force, allowing nanobubbles to remain suspended for 3–6 weeks.

> 12 mg/L DO
HIGH INTERNAL PRESSURE & MASS TRANSFER

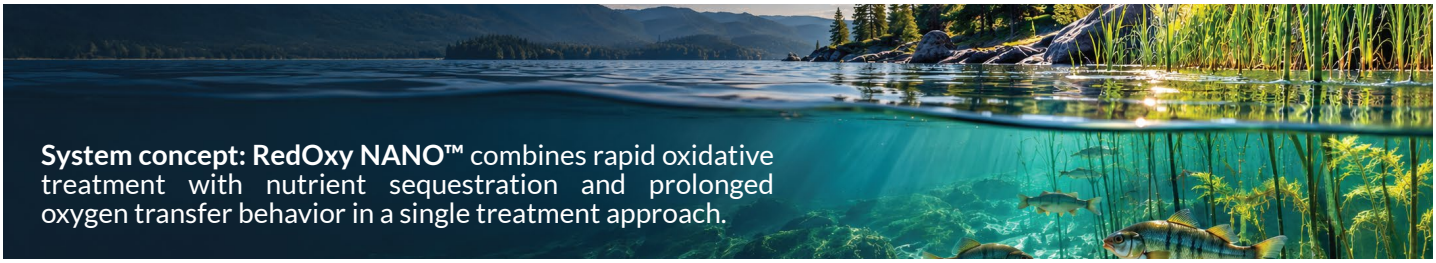
Young-Laplace internal pressure (> 3 bar) elevates liquid phase dissolved oxygen (DO) up to saturation (> 12 mg/L).

−25 to −40 mV
NEGATIVE SURFACE CHARGE

A negative zeta potential prevents coalescence and promotes electrostatic attachment to positively charged micro-flocs and suspended particulate matter.

COMPARATIVE ECOTOXICOLOGICAL & TECHNICAL PERFORMANCE

Performance Benchmark	Copper Sulfate ($CuSO_4$)	Standard Hydrogen Peroxide	RedOxy NANO™ System
Cyanobacteria Lysis Rate	Rapid (4–8 Hours)	Moderate (24–48 Hours)	**Rapid (<12 Hours)**
Orthophosphate Binding	None (0%)	None (0%)	**High (>14 g PO_4^{3-} / kg)**
Sediment Heavy Metal Accumulation	High Bio-Accumulation (Cu^{2+})	None (0%)	**Zero Heavy Metals (0%)**
Benthic Dissolved Oxygen Depletion	Severe (Causes Fish Kills)	Neutral to Slight Rise	**High Elevation (Nanobubbles)**
Water Clarity Improvement	Poor (Secondary Debris)	Moderate	**Excellent (In-Situ DGF)**
Long-Term Bloom Prevention	Poor (Triggers Resurgence)	Poor (No Nutrient Removal)	**Superior (Nutrient Locking)**



System concept: RedOxy NANO™ combines rapid oxidative treatment with nutrient sequestration and prolonged oxygen transfer behavior in a single treatment approach.

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ANALYTICAL PHYSICAL & CHEMICAL SPECIFICATIONS

ANALYTICAL PARAMETER	SPECIFIED VALUE / RANGE	STANDARD TEST METHOD
Physical Form	Free-flowing micro-granular solid with reddish tracer	Visual / Gravimetric
Active Oxygen Content (AvO)	≥ 13.0% w/w Equivalent Active Oxygen	ISO 3123 / $KMnO_4$ Titration
Iron(III) Catalyst Concentration	14.0 g/kg (as elemental Fe^{3+})	ICP-OES Spectroscopy
Bulk Density	0.98 – 1.08 g/cm³	ASTM D1895
pH (10 g/L Aqueous Solution)	10.3 – 10.7 at 20°C	Standard Glass Electrode
Mean Granule Particle Size	0.2 – 1.2 mm	Laser Diffraction (ISO 13320)
Thermal Stability (SADT)	> 55°C (Self-Accelerating Decomposition Temp)	UN Test H.4

DOSING & STOICHIOMETRIC MATRIX

Water Classification	Algae Density / Turbidity	RedOxy NANO™ Dosage	Phosphate Removal Yield
Maintenance / Oligotrophic	Low turbidity (Secchi >1.2 m)	2.5 – 5.0 g/m³ (2.5 – 5.0 ppm)	0.035 – 0.070 mg/L PO_4^{3-}
Moderate Eutrophic Bloom	Planktonic green water (Secchi 0.5–1.0 m)	5.0 – 10.0 g/m³ (5.0 – 10.0 ppm)	0.070 – 0.140 mg/L PO_4^{3-}
Severe Hyper-Eutrophic Bloom	Thick cyanobacteria surface scum	10.0 – 20.0 g/m³ (10.0 – 20.0 ppm)	0.140 – 0.280 mg/L PO_4^{3-}
Acid Wastewater / Industrial	High COD, low pH (<5.0)	20.0 – 50.0 g/m³ + Buffer	Requires Bench Jar Test

Mandatory Alkaline Carbonate Buffer Protocol: For aquatic systems with Total Alkalinity <50 mg/L as $CaCO_3$ or initial pH <6.5, co-dose **RedOxy NANO™** with RedOxy Carbonate Buffer. Maintaining system pH above 6.8 is mandatory to achieve complete ferric phosphate ($FePO_4$) precipitation and optimize the zeta potential of the generated nanobubble phase.

Standard Packaging

Packaging	Weight of product	Quantity/ pallet	Gross Wt./ pallet
Drum	60 kg	18	1163 kg

** Other packaging can be considered on request*

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