BIO-ORGANIC CATALYST

THE POWER IN NATURE®

Bio-Organic Catalysts Improve Treatment Of Water And Waste While Saving Time and Money

Short Case Studies Followed By
A Technology Overview

www.bio-organic.com

Summary

Bio-Organic Catalyst, Inc., headquartered in California, has developed a breakthrough water treatment, currently being used in over ten countries, which helps solve major environmental problems in waste/water (nitrogen, organic pollution, H2S, odors), agriculture (water demand, soil health, crop yields) and industry (effluent, emissions, fouling) in a simple and profitable way.

Our Bio-Organic Catalysts ("BOCs") are highly concentrated liquid biocatalytic agents that immediately increase oxygen transfer rates in water, increase dissolved oxygen levels, and dissolve the build-up of FOGs.

This triggers beneficial effects wherever water is present, so there are surprisingly many useful applications, including pulp & paper, cooling towers, agriculture, anaerobic digestion, aquaculture, fire control, hydrocarbon remediation, commercial cleaning and many others.

BOCs are made from plant and mineral extracts, yeast fermentation by-products and a non-ionic surfactant.

BOCs are easy to use (just add to water), cost-effective (just 1 - 4 parts per million), increase operating profits (important for rapid large-scale adoption) and are completely safe and green.

Case Study: Eliminating Fouling In Cooling Towers

Nijhuis Industries (https://www.nijhuisindustries.com/) is a 115-year-old Dutch engineering firm, with a global presence, specializing in sustainable water use, energy and resource recovery.

Nijhuis has performed many cooling tower installations. These suffer from fouling, which is treated with toxic chemicals and manual interventions. This is costly, time-consuming and can lead to environmental compliance issues.

Nijhuis is now offering BOC to their cooling tower customers. Simply adding 2ppm of BOC to the cooling tower water reduces cooling tower fouling 90%+ while reducing costs, maintenance, water consumption and pollution.

In a case study at a UK food factory cooling tower, BOC reduced organic solids/sludge by 95%, reduced water consumption 40%, and reduced offline maintenance time by 50%. Here's a link: https://bio-organic.com/wp- content/uploads/2019/11/boc-case-studies-cooling-towers-2019-Aquatech- industrial.pdf

Nijhuis is now expanding BOC use to other areas such as WWTPs, food processing & dairy waste, anaerobic digesters, etc.

Case Study: Improving Operations In Paper Mills

We are working with a major South American forestry, pulp and paper company with operations from Chile to Mexico (name available under NDA).

Paper manufacturing suffers from acute buildup on surfaces of slime layers which clog up machines and degrades performance throughout the manufacturing cycle. This is generally treated with biocides, other toxic chemicals and manual interventions. This is costly, time-consuming and can lead to environmental compliance issues.

The company is now adopting BOC to reduce or completely replace biocides. They find the following benefits:

- Accelerate the disintegration of pulp from 45 minutes to approx. 7-12 minutes.
- Improve paper quality and eliminate holes & stickies in production.
- Lower energy costs 25%.
- Improve effluent quality and reduce pollution.
- Clean and maintain the machinery itself in the process.
- Completely green, safe for operators, no protective gear needed.

Here's a short testimonial: https://www.youtube.com/watch?v=cUNSTAOYcwY

Case Study: Keeping Irrigation Lines Clear At Foley Wines

Foley Wines (https://www.foleywines.com/) is a premium winery in Santa Barbara County, owned by finance billionaire Bill Foley.

Foley Wines uses drip irrigation. These systems suffer from blockages by scale and slime. This is normally treated by flushing with bleaches and/or acids. However, this is expensive, polluting, corrodes equipment, damages and acidifies the soil, creates runoff pollution and puts workers at risk. Worst of all, it doesn't actually work very well, so they must still do manual cleaning.

For two years, Foley Wines has been using BOCs to keep their irrigation lines free of slime and scale. In this time, they have had literally zero problems with scale, slime or blockages.

This saves them time and money. Moreover, the vines show much improved growth and health.

Here's a 2-minute testimonial from the Foley Wines farm manager:
https://www.youtube.com/watch?v=vzyV8zOPXpE&feature=youtu.be

Here's a testimonial on using BOC compared with hydrogen peroxide with irrigation water heavy in iron: https://www.youtube.com/watch?v=birDTZd06A4

Case Study: Reducing Water Consumption In Agriculture

We completed a two-year study at University of California, Davis to examine the impact of Phyto-C_3™ on viticulture and, by extension, on agriculture in general. The study was led by Dr. S. Kaan Kurtural, Associate Specialist in Cooperative Extension in Viticulture. Dr. Kurtural is a well-known viticulture expert with over 70 published papers. He specializes in improving production efficiency in vineyards and improving berry composition.

Key findings:

- Decreased water consumption up to 50%, while improving grape yields 50% - 90%.
- Increased berry flavonols, anthocyanins and other quality parameters.
- Increased photosynthesis, stem water potential and water use efficiency.
- Improved the transport of sugars from source to sink organs in grapevines, resulting in healthier plants, higher yields and greater resilience to heat and water stress.
- Increased root mass by 36%, leaves by 107%, trunk by 22%, shoots by 100% and shoot to root ratio by 35% over two years.
- Kept drip irrigation system free of scale/slime, saving time and labor.
- Replaced phosphoric / sulfuric acid, thus reducing corrosion and soil acidity.
- Link: https://bio-organic.com/wp-content/uploads/2020/12/PhytoCat2020Report.pdf

Case Study: Increasing Yields 100% In Habanero Chili Peppers

In 2019, working with the Mexican state of Quintana Roo, agronomist Dr. Eliseo Sanchez conducted a study to determine the effects of Phyto-C_3™ on greenhouse habanero chilis.

Phyto-C_3™ was tested at concentrations of 2ppm and 4ppm against a control.

Key findings:

- Kept greenhouse completely free of slime/scale. No acid flush needed.
- At 2ppm, increased yields 100%. At 4ppm, increased yields 140%.
- Applied as a foliar spray at 1:1000, Phyto-C_3™ was more effective than a leading industrial pesticide at controlling white fly and mites, while being much easier to work with, since it is non-toxic. The combination of Phyto-C_3™ with the industrial pesticide provided 100% protection against white fly and mites.
- Here's a link to the original report, translated into English and certified by the Quintana Roo state government: https://bio-organic.com/wp-content/uploads/2019/11/case_study_boc_habaneros-1.pdf

Case Study: Improve Processing Of Dairy Products Waste

Dairy Farmers Of America (https://www.dfamilk.com/) is a group of 13,000 US dairy farms. They make large quantities of dairy products such as cheese. This creates waste streams which must be processed in WWTPs.

Dairy Farmers Of America are increasingly using BOC to assist in treatment of this waste.

They find the following benefits:
•Lowers energy costs.
•Reduces odors.
•Reduces sludge.
•Improves effluent quality.
•Completely green, safe for operators, no protective gear needed.

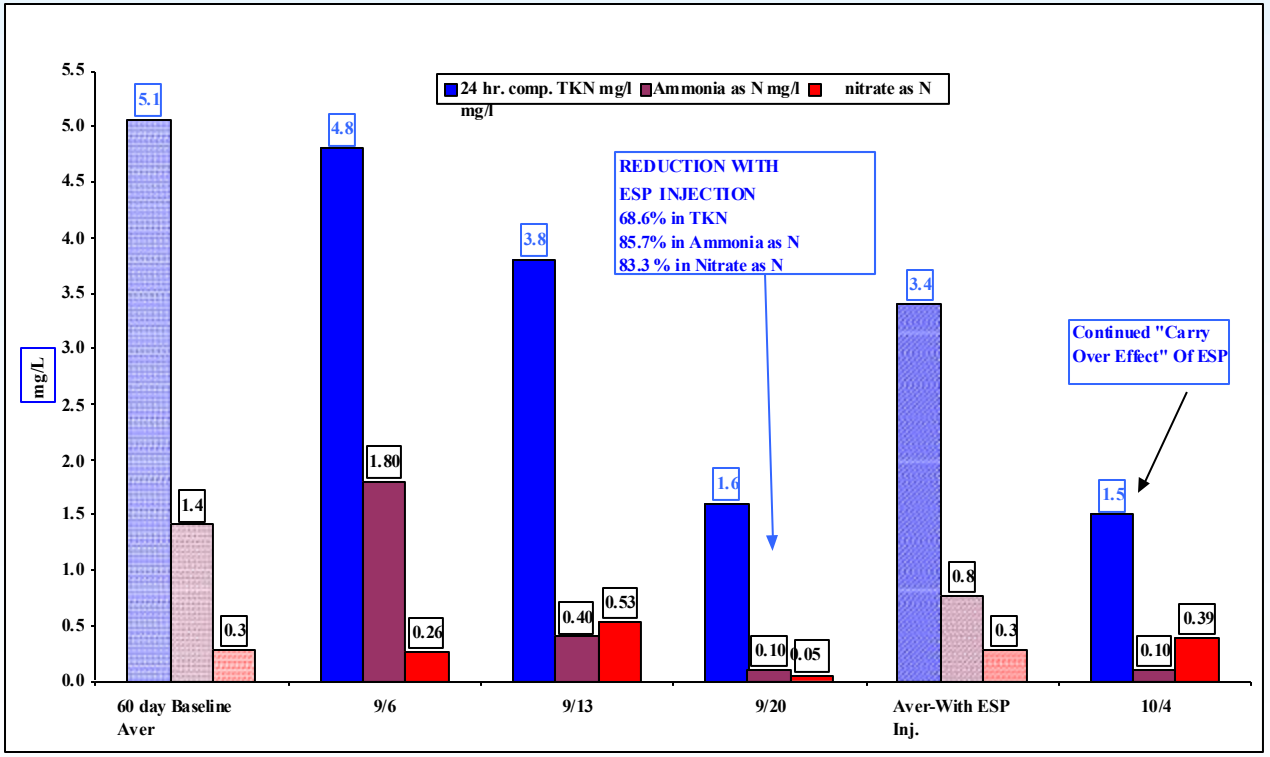
Case Study: Major Reduction In Final Discharge Levels Of Tkn, Nh_3-n & Nitrates In Secondary Aeration Lagoons

Reductions In Final Discharge Levels:

68.6% in TKN mg/l

85.7% in Ammonia as NH-3 mg/l

83.3 % in Nitrate as N mg/l



Case Study: Major H_2s Reduction In 5 Miles Of San Francisco Sewers

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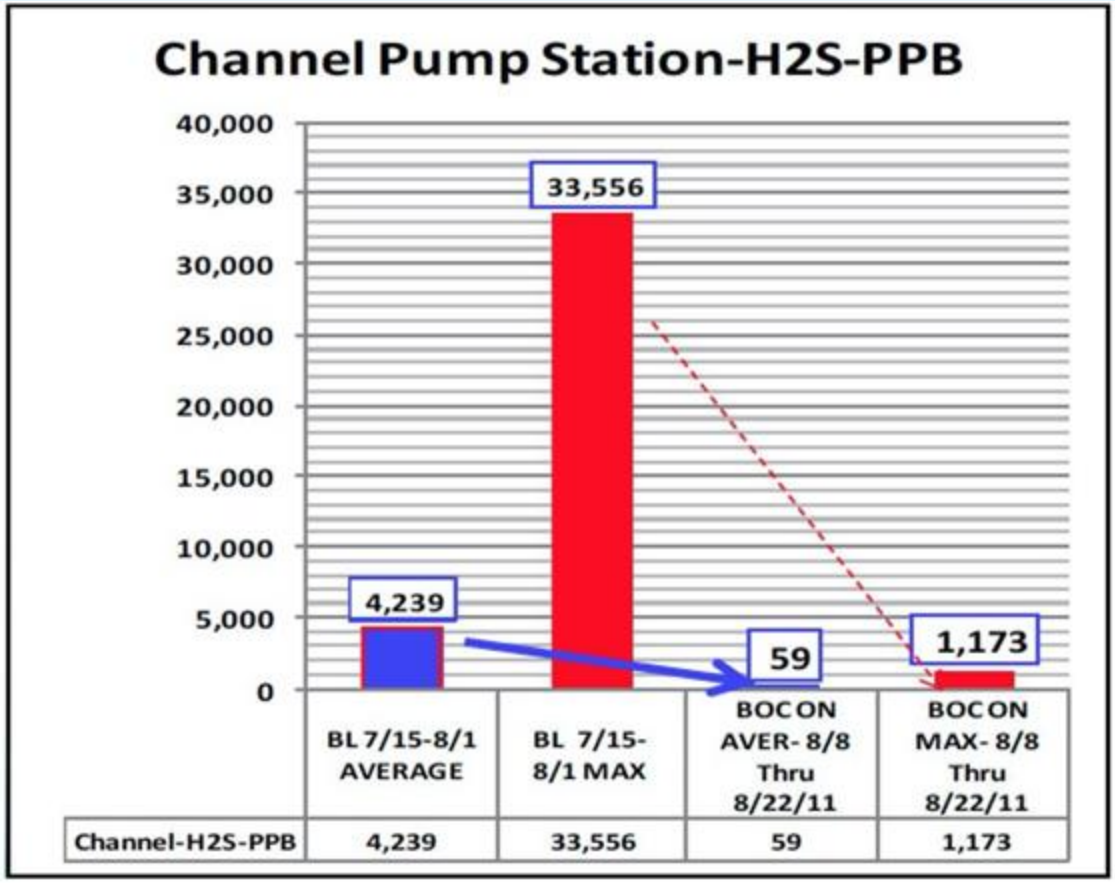


Case Study: Successfully Solving Persistent H_2s Odor Problem At Gillette Stadium / Retail Complex

Situation:

- SBR Membrane System operated by NSU-Applied Water.
- Used Bioxide and VX-456 to control odors.
- Community complaints of odors.

Treatment:

- EcoSystem Plus injected with aeration into two wet wells.

Results:

- H_2S odors completely eliminated.
- Community satisfied.
- Reduced H_2S treatment cost ~ 50 to 60%.
- Reduced FOG removal & hauling cost.

Case Study: 85% H_2S Reduction In Kiewit Construction Sewer Relining Project, Fountain Valley, CA

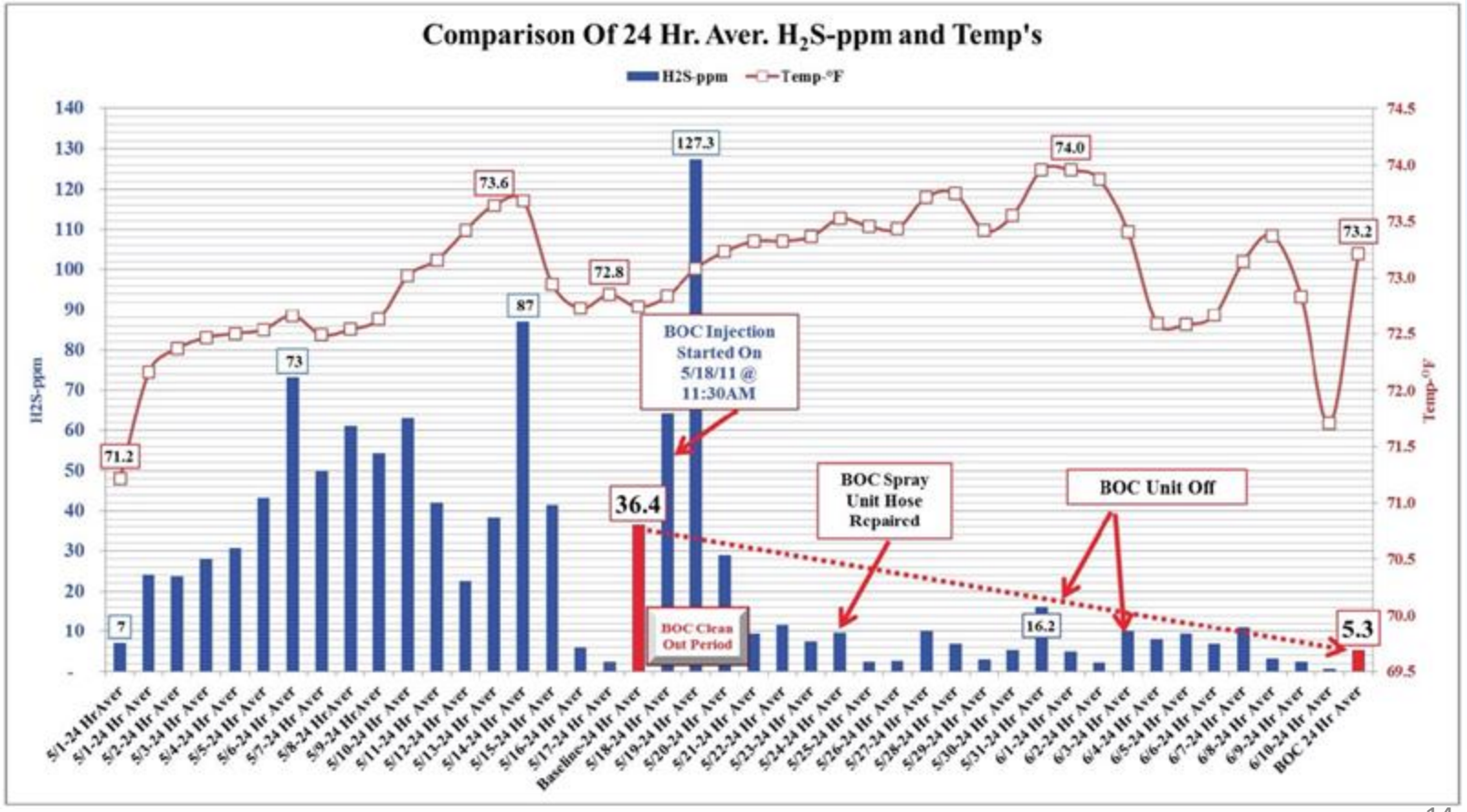
Problem:
High levels of H_2S in the sewer.

Treatment:
BOC was injected 1.5 miles upstream from the reline pit, using three very fine atomizer spray nozzles.

Case Study: 85% H_2S Reduction In Kiewit Construction Sewer Relining Project, Fountain Valley, CA

Outcome:

H_2S Reduced 85%



Case Study: Completely Dissolving A 95-Foot Fatberg In 11 Days At MWRA Deer Island, Boston

Breakdown and Solubilization of FOGs in MWRA, Secondary Clarifier Influent Channel

Before Treatment:
FOG mass was dense and hard, filled with embedded plastics.
95 Feet Long, 6 Feet Wide,
5 Feet Deep

After 11 Days:
FOGs eliminated
FOGs cannot reform
Floating plastics separated

Technology Summary

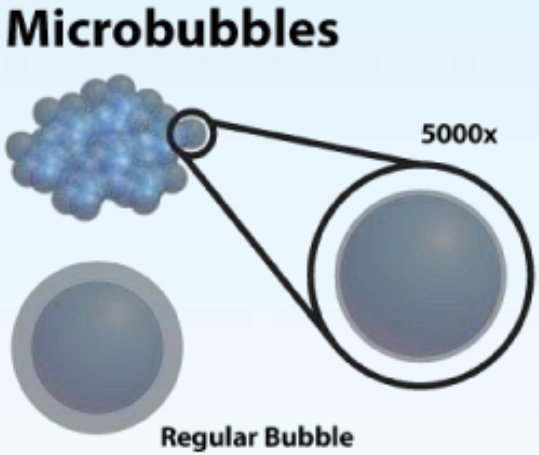
BOCs are highly concentrated liquid biocatalytic agents made from plant and mineral extracts, yeast fermentation by-products and a non-ionic surfactant. BOCs greatly increase the rate of gas transfer across membrane barriers or between a gas and a liquid. Rates of gas transfer are intimately tied to cellular respiration and are a critical factor in the vitality of all aerobic and anaerobic biological processes.

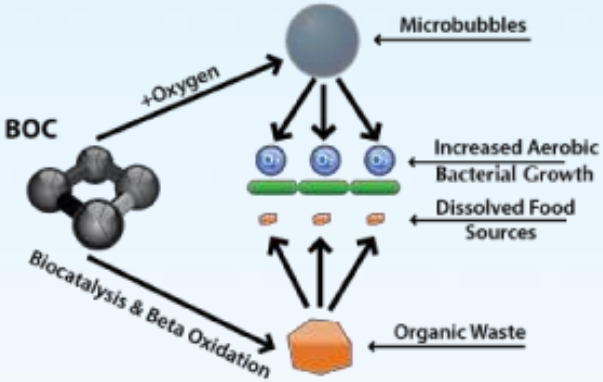
BOCs increase dissolved oxygen by creating ultra-fine micro-bubbles with loose, porous shells that enable very rapid transfer of air into the water column.

BOCs break it down by breaking organic pollutants into more digestible components for microorganisms to consume as a food source.

BOCs contain no bacteria and are completely nontoxic and biodegradable. Here's a link to the Safety Data Sheets: https://bio-organic.com/safety-data-sheets/

The Technology: Bio-Catalysis Of Organic Waste Elements



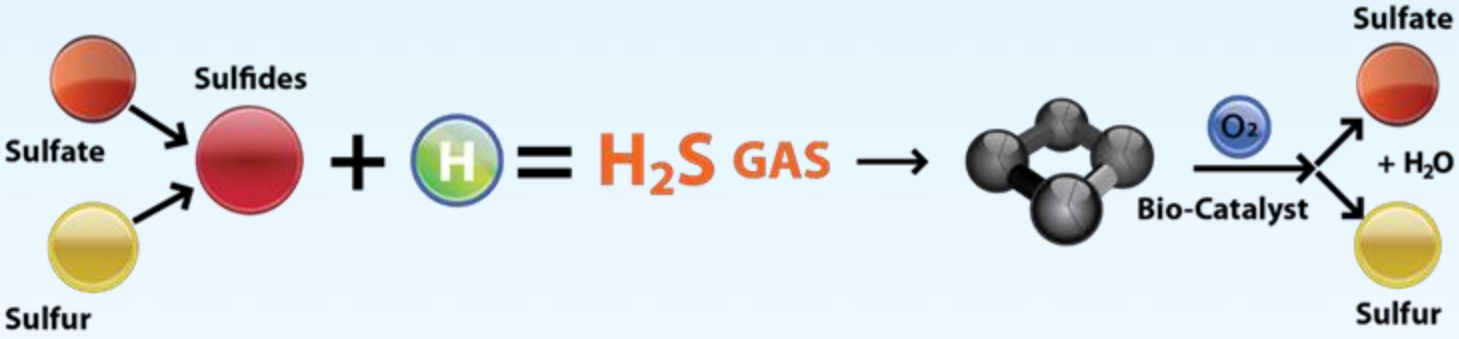


BOCs form micro-bubbles within the water. Unlike normal bubbles, which have shells that are “hard” and very difficult for gas to penetrate, BOC micro-bubbles have loose “porous” shells. This allows for very rapid oxygen transfer into the water, thereby increasing the dissolved oxygen (DO).

The micro/nano-bubbles attach to long molecular chains and break the ester bonds. This breaks down the long molecular chains into smaller pieces, which are now small enough for the local microbiology to consume.

BOCs enhance microbiological reactions.

The Technology: Bio-Catalytic Oxidation



Works through an immediate and rapid oxygen transfer into the water column.

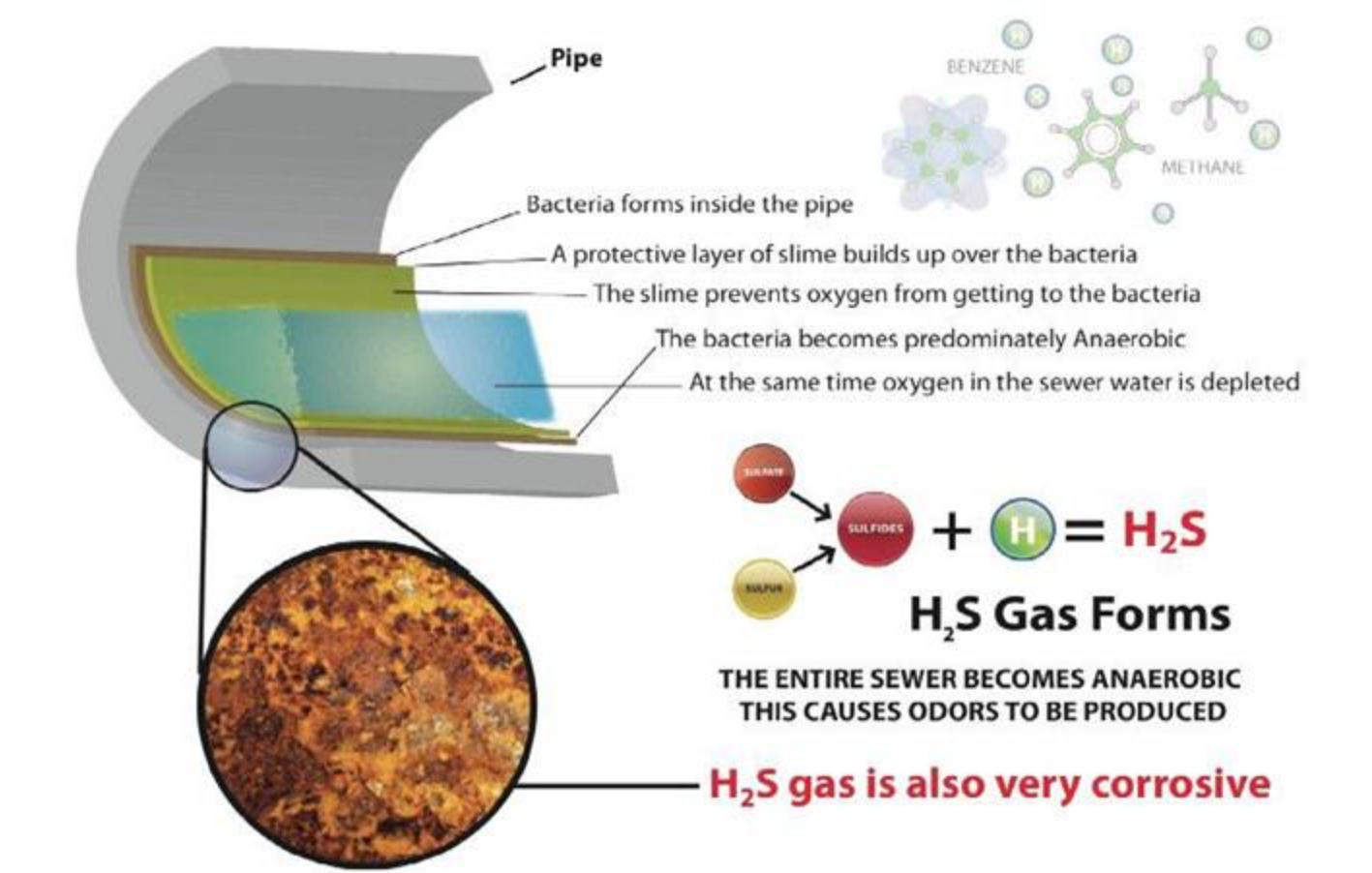
Oxidizes noxious gases on contact.

Drives greater aerobic biological reactions in solid wastes and wastewater.

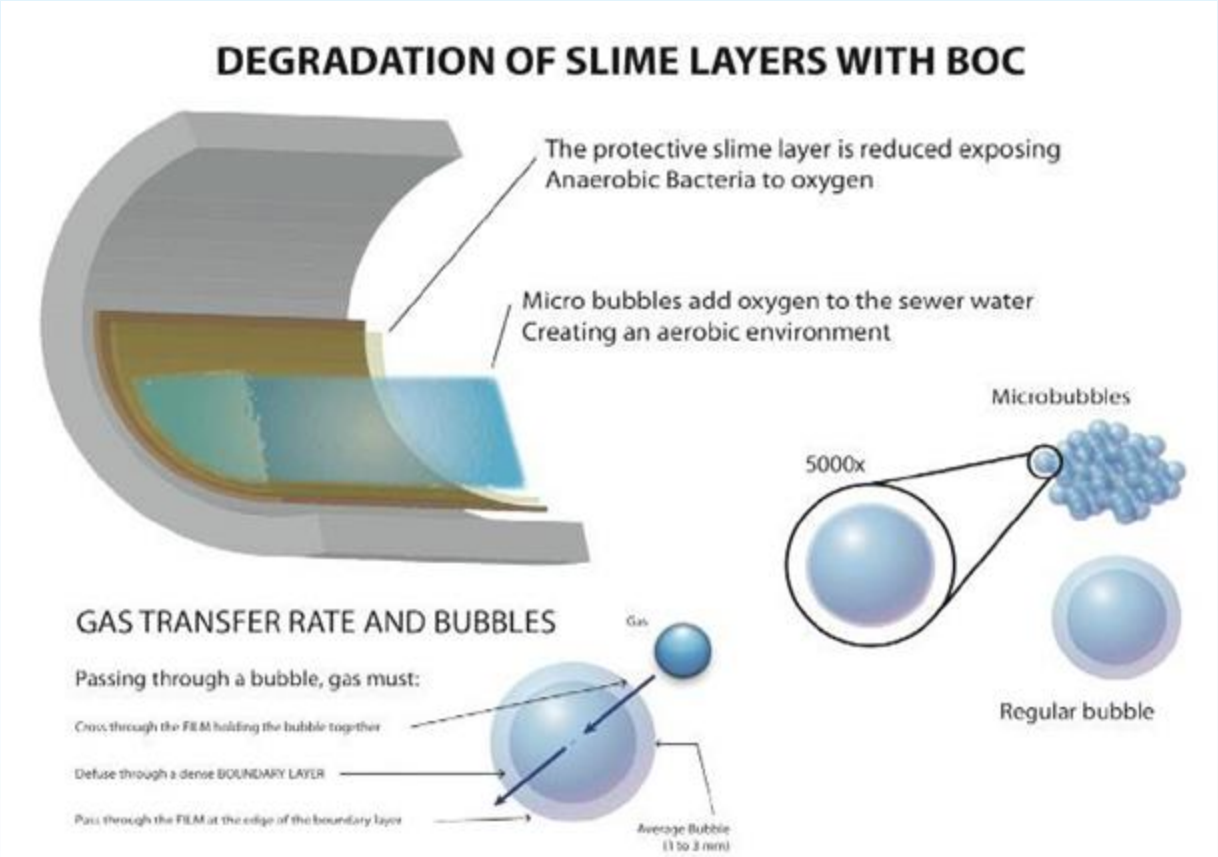
Facilitates a more rapid conversion of waste compounds (beta-oxidation).

Clarifies the entire water column of dissolved organic solids.

How H_2S Forms In Sewer Lines



How BOC Functions In Sewer Lines



With continuous use of BOC the pipe is cleaned and flow is increased, eliminating the possibility of odor blooms at the same time preventing corrosion

Key Benefits In Waste Treatment

- Solubilizes organic wastes to optimize wastewater/sewage treatment.
- Enhances nitrification and organic discharges (BOD/COD/TSS).
- Neutralizes odors from volatile organics (VOCs).
- Improves oxygen transfer and increases DO.
- Improves the efficiency of biological reductions for improved discharges.
- Increases total treatment plant capacity and load balancing.
- Activates the biomass for more rapid wastewater treatment.
- Reduces volatiles in solids dewatering.
- Acts to shift the biomass to more efficient aerobic conditions.

BOCs vs. Calcium Nitrate (Bioxide)

Many WWTPs use Calcium Nitrate (Bioxide) to control odors.
This leads to the following problems:

- Increases nitrogen load on the wastewater treatment facilities (WWTF).
- Increases electricity use for aeration by up to 50%.
- Costly and doesn't address FOGs.

BOCs offer a more biologically advanced alternative:

- Shifts microbiological conditions to more aerobic, providing odor control.
- Lowers organic loadings on the WWTF.
- Breaks up FOGs, and removes slime buildup in sewer lines, a major source of sulfides and corrosion.

Using BOCs To Pre-Treat Sewage In Collection Systems

Adding BOCs to sewers and collection systems can potentially convert collections systems into pre-treatment extensions of the influent waste stream.

BOCs can be added by injection at lift stations, or manholes. Key benefits:

- Reduce hydrogen sulfide gas levels (H_2S).
- Break up FOGs.
- Perform nitrification of ammonia nitrogen, and denitrification, within the sewage lines, prior to entering the WWTF.
- Reduce corrosion of critical infrastructure.
- Lowers load on the WWTF, and significantly reduce energy consumption.

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