

Reclaim Water Management Case Study

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**ARCADIAN CHEMISTRY
SOLUTIONS**
SHINE BRIGHTER, SPEND SMARTER



Executive Summary

Reclaim Defender biological water purification technology represents a breakthrough in car wash reclaim water processing. Offering a safe all natural, sustainable solution to clean and purify recovered wash water. Saving resources, lowering operating cost and providing a safer environment for employees and customers alike.

Project

Until recently, most reclaim water management systems primarily focused on removing suspended solids, offering little in terms of genuine water

purification. This has led to widespread unhealthy working conditions in the industry. Which has recently been the focus of concern of operators and OSHA as workplace injuries rise.

Scope

Through the use of microbiology, reclaim water is safely restored from black smelly septic water to clear, odor free, chemical free water. This process leads to sustainable cost effective approach to healthier / cleaner reusable wash water.

Reclaim Defender

Water Purification Technology

Benefits:

- Removes all Malodor Naturally
- Does Not Require Capital Investment
- Restore Septic Water to "Living Water"
- Lowers Operating Costs
- Lowers Labor Costs
 - Fewer Equipment Breakdowns
 - Cleaner Car Wash Bay Operations

TURN THIS

Quality of Reclaim Water
from Standard Reclaim
Water Processor

INTO THIS

Reclaim Water
Separator Tank Water
treated by Anaerobic
and Aerobic Bacteria
for Improved Turbidity

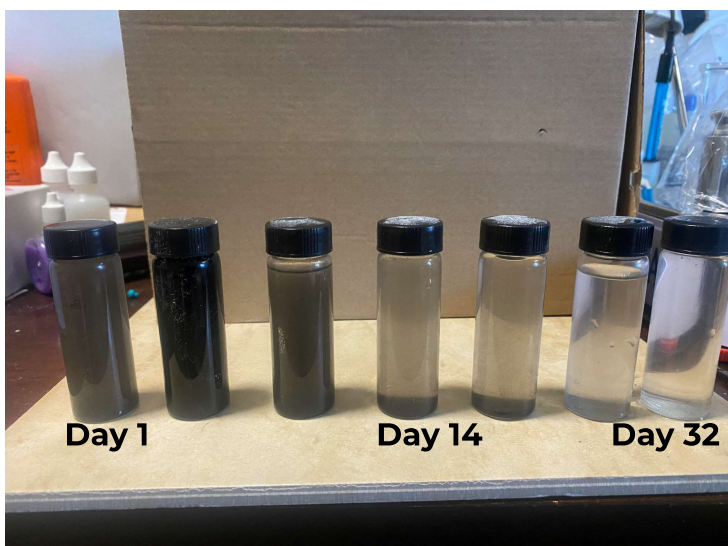
Arcadian's Reclaim Defender treatment process restores recovered wash water to 'Living Water' by eliminating harmful bacteria, car wash chemicals, and organic compounds. Our all-natural process enhances water clarity, reduces TSS, COD, and BOD levels,. Restoring the natural balance of the water.

Objectives

Reclaim Defender offers an environmentally friendly, cost effective solution for treating recovered wash water, enhancing the water treatment process by pretreating it before reclaim filtration. Addressing the water organically before it is passed through mechanical filtration. Reclaim Defender consumes organic material, wash chemicals and pollutants like oils, pollen, and grease.

This pretreatment application uses beneficial bacteria to safely consume organic materials which forms the black sludge that accumulates in separator pits. Using gram-positive and gram-negative bacteria, the reclaim separator tank sludge is consumed and recovered wash water is cleared of all organic compounds, resulting in clear odor free reclaim water. Providing significant

savings to the operator. Additionally, by removing the sludge where non oxygen breathing bacteria grow. We stop the production of hydrogen sulfide (H_2S) gas from forming. Eliminating one of the biggest concerns from customers who must endure the harsh and some times dangerous toxic odor. The result is clear, odor-free re-usable wash water that improves wash quality and reduces the environmental impact of the car wash operations.



THREE PRODUCTS ONE SOLUTION



Bio-SulfurShield

Biologically inhibits the production of H_2S Gas and controls foam. Scientifically engineered to balance the wash water pH and remove chlorine. Using no harsh chemistry.



Bio-Vorax

Biologically clarifies reclaim water, significantly improving COD, BOD while lowering TSS and TDS in the wash water. Transforming recovered wash water from septic to clear

LIVING WATER



Bio-SludgeBane

Is the powerhouse of the defender family. using gram positive bacteria to devour black sludge in reclaim separator tanks, preventing the formation of H_2S gas. Reducing separator tank cleanouts and cost.

Two Step Process



Step One : Inoculation

Reclaim Defender - Bio-Vorax

Biologically clarifies reclaim water, significantly reducing COD and BOD levels. With improved dissolved oxygen levels. H₂S gas is metabolically blocked from being produced as **Bio-SludgeBane** begins to consume solids at the bottom of the separator tank.

Reclaim Defender - Bio-SludgeBane

Anaerobic bacteria consumes organic compounds and car wash chemistry. Provides reduced TDS, consumes organic materials and greatly improving water clarity..



Step Two: Sustainability

Arcadian's Biologics are automatically dosed into recovered wash water in small amounts, using controlled delivery system to treat changes in the water's chemistry as they happen, preventing malodors before they can permeate the car wash.

Guardian 1000 – Controls TSS of reclaim water and sludge production. Ensuring water quality remains within defined limits. Continuously dosing small amounts of biologics as required to control changes that occur during the wash process.

KEY FEATURES

AUTOMATED DOSING

EFFORTLY MANAGE DOSING FOR 2 PRODUCTS, "**SET-IT-AND-FORGET**" MODE.

INVENTORY CONTROL

INCLUDES TWO SONAR EQUIPED INVENTORY TANKS, NEVER RUN OUT OF PRODUCT.

SYSTEM ALERTS

STAY INFORMED ON CONFIGURABLE REPORTS BY SMS TEXTS MESAGES.

REPORTING CAPABILITIES

IGENERATE AND RECIEVE DETAILED REPORTS (DAILY, WEEKLY MONTHLY).



Overview of Reclaim Systems

Challenges of Current Systems

Most reclaim systems fail to eliminate dissolved chemical residues and organic matter, resulting in poor water quality. This can cause customer dissatisfaction when reclaimed water is used in the wash process.

Traditional Reclaim Systems

In the car wash industry, traditional reclaim systems use cyclonic separation to filter out solids larger than 200 microns and rely on sterilization to control odors and improve water clarity. However, these systems have limitations. They don't effectively remove dissolved solids held in the water by car wash chemicals or address low oxygen levels, which often fall between 0.27 mg/L and 1.80 mg/L. Water with less than 1 mg/L of oxygen is considered septic. Using such water can cause anaerobic conditions, leading to unpleasant odors, reapplication of oils and soaps on vehicles, resulting in reduced wash quality.

Arcadian's Approach to Reclaim Water Management

Arcadian tackles these challenges by pretreating the recovered wash water in separator tanks. Biological digestion processes break down organic sludge, surfactants, and other contaminants. By adding small amounts of biological additives, organic materials such as oils, fats, and sludge are effectively consumed. This process digests surfactants, waxes, and harmful oils, reducing Total Suspended Solids (TSS) and improving the Biochemical Oxygen Demand (BOD)—two critical measurements for water quality.

Arcadian's approach minimizes the need for ozone treatments, restoring the reclaimed water to a state called "Living Water." Aeration or blending of Reverse Osmosis (RO) concentrate water into the biologically processed water, increases dissolved oxygen levels, though this does little to remove residual solids trapped in the recovered wash water.

Nanobubble Technology

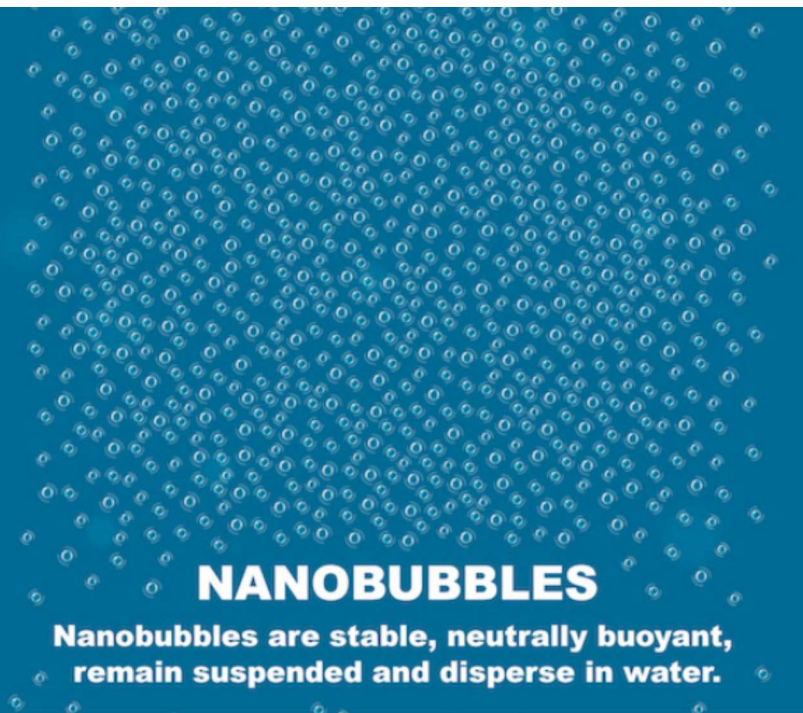
Nanobubble technology, a recent innovation in the car wash industry, addresses these shortcomings. These ultra-fine, high-energy bubbles are effective at removing saturated solids and significantly increasing dissolved oxygen levels. Already used in wastewater treatment, nanobubbles provide an environmentally friendly, chemical-free solution. When combined with biological treatments, this technology allows operators to reduce their reliance on municipal water, lowering operational costs. This sustainable method improves water quality, making reclaimed water more useful throughout the car wash process.

Nanobubbles & Dissolved Oxygen (DO)



LARGER BUBBLES

Larger bubbles rise to the surface and burst.



NANOBUBBLES

Nanobubbles are stable, neutrally buoyant, remain suspended and disperse in water.

Aeration Practices

Oxygen levels in recovered wash water are often critically low, below 0.65 mg/L. Air micro-diffusers used to improve dissolved oxygen (DO) in separator tanks have shown little benefit in untreated reclaim water.

However, when applied to biologically treated water, aeration raises DO levels from 0.65 mg/L to 3.43 mg/L on average. Adding a small amount of RO reject water via a Bio-Tank further increases DO levels to 4.71 mg/L, significantly improving water turbidity and BOD. Preventing septic water in use of car wash operations.

Despite these gains, saturated solids continue to impact water quality, with turbidity at 28 NTU

Ultra Fine Bubbles

Ultra-fine bubbles, or nanobubbles, behave differently from larger bubbles due to their stability, surface charge, neutral buoyancy, and high saturation levels, all attributed to their sub-100 nanometer size.

These unique properties enable nanobubbles to enhance various biological, physical, and chemical reactions. Unlike conventional aeration, which achieves less than 3% oxygen transfer efficiency in clean water, nanobubbles can elevate dissolved oxygen levels to over 10 mg/L in biologically treated reclaim water.

Due to their size and neutral buoyancy water dispersion enables saturated solids to separate from the water, lowering TSS levels.

NanoBubble Behaviors

Nanobubble behaviors are controlled by the size of the bubble, the number of nanometer sized bubbles and thier surface charge.

Nano-Size

- Exhibits random Brownian motion
- Net zero directional movement creates:
 - **Neutral buoyancy**
 - **Long life / stability**
- Nano size has extreme surface curvature which creates:
 - **Extremely high bubble pressure** as per Young-Laplace equation ~ 400psi which accounts for:
 - **"Hard sphere"** behavior scouring effect
- Small size leads to very high surface area which enhances **gas transfer efficiency**

Concentration

- Amplifies the functional properties related to size and charge
- Negatively impacts stability

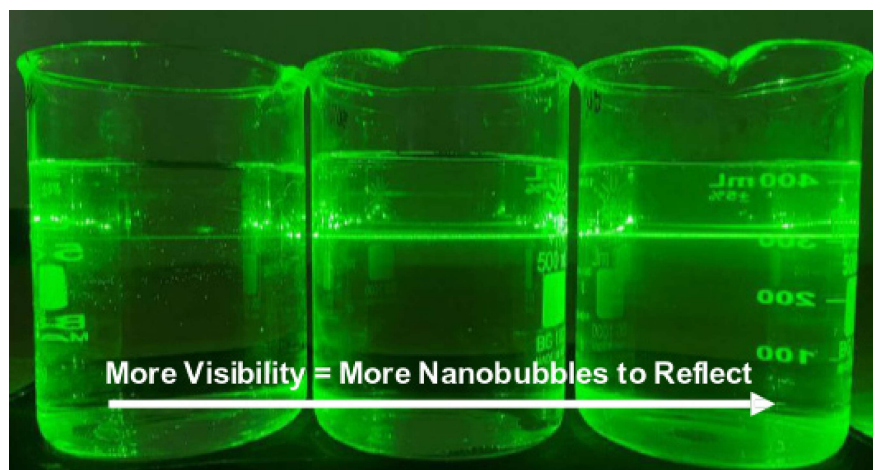
All properties of nanobubbles derive from 3 basic characteristics: size, concentration, and charge. Bubble characteristics are highly dependent on water quality and method of production

Charged Surface

- Charge repulsion leads to **high stability** of bubbles against coalescence and dissipation
- Charged surface can attract suspended particles leading to **flocculation** property
- Molecules and ions can adsorb onto the bubble surface leading to **cleaning, remediation, dispersion** effects
- Electric double layer of charged surface also creates a **hydrophobic** property
- Hydrophobic property attracts molecules and particles leading to **flocculation, settling, flotation cleaning & dispersion** effects
- Surface charge can interact with and alter conduction & transport pathways in **electrochemical** processes
- Surface charge creates a local gradient of ions and reactive species which is manifested in **surface/interfacial tension** property and **oxidation/degradation** effects

The **green laser** beam test is a way to visualize the presence of nanobubbles even though they are not visable to the naked eye Visibility of the laser beam through the nanobubble water is due to the laser beam reflecting off the nanobubbles.

At lower concentrations of NBs, the laser is less visable becouse there are fewer nanobubbles to reflect the laser beam.



Deionized Water

300 million NBs/mL
of Deionized Water

600 million NBs/mL
of Deionized Water

Biological NanoBubble Reactor

Nanobubble technology, known for enhancing biological, physical, and chemical processes, is quickly becoming an essential tool in car wash reclaim systems. When introduced through a simple mixing tank, nanobubbles begin the vital process of separating solids from reclaimed water while delivering the oxygen needed to support biological agents that consume unwanted organic materials.

ENHANCED OXYGEN TRANSFER: Nanobubbles boost oxygen saturation, promoting aerobic bacterial growth and activity, which accelerates digestion of organic compounds in water.

IMPROVED WATER QUALITY: By optimizing bacterial performance, nanobubbles help reduce organic matter, oils, and greases, improving the clarity and overall quality of the reclaimed water.

REDUCTION OF ODOR ISSUES: With higher oxygen levels, nanobubbles help prevent the formation of anaerobic zones where foul odors typically originate due to low-oxygen environments.

INCREASED SYSTEM EFFICIENCY: Nanobubbles enhance the contact time and surface area for chemical reactions, enabling faster and more thorough cleaning of reclaim water.

POTENTIAL FOR CHEMICAL REDUCTION: Nanobubbles improve chemical dispersion, allowing wash chemicals to work more efficiently and potentially reducing the amount needed.

COMPATIBILITY WITH BACTERIAL-BASED PRE-TREATMENTS: Nanobubbles work synergistically with bacterial pre-treatments by providing a consistent oxygen supply, boosting bacterial effectiveness in breaking down pollutants.



Bio Reactor Tank Function

A bio tank where nanobubbles are being added serves as a water treatment solution that enhances the separation of Total Suspended Solids (TSS) and improves Oxidation-Reduction Potential (ORP).

Here's how the process works and how Nanobubbles contribute to it:

“NANOBUBBLES
BEHAVE MORE LIKE
SURFACTANTS
RATHER THEN
BUBBLES”

A bio tank is typically part of a biological water treatment system where microorganisms break down contaminants, through aerobic or anaerobic processes. When nanobubbles are introduced into the bio tank, they attach to the surface of suspended solids, causing the solids to become less dense and rise to the surface more easily. This is because nanobubbles increase buoyancy, leading to more efficient separation of TSS from the water.

Key Features of a Bio Reactor

Water Sources: Domestic Water only used for RO water generation and emergency supply

RO Unit Setting: RO Generator adjusted to maximum RO water production, Reject water is added to Bio Reactor to augment oxygen levels in reclaim.

Bio-Reactor Blends: RJ-RC water with Nanobubbles which combine to raise oxygen levels and separate saturated solids from reclaimed water.

Water Blending: TSS separates from water, lighter material floats to the top and heavier material falls to the bottom of the tank.

Oxygen Levels: Must be controlled to promote the necessary energy for biologicals but no more.

Water Flow and Control: Cyclonic flow of water currents in tank causes even dispersion of oxygen and aids in separation of solids.

High and Low-Level Float Switches: Regulate the water volume in the storage tanks.

Oxygen Control: Dissolved Oxygen (DO) meter on the nanobubble generator (NBG) monitors and controls oxygen saturation levels.

Foam and Solids Removal: Foam skimmer removes separated TSS from tank preventing resublimization of organic material into water.

Tank Flush: Removes heavier materials which fall to the bottom of tank.

Reclaim Water Management

For more information on the use of biological water filtration or advanced Nanobubble Technology please contact Arcadian Chemistry Solutions

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**Info@arcadianchemistrysolutions or call
720-234-2462 for more information**



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