INDUSTRIAL WATER • BIOFILM CONTROL

Is Biofilm Affecting Your Process or Application?

Biofilm is the silent driver of fouling, corrosion, and lost efficiency across industrial water systems. JC 9465 / JC 9450 mineral-oxychloride ROS destroys the protective EPS matrix at its source — not just the cells inside it.

6-log
MICROBIAL KILL
DRIVEN BY ROS

>+700 mV
ORP TARGET FOR
BIOFILM-FREE WATER

2.8–2.9 V
OXIDATION POTENTIAL
VS. 0.94 FOR HYPOCHLORITE

Established biofilm colonizing a water surface — before JC 9450 treatment.

What biofilm actually is

When a bacterium attaches to a surface, it switches on genes that encase the colony in an adhesive **extracellular polymeric substance (EPS)** — a polysaccharide matrix threaded with water channels. EPS anchors the cells, traps nutrients, and shields the growing community from disinfectants. Mature biofilms are heterogeneous, layering aerobic and anaerobic zones and many microbial species into an interdependent, self-protecting community.

Because the negatively charged EPS behaves like an ion-exchange resin, strongly charged or reactive oxidants are captured before they reach the cells beneath. Bacteria deep in the matrix also drop into a slow-growing state that resists growth-dependent killing. The result: colonies survive treatments that would destroy the same organisms floating free.

Where biofilm affects your process

Wherever water meets a surface, biofilm follows — and it forms fast, even under continuous disinfection:

Cooling towers & heat exchangers. The slime layer insulates far better than mineral scale, cutting heat transfer and seeding under-deposit and microbiologically influenced corrosion (MIC).

RO membranes & spacers. Primary colonizers such as *Sphingomonas* spread a dense EPS layer across membrane sheets, raising differential pressure and slashing flux and recovery.

Potable & distribution systems. Biofilm reaches 10^4 CFU/cm² on pipe within the first week and re-forms even in a 1–2 mg/L free-chlorine residual; it harbors *Legionella*, *E. coli* and mycobacteria.

Filtration media. Sand filters accumulate biofilm densities of 10^{11} CFU per gram within two days.

Food processing. *Listeria monocytogenes* and *Salmonella enterica* survive 6-minute treatments with hypochlorite, peracetic acid, and hydrogen-peroxide sanitizers — a direct spoilage and safety risk.

Oil & gas water systems. Sessile communities drive souring, H_2S generation, and corrosion of lines and equipment.

MEMBRANE / RO FOULING

EPS biofouling on RO membrane skids raises pressure drop and cuts flux long before scale does.

What biofilm costs you

Once EPS establishes, the damage compounds: **lost efficiency** from insulating deposits, **fouling** of fill, media, spacers and basins, **corrosion and MIC** under the deposit, **scale nucleation** as the matrix traps calcium and phosphate, and **product spoilage and pathogen risk**. The community also depletes dissolved oxygen and generates hydrogen sulfide, causing bad taste, odor, and cloudy water.

DISINFECTANT CHALLENGE	WHY BIOFILM WINS
Physical barrier	EPS blocks and binds oxidants before they reach the cells
Chemical scavenging	Negatively charged matrix strips reactive agents like an ion-exchange resin
Dormancy	Nutrient / oxygen depletion puts cells in a kill-resistant stationary state
Regrowth	**Surviving cells re-seed the matrix within days — even under a chlorine residual**

Why conventional disinfectants fall short

Chlorine oxidizes by *addition* — it attaches to organics rather than delivering oxidation energy, so its potency is measured in ppm, not in oxidation potential. Even at 500–1,000 mg/L it barely touches organic material other than to form chlorinated by-products, and it needs a 45–60-minute contact time at pH 4–5 to disinfect. UV and ozone act only at the point of application and leave no downstream ORP to hold biofilm at bay.

How JC 9465 / JC 9450 destroys the matrix

JC 9465 / JC 9450 is a complex **mineral-oxychloride solution** that forms metal-oxy-complexes with Ca, K, Mg, Fe and Mn. On contact with organics and microbes these complexes release a cascade of **reactive oxygen species (ROS)** — hydroxyl radical, superoxide, peroxide and singlet oxygen — via the natural Haber-Weiss and Fenton reactions.

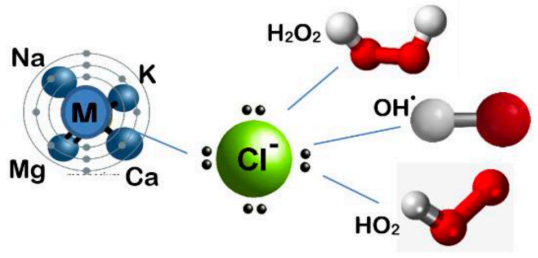
ROS attack biofilm two ways: they **penetrate and erode** the cells, damaging membranes and DNA; and they **etch and chemically break down the EPS itself**. Once the matrix can no longer hold together, dead and live cells detach and wash away — so surfaces stay clean and regrowth is suppressed.

Because the metals act as catalysts, the reaction both conserves and extends ORP, giving a measurable **residual** throughout the system. The whole program is monitored with a single ORP reading — no organic-load testing required — and the mineral-oxide by-products fall well below FDA MCL.

OXIDATION POTENTIAL OF COMMON OXIDANTS

REAGENT	FORMULA	VOLTS
Fluorine	F_2	3.06
Mineral Oxychloride	$M_xO_sCl_t$	2.8–2.9
Hydroxyl Radical	OH•	2.80
Oxygen Ion	O^-	2.42
Ozone	O_3	2.07
Hydrogen Peroxide	H_2O_2	1.78
Perhydroxyl Radical	HO_2	1.70
Chlorine Dioxide	ClO_2	1.57
Hypochlorous Acid	HOCl	1.49
Chlorine Gas	Cl_2	1.36
Oxygen (Molecule)	O_2	1.23
Hypochlorite Ion	OCl^-	0.94
Sodium Hypochlorite	NaOCl	0.94
Hydroperoxide Anion	HO_2^-	−0.88
Superoxide Radical	O_2^-	−2.40

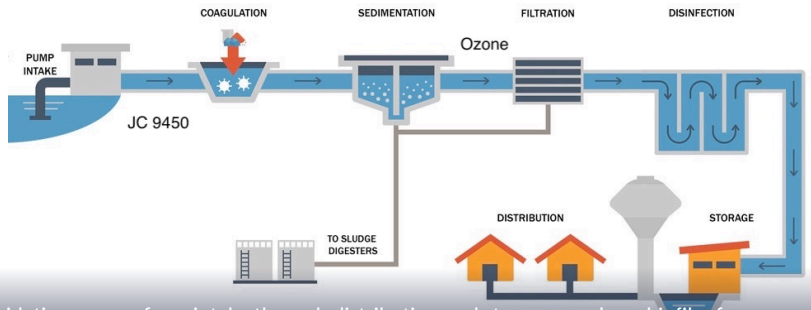
MINERAL-OXYCHLORIDE ROS COMPLEX



TARGET	CHLORINE (ALONE)	JC 9465 / 9450
Inorganics	6 mg/L : 1 mg/L	<1 mg/L : 1 mg/L
Pathogens	1–3 mg/L, 45–60 min	1 : 1,000–10,000
Organics	Poor; forms by-products	1–8 mg/L : 1 mg/L
Residual	Only after demand met	Protective mineral oxide

Reactivity ratios (reagent : contaminant) from Jenfitch program data.

One reagent, monitored across the whole system



JC 9450 delivers residual oxidation energy from intake through distribution and storage — where biofilm forms.

THE TAKEAWAY

Biofilm survives because its EPS matrix shields the cells inside. JC 9465 / JC 9450 delivers ROS that both kill the microbes and dismantle the matrix — restoring efficiency, cutting corrosion and fouling, and holding a protective ORP residual downstream. One ORP reading tells you the system is protected.

Every application is different — cooling loops, membranes, distribution networks, process and food water, and oilfield systems each carry their own microbial community and organic load. Jenfitch sizes a JC 9465 / JC 9450 program to your water chemistry and target ORP, so you control biofilm with less product, fewer by-products, and a metabolically friendly mineral residue that breaks down naturally.

Reactive Oxygen Species | ORP-Monitored | Residual Protection | No Chlorinated By-products | Below FDA MCL

TALK TO JENFITCH

Ask about a biofilm-control assessment for your process.

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