

PermaClean PC-191

Membrane Antiscalant

PermaTreat 191 (PC-191)

Membrane Antiscalant

PermaTreat 191 is one of the principal antiscalants used by the membrane industry. For almost 20 years PermaTreat 191 has found application as an antiscalant and antifoulant in membrane systems using a wide selection of brackish, high salinity, process and effluent feed-waters.

Product Benefits

- highly effective antiscalant across a broad spectrum of waters
- minimizes scaling and reduces the frequency of membrane cleaning
- will reduce, and usually replace the need for acid addition
- low dose rate gives a cost effective application
- compatible with all membrane types
- application based on 20 years practical experience
- effective iron sequestrant
- more stable and more effective than sodium hexameta-phosphate (SHMP)
- enables systems to work at enhanced rates of recovery
- extensive portfolio of toxicological and environmental data available

General Specification*

appearance	pale yellow liquid
pH (as supplied)	10.5
specific gravity	1.36
solubility in water	miscible in all proportions

* All figures are approximate

Safety and Handling Information

Potential Hazards:

PermaTreat 191 is not considered hazardous but as with all industrial chemicals, care should be taken in its handling and use.

A PermaTreat 191 ‘Safety Data Sheet’ is available upon request

PermaTreat is a registered trademark

PermaTreat 191 - Membrane antiscalant

PermaTreat 191 was first used in a membrane system in 1980. Since then it has become the preferred method of antiscalant control in thousands of installations throughout the world, including some of the largest potable plants ever built. It is recommended by most of the worlds leading membrane manufacturers who consider it a highly cost effective scale inhibitor and *product of choice*.

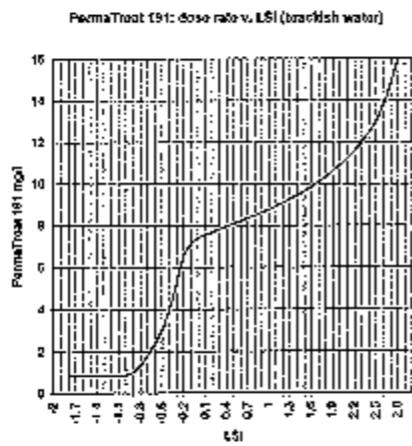
PermaTreat 191 reduces the risk of scaling and eliminates the use of hazardous acids, at the same time maintaining efficient plant operation with optimum conversion rates. It is invariably a cheaper alternative for membrane protection than pH control or ion exchange softening.

Scale inhibition processes have been studied in detail. From this work it has been determined that '*Threshold*' is the key mechanism in the prevention of scale formation in membrane systems.

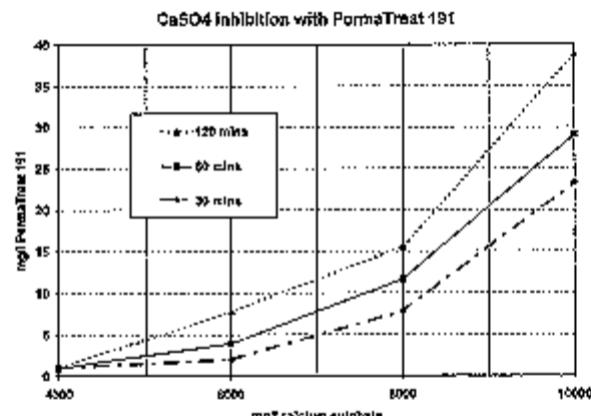
PermaTreat 191 is a super-threshold agent able to stabilize a wide range of supersaturated salt solutions. This property allows the engineer to design systems with maximum recovery rates. **OEMs** with the confidence to offer systems working at their highest rates of recovery have a significant advantage over their competitors because they can offer many benefits:

better environmental acceptance of concentrate discharge

- improved cost effectiveness
- less feed water required
- less concentrate for disposal
- less chemicals to be used



PermaTreat 191 v. CaCO_3



PermaTreat 191 v. CaSO_4

PermaTreat 191 is an excellent inhibitor for a wide range of scaling species. Although minority scalants such as calcium fluoride and strontium sulfate must be considered when designing a system they are virtually unknown in practice.

Foulant	Index	PermaTreat 191 limits	typical dose rate in feed
calcium carbonate(a)	LSI	<2.6	1.0 to 4.0 mg/l
calcium sulfate	Ipb:Ksp	<3.0	1.5 to 2.5 mg/l
barium sulfate	Ipb:Ksp	<50	0.5 to 2.5 mg/l
strontium sulfate	Ipb:Ksp	<12	N/A
calcium fluoride	Ipb:Ksp	<120	N/A
silica	SCR(b)	<1.32	0 to 4.0 mg/l
iron	IFI©	<1.2	0 to 6.0 mg/l

- (a) Where the Stiff and Davis Saturation Index is calculated and PermaTreat 191 is used, the maximum S&DSI limit has never been reached.
- (b) Saturation Concentration Ratio (SCR) at 25°C, pH 7.5 with 165 mg/l SiO₂ in the concentrate.
- (c) Iron Fouling Index (IFI) developed by PermaCare International restricts the total iron level in the concentrate stream to 1.2 mg/l.

Silica Fouling

There are many recorded instances where PermaTreat 191 has allowed systems to operate satisfactorily with enhanced levels of silica. Generally PermaTreat 191 is used with silica levels in the brine less than 165 mg/l, whilst PermaTreat 510 is used at higher concentrations.

Advantages of PermaTreat 191 over acid dosing

- Handling PermaTreat 191 is far safer to handle than either sulfuric or hydrochloric acids.
- Cost advantage The dose rate of PermaTreat 191 is much lower than the acid dose rate and is invariably a cheaper treatment option.
- Technical Sulfuric acid is only effective against carbonate scale and increases the calcium sulfate scaling potential whereas PermaTreat 191 is an effective calcium sulfate inhibitor.

With PermaTreat 191 the product water has a higher pH and is of better quality due to enhanced bicarbonate rejection.

- Corrosivity At natural pH the operating environment is less corrosive.

Advantages of PermaTreat 191 over sodium hexameta-phosphate dosing

- Handling SHMP has a short shelf life and solutions must be made up daily.
- Technical PermaTreat 191 is a far more effective antiscalant than SHMP, maintaining salts in solution at high LSI and Ipb/Ksp values, which means systems can operate at higher recovery rates with PermaTreat 191.
- Cleaning PermaTreat 191 is far more stable than SHMP and is unlikely to cause any calcium or iron based phosphate deposition. For this reason the interval between cleaning when using PermaTreat 191 is significantly longer.
- Dosage The PermaTreat 191 dose rate is significantly lower than for SHMP

PermaTreat 191 performance in the presence of iron

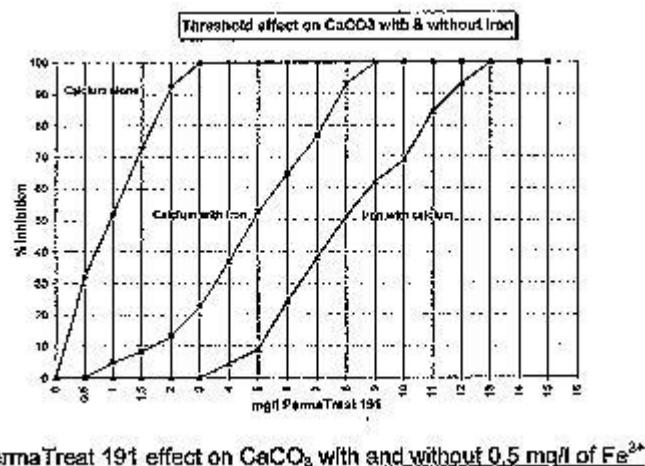
Laboratory experiments determined the PermaTreat 191 threshold performance against calcium carbonate and ferric salts under the following test conditions:

pH	8.0	duration	2 hours
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calcium (mg/l as ion)	640	agitation	200 rpm
bicarbonate (mg/l as ion)	1,952	temperature	25oC
chloride (mg/l as NH4Cl)	5,000	LSI	+2.43

The results show the effect that 0.5 mg/l of iron has on inhibitor performance. In the blank case (without iron), complete calcium stabilization is achieved with 4.0 mg/l of PermaTreat 191. In the presence of 0.5 mg/l of iron, PermaTreat 191 must be present at 9 mg/l to fully stabilize the calcium. As complete calcium inhibition occurs at lower PermaTreat 191 levels than complete iron inhibition, higher inhibitor levels are necessary to prevent the precipitation of both species. In this case 13 mg/l of PermaTreat 191 is needed to prevent both calcium and iron precipitation.

With 1.0 mg/l of iron only 10 mg/l of PermaTreat 191 is needed to inhibit calcium precipitation, but 26 mg/l is needed to inhibit both calcium and iron. With iron at 1.5 mg/l, 40 mg/l of PermaTreat 191 is needed to fully inhibit both calcium and iron.



Toxicological and environmental aspects

The large portfolio of data on PermaTreat 191 includes aquatic, avian and mammalian toxicity. Bioaccumulation, Biodegradation, Abiotic Degradation, Activated Sludge Adsorption and River die-away tests with ¹⁴C labeled material are part of the many studies undertaken. The results demonstrate the acceptability of PermaTreat 191 for potable applications and its environmental acceptance in concentrate streams.

Test Methods

There are several PermaTreat 191 test methods available. They mainly rely on phosphonate hydrolysis and the measurement of the resultant ortho-phosphate. Details are available from your local PermaCare representative.

Additional Information

PermaClean is a registered trademark of ASR Limited.

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