Inlet Water & Sweep Gas Guidelines for 3M™ Liqui-Cel™ Membrane Contactors

Inlet water and sweep gas quality are important considerations when operating 3M™ Liqui-Cel™ Membrane Contactors. This document provides guidelines for inlet water and sweep gas conditions that may help prevent fouling of the membrane surface or scaling which can negatively impact performance. Design and operating guidelines are also available in the 3M™ Liqui-Cel™ Membrane Contactor Design & Operating Guide which can be found on the 3M.com/Liqui-Cel web site.

This document and the Design & Operating Guide should be thoroughly reviewed before designing and operating a system.

When operating a Liqui-Cel membrane contactor system, note the following general recommendations and considerations:

- a comprehensive water quality analysis should be completed. Changes in water quality, such as seasonal variation, should be taken into consideration;
- a softener or cation exchanger is highly recommended;
- liquid and gas inlet streams should always be pre-filtered; and
- the potential for a pH shift should be assessed (for CO_2 removal applications)

The optimal filtration and pre-treatment arrangement will depend on several variables, including the water source, operating conditions, biological matter, organics, Total Dissolved Solids (TDS) and other factors.

Table 1: Inlet Water Quality Guidelines

Water Quality Indicator	Measure	Recommended Level	Prevention / Control	Membrane Cleaning
Colloids	Silt Density Index	<3	flocculation/UF/NF/RO	no treatment
Turbidity	NTU	<0.5	flocculation/UF/NF/RO	no treatment
Total Suspended Solids	mg/L (ppm)	<5 mg/L	flocculation/UF/NF/RO	no treatment
Particulates	um, absolute rating	5	filtration	no treatment
Total Hardness*	ppm	<10	antiscalants	no CIP required
Dissolved Organics	TOC, ppm	<1	UF	(hot) caustic/oxidation cleaning
Suspended Oil	ppm	<5	filtration	(hot) caustic
Chlorine, free**	ppm-continuous	0.5	Sodium Bisulfite addition	no treatment
	shock treatment, ppm	100	30 minutes, 300 cycles	
	Cumulative, ppm-hrs	24000		
pH	units	0.5 - 14		-
Silica - Colloidal	mg/L	<5	antiscalants	hot caustic
Surfactants	ppm	0		
Langelier Saturation Index	Langelier Saturation Index	<0	softening/antiscalants	Acid cleaning
Ozone	ppm	0		no treatment
Chlorine Dioxide	ppm	0		no treatment

* pH shift due to degassing can contribute to precipitation
** consider using alternative non-oxidizing biocide like DBNPA

Table 2: Gas-side Inlet Guidelines

Gas stream (lumenside)*	0.2 µm for high-purity applications
	1 - 3 µm is sufficient for industrial applications

* oil- and aerosol-free

Additionally, some dissolved compounds will pass through any filter and could potentially deposit on the membrane surface. Particularly, agglomeration or precipitation of certain dissolved compounds could occur with pH changes. To prevent blocking or precipitation, we recommend a softener or cation exchanger followed by 5 µm absolute pre-filter as a minimum re-quirement.

Seawater needs to be filtered to ≤ 5 microns and, depending upon the pH, further preventative action may be needed to prevent scaling. Placement downstream of a Sulphate Removal Unit (SRU) is highly recommended.

The tables above provide minimum guidelines that may prevent potential membrane fouling and blockage.

Additional Requirements

Feedwater should be free of surfactants/solvents or oxidants (e.g. ozone, chlorine) to prevent wet-out or oxidation of the hydrophobic membrane. Small amounts of chlorine and oil can be removed by activated carbon. Biological fouling can be reduced with regular, frequent chemical cleaning or sanitization procedure (see Cleaning Guide for additional information).

The physical operating limitations of 3M™ Liqui-Cel™ Membrane Contactors, such as maximum operating temperatures or pressures, should also be considered. For additional information, refer to the 3M™ Liqui-Cel™ Membrane Contactor Design & Operating Guide available at 3M.com/Liqui-Cel.

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