Chemical Cleaning Protocol – RO

Objective of the Chemical Cleaning

Membrane chemical cleaning is an important part of any reverse osmosis maintenance program.

Different types of fouling with consequent choking can cause decline in performance of Reverse Osmosis for effluent/sewage treatment:

a) Biofouling on the membrane surface.

b) Formation of mineral scales on membrane surface.

c) Organic fouling.

Membrane fouling

Foulants lodged on the membrane surface and within pores can cause flux loss (permeate flow), an increase in differential pressure (ΔP), increased conductivity of permeate water and an increase in feed pressure.

Therefore, periodic chemical cleanings as suggested by Aqua Designs is imperative to be implemented as a preventive measure to prevent choking of the membranes and decline in plant performance in terms of recovery and permeate quality.

General Guidelines

Clean membranes on a regular basis as a preventive measure or when differential pressure or normalized permeate flow deviates by about 10%-15% from the design limits. Regular membrane cleaning is necessary and utmost care is to be undertaken to avoid excessive membrane cleaning to prevent shortening of membrane life.

Depending on the type of fouling it may be necessary to clean either only with Aquazzol 601 (Scale Cleaner) or followed by Aquazzol 701 (Organic Cleaner).

Plant operating data must be recorded as mandatory requirement. Parameters such as flow rate, pressure, etc. must be logged and kept recorded for further improvement in plant performance.

When different chemicals are used for cleaning, ensure the pipeline is flushed clean off the previous chemicals by opening the drain valve before adding the second chemical.

Aqua Designs India Limited
Off 200 Feet Road,
Kolathur, Chennai - 600 099, India
Phone : 0091 44 37171717
Fax : 0091 44 37171737
Email : sales@aquadesigns.in
Web : www.aquadesigns.in

In case the plant is not to be operated for a long time, the membranes are to be applied with preservative chemical (Aquazzol 801) for prevention of bacterial growth.

Flow rates during cleaning, must be sufficient to remove foulants from the membrane element but should not exceed manufacturer's limits. Flow rate should be within a value such that it does not result in exceeding the feed pressure and pressure drop limitation determined by the membrane element manufacturer.

TABLE1-RECOMMENDED CLEANING FLOW RATES

S.NO	Diameter of (Membrane) Element (inches)	Feed Flow Rate Per Pressure Vessel(m3/hr)
1	2.5	0.7 – 1.2
2	4	1.8 – 2.3
3	6	3.6 – 4.5
4	8	6.8 – 9.1

The maximum recommended pressure drop during membrane cleaning of 8 inch membranes should not exceed 1.4 bar per element or 4.0 bar for a multi-element pressure vessel.

Aquazzol 601 (Scale Cleaner)

Aquazzol 601 is supplied as a concentrated product and will have been diluted as per guidelines and used. Aquazzol 601 is used to remove acid soluble substances such as metal hydroxides and calcium carbonate. It should also generally be used before Aquazzol 701, an alkali based alkaline cleaner.

Aquazzol 701 (Organic Cleaner)

Aquazzol 701 supplied as a concentrated product will have been diluted as per guidelines and used.Aquazzol 701 is used to remove organic substance and microbiological slimes.

Aquazzol 801 (Preservative chemical)

Aquazzol 801 is a preservative liquid which will have be diluted as per guidelines and used. It is used to prevent formation of microbiological slimes.

Chemical Cleaning Instructions - Reverse Osmosis Plant

TABLE: 2 Cleaning Solution Volume Requirement per RO Element (Membrane)

Element Size (inches)	NORMAL FOULING (Litres)	HEAVY FOULING (Litres)
4 x 40	9.5	19
6 x 40	19	38
8 x 40	34	68
8.5 x 40	38	76
16 x 40	136	272

Aquazzol 601-Scale Cleaner

Step1: Based on the number of RO elements (membranes) and element size the quantity of water is to be calculated using the above table. Let it be X litres.

Step2: Quantity of Aquazzzol 601 is calculated based on the following formula: 0.08X. Let it be Y kg

Step3: Initially membranes are flushed with RO permeate water and drained.

Step4: Circulate RO water through the system under standard pressure and flow conditions.

Step5: For chemically cleaning the system, the reject valve and also permeate valve are to be opened.

Step 6: Add Y kg of Aquazzol 601 slowly to X litres of RO Permeate water to achieve a pH of 2.5

Aqua Designs India Limited
Off 200 Feet Road,
Kolathur, Chennai - 600 099, India
Phone : 0091 44 37171717
Fax : 0091 44 37171737
Email : sales@aquadesigns.in
Web : www.aquadesigns.in

Step 7: If pH>2.5 add 50ml of Aquazzol 602 and mix the contents thoroughly. Check the pH. If pH is not attained repeat additions of 50 ml Aquazzol 602 followed by thorough mixing till pH 2.5 is attained.

Step 8: Circulate the system initial for 1-2 hrs basically to remove the soft settling particles and loosened substances.

Step 9: Allow the membrane to soak in the solution for 1-2 hrs depending upon the severity of the scaling.

Step 10: After soaking, the system can be circulated for another 45-60 min. Drain and completely flush system with RO permeate water till Ph 7 is reached.

Step11: Maintain max. Flow rate of CIP pump flow=9m3/hr per vessel of (8"dia)

Aquazzol 701-Organic Cleaner

Step1: Based on the number of RO elements (membranes) and element size the quantity of water is to be calculated using the above table2. Let it be X litres.

Step2: Quantity of Aquazzzol 701 is calculated based on the following formula: 0.05X. Let it be Y kg

Step3: Initially membranes are flushed with RO permeate water and drained.

Step4: Circulate RO water through the system under standard pressure and flow conditions.

Step5: For chemically cleaning the system, the reject valve and also permeate valve are to be opened.

Step 6: Add Y kg of Aquazzol 701 slowly to X litres of RO Permeate water to achieve a pH of 12.5-13.0

Step 7: If pH<12.5 add 50ml of Aquazzol 701 and mix the contents thoroughly. Check the pH. If pH is not attained repeat additions of 50 ml Aquazzol 701 followed by thorough mixing till pH12.5 is attained.

Step 8: Circulate the system initial for 1-2 hrs basically to remove the soft settling particles and loosened substances.

Aqua Designs India Limited
Off 200 Feet Road,
Kolathur, Chennai - 600 099, India
Phone : 0091 44 37171717
Fax : 0091 44 37171737
Email : sales@aquadesigns.in
Web : www.aquadesigns.in

Step 9: Allow the membrane to soak in the solution for 1-2 hrs depending upon the severity of the scaling.

Step 10: After soaking, the system can be circulated for another 45-60 min. Drain and completely flush system with RO permeate water till Ph 7 is reached.

Step11: Maintain max. Flow rate of CIP pump flow=9m3/hr per vessel of (8"dia)

Note:

1. Flush pipe work, membranes and cleaning tank thoroughly with chlorine –free water/RO Permeate water between each cleaning cycle and when returning the plant to normal operation. When cleaning multi-staged plant, clean each stage individually.
2. Pressure tubes are to be cleaned only in parallel. When a series array of pressure tubes is used for higher recoveries, each blank shall be cleaned separately.
3. RO Permeate only should be used for cleaning. All liquids used for cleaning and dilution should be free from chlorine and oxidizing type chemicals.

Recommended Procedure for Short Term RO System down Periods

Aquazzol 801

The following procedure may be used for down periods of less than 7 days. For longer shutdown periods, see extended down time procedure.

- Shut down the reverse osmosis system in accordance with all written instructions.
- Flush the system with permeate water.
- Flush time should be minimum of 30 minutes based on recommended cleaning instruction flow rates.
- 1% (w/v) Aquazzol 801 may be applied dependant on the membrane supplier's recommendations. The preservation solution is to be renewed after 6 months.[Dosage preparation:- 0.3 kg Aquazzol 801 to be mixed in 33 litres of RO Permeate water for a single (membrane) element.Therefore,depending on the no. of membranes in a vessel the Aquazzol 801 dosage is to be prepared according to the above-mentioned ratio.]
- RO systems exposed to direct sunlight or temperature should not exceed 40 C during shutdown.

Note:

- The water used to prepare this solution must be free off residual chlorine or similar active oxidizing agents.
- Flushing may be done using the cleaning system.
- On system restart, the permeate should be directed to drain for a minimum of one hour to adequately flush the preservative residual substances.

Recommended Procedure for Extended RO System down Periods

The following procedure may be used for extended system down periods provided the system has operated for a minimum period of 48 hrs and the temperature should not have exceeded 45 C and the system is not exposed to direct sunlight.

- Shut down the reverse osmosis system in accordance with all written instructions.
- 1% (w/v) Aquazzol 801 may be applied dependant on the membrane supplier's recommendations. The preservation solution is to be renewed after 6 months[Dosage preparation:- 0.3 kg Aquazzol 801 to be mixed in 33 litres of RO Permeate water for a single (membrane) element.Therefore,depending on the no. of membranes in a vessel the Aquazzol 801 dosage is to be prepared according to the above-mentioned ratio.]
- Flush the system with Aquazzol 801 solution for 10 mins.
- With the system full of Aquazzol 801 close all inlet and outlet valves.
- Repeat the last two steps every 30 days.

Note:

- The water used to prepare this solution must be free off residual chlorine or similar active oxidizing agents.
- Flushing may be done using the cleaning system.
- On system restart, the permeate should be directed to drain for a minimum of one hour to adequately flush the preservative residual substances.