

CHEMICAL CLEANING PROTOCOL – MBR-STP/ETP

Objective of the Chemical Cleanings

The following types of fouling with consequent choking can cause decline in performance of the membrane bioreactor for effluent/sewage treatment:-

- a) Biofouling on the membrane surface due to high MLSS.
- b) Formation of mineral scales on membrane surface.
- c) Organic fouling.

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.

General Guidelines

1. Chemical cleaning should be done every 7th day irrespective of the whether the plant has been operated or not.
2. Depending on the type of fouling it may be necessary to clean either only with **AQUAzzOL 950** (Disinfectant) or followed by **AQUAzzOL 952** (Antifoulant /Dispersant) or followed by **AQUAzzOL 802**(Organic cleaner) or followed by **AQUAzzOL 602**. (Scale cleaner). Plant operating data must be recorded as mandatory requirement. Parameters such as flow rate, pressure must be logged and kept as records for establishing improvement in plant performance.
3. When different chemicals are used for cleaning, ensure that the pipeline is flushed clean off the previous chemicals by opening the drain valve before adding the second chemical.
4. Always use the correct quantity/dilution of chemical when cleaning as per Aqua Designs' guidelines.
5. Do not store **AQUAzzOL 950** and **AQUAzzOL 952** unused for more than a month. Store both the solutions in a cool, dark environment.
6. Permeate tank cleaning is to be carried out once a month. Empty the permeate tank completely. Out of this, Store 10 litres of permeate water from top portion of permeate tank in a clean plastic/HDPE carbuoy for preparing cleaning solutions. Dilute 4 litres of **AQUAzzOL 950** with 4 litres of permeate water and wash the tiles on the side and bottom of the tank free of any algae.

Note:

If the MBR permeate is to be fed to a reverse osmosis unit then AQUAzzOL 950 cleaning is necessarily to be followed by cleaning with AQUAzzOL 902 (Antioxidant) solution prepared by diluting 4 litres of AQUAzzOL 902 with 4 litres of permeate water.

Two types of cleanings are recommended as a Standard Operating Procedure.

Standard Operating Procedure (SOP)

Weekly Cleaning with AQUAzzOL 950

The recommended dosage is 300 ppm to be dosed by gravity in 30 minutes.

Step1: Quantity of RO permeate water/DM water in litres is determined by doubling the area of total area of membranes, i.e. 2 x area of membranes (m²). Let it be X litres.

Step2: Quantity of Aquazzol 950 in litres is determined by the following formula:
 $0.3X / (\% \text{Aquazzol } 950 \times 10)$. Let it be Y litres.

Step3: Mix Y Litres of AQUAzzOL 950 in X litres of RO Permeate/DM water by manual stirring using a wooden/plastic rod in a Plastic/HDPE container (CIP tank) of capacity 10%>X litres. Allow to stand for at least 10 minutes before using.

Step4: The feed line of the module is closed manually/ by auto valve. Feed the above solution of 300 ppm AQUAzzOL 950 to the permeate line of the module by gravity dosing such that the Y litres fill in 30mins. Ensure proper mixing for attaining homogeneity by operating as follows: Start adding Aquazzol 950 solution with continues mixing after tank is half full with RO Permeate/DM water. The entire Aquazzol 950 is to be added and mixed well before X litres mark is reached. THIS IS VERY IMPORTANT.

Step5: Check for free residual chlorine for minimum 300 ppm. If there is a shortfall add 1 or 2 litres (depending on the shortfall) of extra Aquazzol 950 solution and check whether free residual chlorine value lies between 300 ppm and 500 ppm. IT SHOULD NEVER EXCEED 500 ppm.

Step6: Allow soaking for 30 minutes

Step7: After soaking, flush the membrane thoroughly with permeate water and ensure that the pH of the outlet is neutral.

Trimonthly Cleaning with AQUAzzOL 950

The recommended dosage is 3000 ppm to be dosed by gravity in 30 minutes.

Step1: Quantity of RO permeate water/DM water in litres is determined by Doubling the area of total area of membranes, i.e. 2 x area of membranes (m²). Let it be X litres.

Step2: Quantity of Aquazzol 950 in litres is determined by the following Formula:
 $3X / (\% \text{Aquazzol } 950 \times 10)$. Let it be Y litres.

Step3: Mix Y Litres of AQUAzzOL 950 in X litres of RO Permeate/DM water by manual stirring using a wooden/plastic rod in a Plastic/HDPE container (CIP tank) of capacity 10%>X litres. Allow to stand for at least 10 minutes before using.

Step4: The feed line of the module is closed manually/ by auto valve. Feed the above solution of 300 ppm AQUAzzOL 950 to the permeate line of the module by gravity dosing such that the Y litres fill in 30mins. Ensure proper mixing for attaining homogeneity by operating as follows: Start adding Aquazzol 950 solution with continuous mixing after tank is half full with RO Permeate/DM water. The entire Aquazzol 950 is to be added and mixed well before X litres mark is reached. THIS IS VERY IMPORTANT.

Step5: Check for free residual chlorine for minimum 300 ppm. If there is a shortfall add 1 or 2 litres (depending on the shortfall) of extra Aquazzol 950 solution and check whether free residual chlorine value lies between 300 ppm and 500 ppm. IT SHOULD NEVER EXCEED 500 ppm.

Step6: Allow soaking for 30 minutes

Step7: After soaking, flush the membrane thoroughly with permeate water and ensure that the pH of the outlet is neutral.

Note:

Ensure that the plant is cleaned in case of the following situations:

- A. After 7 day's operation or idle time since last cleaning.
- B. If the permeate "Specific Flux" goes below 70% design LMH (when the permeate flow falls below 70% design permeate flow).
- C. Irrespective of the number of days since the last cleaning, the plant has to be cleaned in case the above mentioned flux value is reached.

The cleaning (given below) is required only if the fouling is inorganic in nature (when design TMP is not restoring after cleaning with AQUAzzOL 950)

Cleaning with AQUAzzOL 952

The recommended dosage is 10,000 ppm to be dosed by gravity in 30 minutes.

Step1: Quantity of RO permeate water/DM water in litres is determined by doubling the area of total area of membranes, i.e. 2 x area of membranes (m²). Let it be **X** litres.

Step2: Quantity of **AQUAzzOL 952** to be mixed in permeate water is determined by the following formula: $10 X / (\text{Aquazzol } 952 \times 10)$. Let it be **Y** litres.

Step3: Mix **Y** Litres of **AQUAzzOL 952** in **X** litres of RO Permeate Water/DM water by manual stirring using a wooden/plastic rod in a Plastic/HDPE container (CIP Tank) of capacity >10% of **Y** litres. Allow to stand for at least 10 minutes. before using.

Step4: The feed line of the module is closed manually/ by auto valve. Feed the above solution of 10,000 ppm **AQUAzzOL 952** to the permeate line of the module by gravity dosing such that the **Y** litres fill in 30 minutes.

Step5: Ensure proper mixing for attaining homogeneity by operating as follows: Start adding **Aquazzol 952** solution with continues mixing after tank is half full with RO Permeate/DM water. The entire **Aquazzol 950** is to be added and mixed well before **X** litres mark is reached. THIS IS VERY IMPORTANT.

Step6: Check pH and maintain it at 2.5 .If the pH is high add 20ml of **Aquazzol 952**, stir thoroughly for 5 minutes. and check whether pH 2.5 is attained. If not, add increments of 20ml at a time followed by thorough stirring and checking for pH 2.5 after each incremental addition.

Step7: Allow soaking for 30 minutes.

Step8: After soaking, flush the membrane thoroughly with permeate water and ensure that the pH of the outlet is neutral.

The cleaning procedure given below is required only if the fouling is organic in nature
(When design TMP is not restoring after cleaning with **AQUAzzOL 952**)

Cleaning with AQUAzzOL 802

The recommended dosage is 1,000 ppm to attain pH11-12.

Step1: Quantity of RO permeate water/DM water in litres is determined by doubling the area of total area of membranes, i.e. 2 x area of membranes (m²). Let it be X litres.

Step2: Quantity of AQUAzzOL 802 to be mixed in permeate water is determined by the following formula: $X/400$. Let it be Y litres.

Step3: Mix Y Litres of AQUAzzOL 802 in X litres of RO Permeate/DM water by manual stirring using a wooden/plastic rod in a Plastic/HDPE container of capacity >10% of Y litres. Allow to stand for at least 10 minutes before using.

Step4: The feed line of the module is closed manually/ by auto valve. Feed the above solution of 1,000 ppm AQUAzzOL 802 to the permeate line of the module by gravity dosing such that the Y litres fill in 30 minutes.

Step5: Ensure proper mixing for attaining homogeneity by operating as follows: Start adding Aquazzol 802 solution with continuous mixing after tank is half full with RO Permeate/DM water. The entire Aquazzol 802 is to be added and mixed well before X litres mark is reached. THIS IS VERY IMPORTANT.

Step6: Check pH and maintain it at 11-12 .If the pH is below 11 add 20 of Aquazzol 802 solution, stir thoroughly for 5mins, and check whether pH is attained. If not, add increments of 20ml at a time followed by thorough stirring and checking for pH 11 after each incremental addition.

Step7: Allow soaking for 30 minutes.

Step8: After soaking, flush the membrane thoroughly with permeate water and ensure that the pH of the outlet is neutral.

The cleaning procedure given below is required only if the fouling is organic in nature (When design TMP is not restoring after cleaning with AQUAzzOL 802)

Cleaning with AQUAzzOL 602

The recommended dosage is 500 ppm to attain pH 2 to be dosed in 30 minutes.

Step1: Quantity of RO permeate water/DM water in litres is determined by doubling the area of total area of membranes, i.e. 2 x area of membranes (m²). Let it be X litres.

Step2: Quantity of AQUAzzOL 602 to be mixed in permeate water is determined by the following formula: $X/600$ Let it be Y litres.

Step3: Mix Y Litres of AQUAzzOL 602 in X litres of RO Permeate/DM water by manual stirring using a wooden/plastic rod in a Plastic/HDPE container of capacity >10% of Y litres. Allow to stand for at least 10 minutes before using.

Step4: The feed line of the module is closed manually/ by auto valve. Feed the above solution of 500 ppm AQUAzzOL 602 to the permeate line of the module by gravity dosing such that the Y litres fill in 30 minutes.

Step5: Ensure proper mixing for attaining homogeneity by operating as follows: Start adding Aquazzol 602 solution with continuous mixing after tank is half full with RO Permeate/DM water. The entire Aquazzol 602 is to be added and mixed well before X litres mark is reached. THIS IS VERY IMPORTANT.

Step6: Check pH and maintain it at 2.5. If the pH is high, add 20ml of Aquazzol 602, stir thoroughly for 5 minutes, and check whether pH 2.5 is attained. If not, add increments of 20ml at a time followed by thorough stirring and checking for pH 2.5 after each incremental addition.

Step7: Allow soaking for 30 minutes.

Step8: After soaking, flush the membrane thoroughly with permeate water and ensure that the pH of the outlet is neutral.