

Analytical Data Logging and Performance Analysis for HYDRAsub[®]- MBR Systems

This Technical Service Bulletin provides detailed information for manual data logging of analytical data for HYDRAsub[®]-MBR systems. The MBR Data Sheets referenced in this bulletin can be obtained from Hydranautics.

General

Some HYDRAsub[®]-MBR systems may have online monitoring of certain analytical parameters through the supervisory control and data acquisition (SCADA) such that operating data is capable of being automatically acquired and stored at least every minute. Despite this technical convenience, manual data logging should be performed at every HYDRAsub[®]-MBR plant. Not only does the physical act of data logging allow operators to inspect their systems, but it also facilitates corroboration amongst transmitters and gauges. Data sheets are also a good backup source of data should the electronic data be lost.

Data Logging Sheet for Analytical Parameters

A sample data logging sheet is available through Hydranautics. The sheet lists many of the analytical parameters that are necessary to determine biological system performance of a membrane bioreactor (MBR). Some systems require supplemental data parameters to be monitored, such as MLSS in multiple treatment zones and other chemical analyses. Data from each of these items should be added to the logs to ensure proper plant performance and establish baseline characteristics.

These parameters are monitored by sampling from the appropriate treatment zone and measured using various methods. The method may vary based on available resources and type of water being tested. Refer to *Standard Methods for the Examination of Water and Wastewater* for information on each parameter. The sampling frequency will depend on the importance of the parameter and how quickly the test may be completed. Recommended frequencies and sample points are listed on the analytical data sheet.

The following is a detailed description of analytical data and biological parameters to be monitored for municipal treatment plants. The data may be recorded in the Analytical Data (Input) sheet in the MBR Data Sheets provided by Hydranautics.

Analytical Data and Biological Parameters Description:

- BOD₅, 5-Day Biochemical Oxygen Demand: Measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter in 5 days.
- Chemical Oxygen Demand (COD): Amount of oxygen required to chemically oxidize organic compounds to carbon dioxide and water. Indirect measurement of organic pollutants in water. Easier to test for compared to BOD.
- Total Kjeldahl Nitrogen (TKN): Combination of ammonia (NH₃), ammonium (NH₄⁺), and organic nitrogen present in sample.
- Ammonia Nitrogen (NH₃-N): Amount of ammonia (NH₃) and ammonium (NH₄⁺) present in sample. In the filtrate, this is an indication of the degree of nitrification occurring in the aerobic zone. The higher the amount of nitrification, the lower the ammonia nitrogen reading.
- Nitrate Nitrogen (NO₃-N): Nitrate is the oxidized product of nitrite. In the filtrate, this is an indication of the degree of denitrification occurring in the anoxic zone. The higher the level of denitrification, the lower the nitrate reading.
- Nitrite Nitrogen (NO₂-N): Nitrite is the oxidized product of ammonia. Nitrite concentration is usually low in the system since nitrite can be oxidized to nitrate quickly.
- Total Nitrogen (T-N): Amount of nitrogen present from all nitrogen containing sources.
- Orthophosphate (o-P): Also called reactive phosphorus. Combination of PO₄³⁻, HPO₄²⁻, H₂PO₄⁻, H₃PO₄.
- Total Phosphorous (T-P): Combination of orthophosphate, polyphosphate, and organic phosphate.
- Total Organic Carbon (TOC): Concentration of all organic carbon atoms covalently bonded in the organic molecules of a given sample of water. Identifies the presence of any organic contaminants. If a valid relationship can be established between TOC concentration and BOD concentration, use of the TOC test for process control is recommended.

- Total Suspended Solids (TSS): Portion of the total solids in the wastewater retained on a filter paper with a specified pore size.
- Mixed Liquor Suspended Solids (MLSS): Mixture of solids resulting from combining recycled sludge with influent wastewater in a bioreactor. The solids are comprised of biomass, non-biodegradable volatile suspended solids, and inert inorganic total suspended solids.
- Mixed Liquor Volatile Suspended Solids (MLVSS or VSS): Amount of solids that can be volatilized at 550°C. The solids are comprised of biomass and non-biodegradable volatile suspended solids. Typically 70-90% of MLSS.
- Food to Microorganism Ratio (F/M): An important process parameter commonly used to characterize process designs and operating conditions. The F/M ratio can be obtained by either of the equations below:

$$\frac{F}{M} \text{ (g COD / g VSS} \cdot \text{d)} = \frac{COD \text{ (g / L)} \times Q \text{ (m}^3 \text{ / d)}}{VSS \text{ (g / L)} \times V \text{ (m}^3 \text{)}}$$

(typically 0.1 – 0.2 g COD/ g VSS*d)

or

$$\frac{F}{M} \text{ (g BOD / g VSS} \cdot \text{d)} = \frac{BOD \text{ (g / L)} \times Q \text{ (m}^3 \text{ / d)}}{VSS \text{ (g / L)} \times V \text{ (m}^3 \text{)}}$$

(typically 0.05 – 0.1 g BOD /g VSS*d),

where Q is the influent flowrate and V is volume of bioreactor.

- Solid Retention Time (SRT): The SRT represents the average period of time during which the sludge has remained in the system. SRT is a critical parameter for activated sludge system design as it affects the process performance, bioreactor volume, sludge production, and oxygen requirements. For a MBR system, SRT typically range from 8-30 days and can be calculated using the equation below.

$$SRT \text{ (days)} = \frac{\text{Total Volume (gal)}}{\text{WAS Rate (gal / day)}}$$

where total volume includes the volume of all treatment tanks and membrane tanks.

- Operator Initials- initials of operator recording data. This is needed in order to keep track of who was present when specific data points were taken for clarification and accountability reasons.

- Comments –type of cleaning performed (i.e., chlorine CEB), chemical concentration used during cleaning, any alarms or other notable events.
- Frequency: W – weekly, BW – biweekly, D – daily.

Hydranautics
401 Jones Rd.
Oceanside, CA 92058
Tel: (760) 901-2500
Fax: (760) 901-2578
email: info@Hydranautics.com