

Technical Service Bulletin

October 2013 TSB 409.01

Oxygen Uptake Rate Test for HYDRAsub[®]-MBR Systems

This Technical Service Bulletin provides information on how to perform an unspiked oxygen uptake rate test to check biological activity in a HYDRAsub[®]-MBR system. This measurement is used to calculate the oxygen uptake rate (OUR) and specific oxygen uptake rate (SOUR), which may be used for identifying potential instabilities of a HYDRAsub[®]-MBR system. The calculation of OUR and SOUR are done in the OUR Data (Input) Sheet.

Required Equipments:

- Dissolved oxygen meter and probe OR respirometric device with appropriate reading range and sample capacity of at least 300 mL
- Stopwatch
- Thermometer
- Aeration device such as an aquarium pump connected to a stone diffuser
- Magnetic stirring plate and stirring bar
- Standard 300-mL BOD bottle
- 1 liter sample container

Sampling:

The mixed liquor sample should be collected at the same time with samples for MLSS/MLVSS analysis since the MLSS/MLVSS values will be used for SOUR calculation. The mixed liquor sample should be collected at the end of an aerobic basin.

Storage:

The mixed liquor sample collected for the respiration rate test should be analyzed as soon as possible. If the test cannot be performed on site and some time will be required to transport the samples to the laboratory, delays will cause the value obtained to be lower than the actual value. Samples should be stored in an ice cooler or refrigerator at or below 4°C until analyzed. If conditions cause the testing to be delayed, it may be better to obtain a new mixed liquor sample that can be analyzed without delay.

Analytical Procedure:

Calibration of Oxygen Reading Apparatus

1. Calibrate the oxygen electrode and meter according to the manufacturer's calibration procedure. Generally, calibrate membrane electrodes using water saturated air or samples of known DO concentration, OR
2. Calibrate the respirometric device according to manufacturer's instructions.

Measurement of respiration rate with a dissolved oxygen meter

1. Gather at least 1 liter mixed liquor sample in a sample container. Insert DO probe. Agitate the sample with an aeration device to get dissolved oxygen level between 6-7 mg/L within 2 minutes;
2. Gently pour the aerated sample into a standard BOD bottle allowing any bubbles to come to the surface and out of the bottle;
3. Insert a magnetic stirring bar into the bottle followed by the dissolved oxygen meter probe. Put the BOD bottle on a magnetic stirring plate. Allow 30 seconds for the meter to be stabilized and take the first dissolved oxygen reading;
4. Take subsequent readings and record every 30 seconds for the first 5 minutes and every minute thereafter. Stop testing in any event when the dissolved oxygen concentration drop below 2.0 mg/L or if the testing period reaches 15 minutes.

Follow the manufacture's instructions when a respirometric device is used.

Calculation:

1. If a dissolved oxygen meter is used, plot observed readings (mg DO/L) versus time (minutes) on graph paper and determine the slope of the line of best fit. The slope is the oxygen uptake rate in milligrams per liter per minute (mg/L/min).
2. Calculate specific oxygen uptake rate in milligrams per liter per gram per hour (mg/g/hr) as follows:

$$SOUR (mg / g / hr) = \frac{\text{oxygen uptake rate (mg / L)}}{\text{min}} \times \frac{60 \text{ min}}{\text{hour}} \times \frac{1000 \text{ mg / g}}{MLVSS \text{ mg / L}}$$

The readings can also be entered into the OUR Data (Input) Sheet in the MBR Data Sheets file to be calculated automatically.

MBR OXYGEN UPTAKE RATE DATA SHEET																
PROJECT TITLE:			Raw data from OUR experiment													
Date	Time	Machine Time	Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13
mm/dd/yy	hh:mm	h														
		EXAMPLE:	Time (sec)	0	30	60	90	120	150	180	210	240	270	300	330	360
			DO (mg/L)	6.5	6.1	5.8	5.3	5.0	4.6	4.2	3.9	3.4	3.0	2.7	2.4	1.9
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