

SOTR Estimation trials of Repãrator Fine Bubble Aerator

Overview

The Repãrator Aeration system is a combination of Venturi and sparge type aeration units with impressive oxygen transfer rates, generating very fine, long lasting bubbles. Aerator operation was initially tested in a 1000L tank to fine tune operating parameters such as flowrate and insertion depth, before upscaling to a 10,000L test where the SOTR was estimated.

Methodology

Testing follows where practicable the guidelines set out in ASCE measurement of Oxygen Transfer in Clean Water (2007). Tests were carried out in a 10,000L tank with one Aerator head with 2 calibrated DO meters (1 submerged by 300mm and one 300mm from the bottom). Compensation for saturated oxygen levels at an altitude of 641m and 25°C was done by referring to Weiss, CRC Handbook.

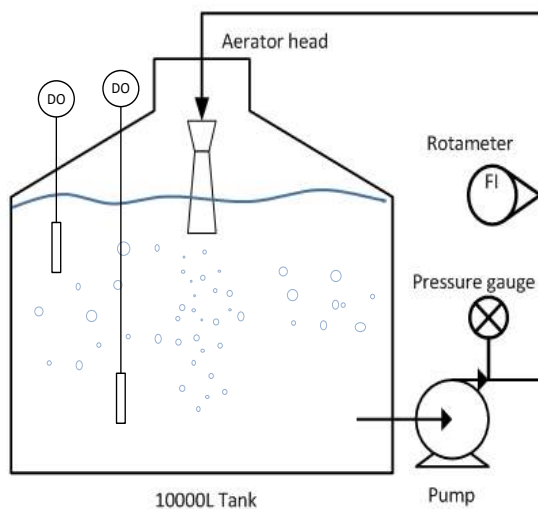


Figure 1: Simplified SOTR Setup

No additional circulating pump was required as the aeration head operating from a central location at 6-7L/s allowed for good circulation, with little noticeable difference observed in recorded readings between the DO meters.

Results

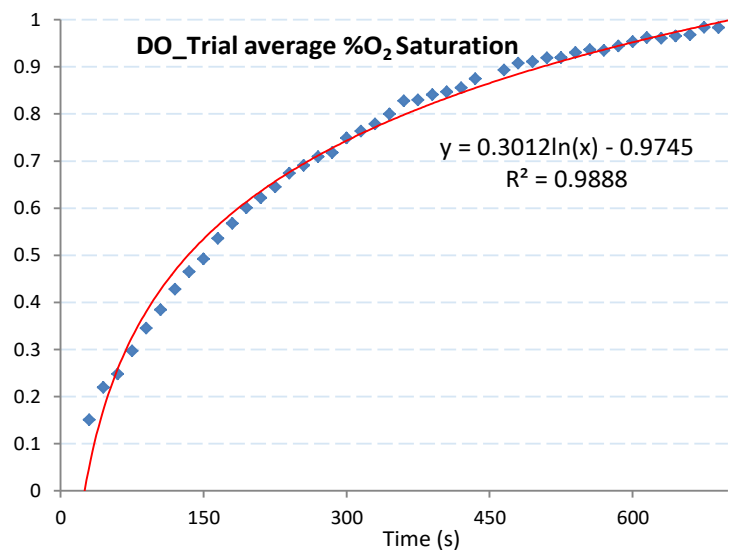


Figure 2: 10,000L O₂ Saturation 1 aeration head

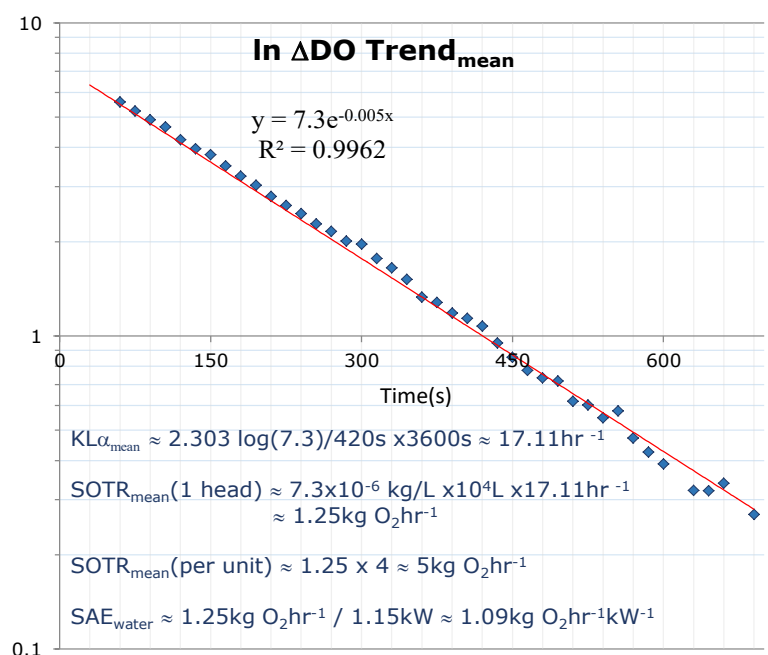


Figure 3: Linearized Change in Oxygenation rate

Hydraulic Data

Water Source: Toowoomba Regional Council

Volume 10,000 litres freshly filled on the 20 Jan 2017

Time	90FL-T	°C	Aqua DO ₂	°C	TDS	pH	NTU	ORP
TCC Water 10:28:44	57.3%	26.7	60.9%	25.5	0.4PSU Salinity	7.44	-0.5	74

Pump Power requirements:

A Honda IC Engine powered 3" Centrifugal pump was used to draw water from the tank with a 3" suction pipe and pumped through a 2" inlet to the Flow Meter followed by a 2" delivery pipe to the Aeration head. **Flow Rate:** 30m³/hr or 8.33L/sec, 200kPa at outlet.

The 200kPa(20.4m H₂O) represents static head loss plus the frictional loss from piping and the aerator unit(approx. 6.3m H₂O for piping). Hence Aerator water power required:

$$Q\rho gh = 30m^3 \times 997kg/m^3 \times 9.81m/s^2 \times (20.4m - 6.3m) / 3.6 \times 10^6 = 1.149kW$$

Pumping Details:

Water level: 1805mm

Suction Valve in tank: 1050mm above base of tank

Maximum lift from Foot valve to top of tank: 955mm

Length of 3" suction tube: 4100mm

Pump inlet height from base of tank to centre: 185mm

Pump outlet height: 325mm

3" Outlet pipe length: 1300mm

Height from tank base to bottom of 2" Flow Meter: 760mm

2" Delivery pipe from flow meter to aeration head inlet: 3300mm

Maximum height of aeration head inlet pipe from base of tank: 2455mm

Lift height from pump outlet centre: 2130mm

Aeration head outlet depth in the water: 280mm

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References:

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