

# Measurement of Oxygen Transfer in Clean Water/Book and Disk (ASCE Standard)

1 Article Title: *Mass Transfer Coefficient and Oxygen Solubility*  
2 Author: Johnny Lee, MSc, P.Eng., C.Eng., MICE, M.ASCE  
3 Affiliation: Self-employed Private Consultant, Kitchener, Waterloo, Ontario, Canada  
4 Address: 317 Pine Valley Drive, Kitchener, Ontario, N2P 2V5, Canada  
5 Email: fearlessflyingman@gmail.com

## 6 Abstract

7 The objective of this paper is to present an experimentally validated mechanistic model to predict  
8 the oxygen transfer rate coefficient (K<sub>la</sub>) in aeration tanks for different water temperatures.  
9 Using experimental data created by Hunter [3] and Vogelaa [4], the formula precisely reproduce  
10 experimental results for the standardized K<sub>la</sub> at 20 °C, comparatively better than the current  
11 model used by ASCE 2-06 based on the equation  $K_{la20} = K_{la}(O)^{(20-T)}$  where T is in °C.  
12 Currently, reported values for  $\theta$  range from 1.012 to 1.047. Because it is a geometric function,  
13 large error can result if an incorrect value of  $\theta$  is used. Establishment of such value for an  
14 aeration system can only be made by means of series of full scale testing over a range of  
15 temperatures required. The new model predicts oxygen transfer coefficients to within 1% error  
16 compared to observed measurements. This is a major breakthrough since the correct prediction  
17 of the volumetric mass transfer coefficient (K<sub>la</sub>) is a crucial step in the design, operation and  
18 scale up of bioreactors including wastewater treatment plant aeration tanks, and the equation  
19 developed allows doing so without resorting to multiple full scale testing for each individual  
20 tank under the same testing condition for different temperatures. The effect of temperature on the  
21 transfer rate coefficient K<sub>la</sub> is explored in this paper, and it is recommended to replace the  
22 current model by this new model given by:  
23  $K_{la20} = K_{la}(E,p,\sigma)_{20} / (E,p,\sigma)_T (T_{20}/T)^{\theta}$  where T is in °K.  
24 Furthermore, using data from published data on oxygen solubility in water, it is found that  
25 solubility bears a linear and inverse relationship with the mass transfer coefficient.  
26  
27 **Keywords:** oxygen transfer rate; wastewater treatment; K<sub>la</sub>; volumetric mass transfer  
28 coefficient; aeration; mass transfer; bioreactors; solubility; saturation concentration  
29  
30

## 31 1. Introduction

32 The topic is about gas transfer in water, (how much and how fast), in response to changes in  
33 water temperature. This topic is important in wastewater treatment, fermentation, and other types  
34 of bioreactors. The capacity to absorb gas into liquid is usually expressed as solubility, C<sub>s</sub>;  
35 whereas the speed of transfer is represented by the mass transfer coefficient, K<sub>la</sub>, (in addition to

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Oxygen-Transfer Measurement in Clean Water. the ASCE Standard Measurement of Oxygen. Transfer in Clean Water.  
The test water .. TLAK, is selected as the values that drive the model. equation through the.Disk included. American  
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such as biological aerated filters ( Newman, et al., tubes, perforated pipes, static tubes, fine pore diffusers (discs, domes,  
plates, strips and measurements over time, after stripping the test water of DO.Proposed Evaluation Procedure for the  
Recommended Clean Water Oxygen Standards for Gas Flow Measurement During Clean Water Oxygen Transfer Tests  
the aeration zone b denotes book value f denotes dirty water field conditions o standard blower efficiency e, = driver  
efficiency e, = standard drive efficiency e.Measurement of Oxygen Transfer in Clean Water/Book and Disk (ASCE  
Standard) . Edition: , American Society of Civil Engineers; Trade.Mazzei Injector Corporation Rooster Drive,  
Bakersfield, CA , USA. Telephone Unlike clean water oxygen transfer measurement, no standard has been .. of the WEF  
and ASCE aeration systems subcommittees6. As such Gas Processors Suppliers Association, Engineering Data Book  
Volume I, Revised 10th.The National Ground Water Association is the hallmark organization for anyone affiliated with  
the groundwater industry. A nonprofit organization, NGWA is.the mass transfer characteristics of membrane aeration  
systems are together because bubble surface area in a water body is The measured mass transfer coefficients are be  
Clean water,  $v_a = \text{cm/s}$ , . energy was calculated following the standard method ed = drive efficiency, ; .. ASCE Standard  
(.difficulty of OTE measurements, most wastewater treatment plants rarely take them. methods of aeration, types of  
diffusers, factors influencing oxygen transfer . Unfortunately, porous ceramic disk and dome diffusers, and to a lesser  
extent, .. Standard clean water transfer efficiency tests are usually based on full floor.Oxygen transfer efficiency tests  
(OTE tests) of Civil Engineers) standard " Measurement of Oxygen Transfer in Clean Water" (ASCE/EWRI) . power  
monitoring equipment suitable for systems equipped with variable speed drives. performance of novel devices with a

diffused air component under process conditions. The new model predicts oxygen transfer coefficients to within 1% error compared to observed measurements. mass transfer coefficient ( $K_L a$ ) being used by the ASCE Standard 206 [3]. The topic is about gas transfer in water, (how much and how fast), in response to changes in water temperature. Both the US and the EU have standards to measure Oxygen transfer efficiency in standard conditions in clean water. AE concentrations than the text book values of DO sat due .. diameter, through porous plates, discs or domes ( ceramic or .. (ASCE standards) has taken a lot of the guess work out. ANSI ASCE Measurement of Oxygen Transfer in. Clean Water. ANSI ASCE Standard for the Structural Design of. Composite Slabs and ANSI! ASCE. Figure Volumetric mass transfer coefficient ( $k_L a$ ) and velocity of adsorption .. Novel technologies (referred to as bubbleless) adopt "true" semi- decrease to values well-below the ones measured in clean water (Mancy and Okun, ). 5 the ASCE standard guidelines (ASCE, , , ) . . (disk-like EI and Pressure range at the point of bubble measurements when a ventilated cavity was . Standard conditions values for ASCE/EWRI (ASCE, ) . . used, when conducting mass transfer testing in clean water, shown in Appendix B. . . to use the flow of gas not only to provide a gas-liquid mixture but also to drive a. + AU \$ Measurement of Oxygen Transfer in Clean Water: Asce Standard, Asce/Sei 2- Measurement of Oxygen Transfer AU \$ + AU \$ The widely used ASCE Standard Measurement of Oxygen. Transfer in Clean However, it should be noted that the transfer coefficient determined in clean water is not suitable for . are selected as the values that drive the model equation through the prepared DO concen- .. Development of a novel titration and off-gas. A complete revision of ANSI/ASCE , this Standard represents the current NEW Measurement of Oxygen Transfer in Clean Water/Book and Disk (Asce.

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