

Effect of Attached Growth on Treatment Performance in Waste Stabilization Ponds

Yirui Lian, Liah X. Coggins, Jessica Hay, Andrew van de Ven and Anas Ghadouani *

Department of Civil, Environmental and Mining Engineering, The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia

* Correspondence: anas.ghadouani@uwa.edu.au; Tel.: +61-8-6488-2687

Tables

Table S1. List of equations.

Description	Formula	Reference
(1)	$e = \frac{V_{effective}}{V_{total}} = \frac{t_m}{t_n}$	Persson and Wittgren (2003)
(2)	$C_e = \frac{4a_1 * e^{1-a_1/2d}}{(1+a_1)^2} * C_i$	Polprasert and Bhattarai (1985)
(3)	$C_e = \frac{4a_1 * e^{1/2d}}{(1+a_1)^2 * e^{a_1/2d} - (1-a_1)^2 * e^{-a_1/2d}} * C_i$	Polprasert and Agarwalla (1994)
(4)	$C_e = \frac{2a_1 e^{1/2d}}{(1+a_1) * e^{a_1/2d} - (1-a_1) * e^{-a_1/2d}} * C_i$	Muttamara and Puetpaiboon (1997)
(5)	$d = 0.10201 \left(\frac{U_*}{u} \right)^{-0.81963} * \left(\frac{h}{L} \right) \left(\frac{h}{W} \right)^{-(0.98074 + \frac{1.38485h}{W})}$	Polprasert and Agarwalla (1994)
(6)	$d = \frac{0.184 * [tv * (W + 2h)]^{0.489} * W^{1.511}}{(L * h)^{1.489}}$	Polprasert and Bhattarai (1985)
(7)	$k = k_{fs} + a_s * \frac{\alpha\beta}{\alpha + \beta}$	Polprasert and Agarwalla (1994)
(8)	$k_{fs} = k_{fss} * \left\{ 1 - \frac{0.083 \left[\log \left(\frac{67.2}{L_0} \right) \right]}{k_{fss}} \right\}$	Thirumurthi (1974b), Polprasert and Agarwalla (1994)
(9)	$a_s = \frac{2}{W} + \frac{1}{h} + \frac{2}{L}$	Polprasert and Agarwalla (1994)
(10)	$a_s = \frac{2}{W} + \frac{1}{h} + \frac{2}{L} + n * \left(\frac{2h_1 l_1}{WhL} \right)$	Polprasert and Agarwalla (1994)

Table S2. Modelled effluent result (mg L⁻¹) of equation (2), (3), and (4).

Parameters	Pond 1	Pond 2 (baffle)
Observed	89	64
Equation (2)	~89.7	~65.5
Equation (3)	~89.2	~67.9
Equation (4)	~112.6	~92.9

Notes

1. The modelled effluent results of equation (3) and (4) are shown in Table S2.
2. Equation (2) is simplified and suitable for estimating BOD reduction if dispersion number (d) was less than 2.
3. Compared with equation (6), equation (5) has been validated with data of some full-scale ponds
4. Some of the parameters were obtained from other literature, of which d and k_{fa} are the most sensitive to the result, but the impact was within $\pm 1.5\%$ when varied by $\pm 10\%$; the effluent concentration will vary within ± 1 mg L⁻¹ depending on the precision of the values used in the calculation.