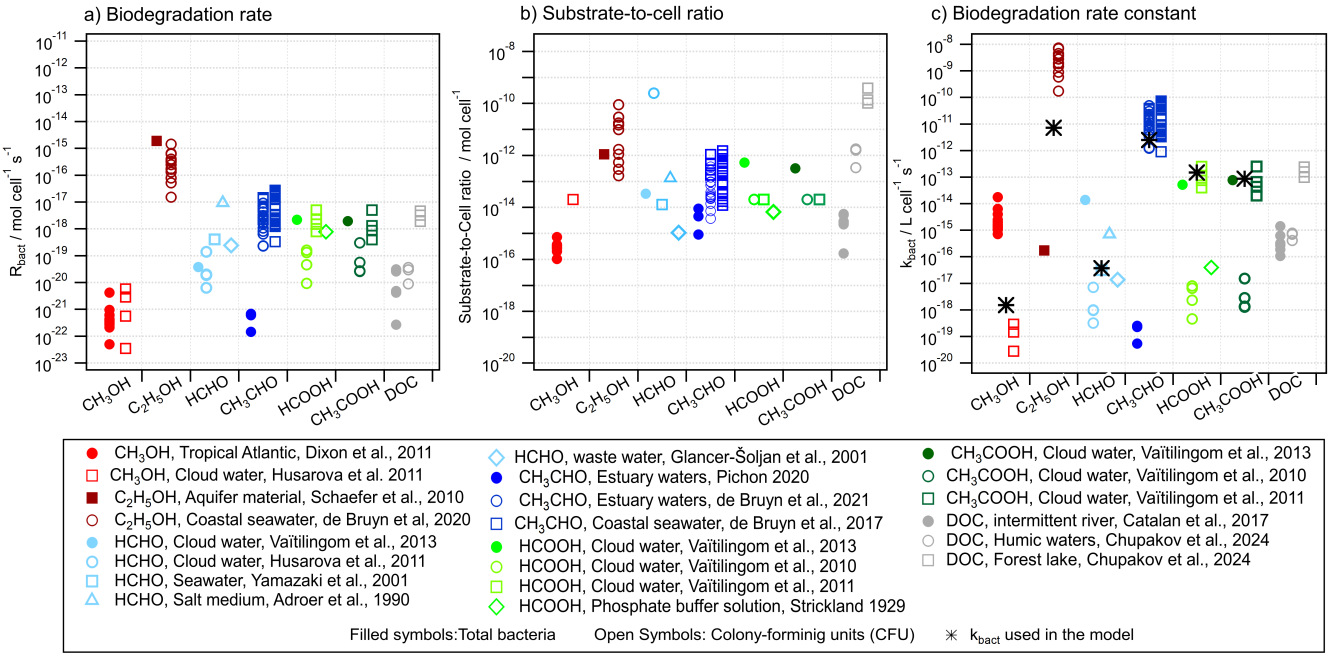

Figure S1. Literature data related to biodegradation rates in various aqueous environments: a) Biodegradation rates [mol cell^{-1} s^{-1}]; the original literature data and conversion are included in Table S1, b) ratios of organic substrates to bacteria cells [mol cell^{-1}], c) derived biodegradation rate constant k_{bact} [L cell^{-1} s^{-1}]. References: Dixon et al. (2011); Husárová et al. (2011); Schaefer et al. (2010); de Bruyn et al. (2020); Vaïtilingom et al. (2013); Yamazaki et al. (2001); Adroer et al. (1990); Glancer-Soljan et al. (2001); Pichon (2020); de Bruyn et al. (2021, 2017); Vaïtilingom et al. (2010, 2011); Stickland (1929); Catalán et al. (2017); Chupakov et al. (2024)

Table S1: Literature data of biodegradation rates in various aqueous environments.

Literature data						Calculated		
						R2nd	**kbact**	
						mol/cell/s	**L cell-1 s-1**	
Husarova Methanol, Cloud water								
	Observed rate	CH3OH	**Cell**				**kbact**	
	mol cell-1 s-1	mol L-1	mL-1				**L cell-1 s-1**	
	5.60E-22	0.02	1.00E+09	2.00E-14			2.80E-20	
	5.70E-21	0.02	1.00E+09	2.00E-14			2.85E-19	
	3.50E-23	0.02	1.00E+09	2.00E-14			1.75E-21	
	2.90E-21	0.02	1.00E+09	2.00E-14			1.45E-19	
	2.30E-21						**1.15E-19**	**Average**
Dixon et al 2011 Methanol, tropical Atlantic								
	Observed rate /	**[CH3OH]**	**Cell /mL**			**R2nd**	**kbact**	
	nmol/L/h	mol/L				**mol/cell/s**	**L cell-1 s-1**	
	5	2.41E-07	3.30E+05	7.30E-16		4.21E-21	1.75E-14	
	1	2.41E-07	7.37E+05	3.27E-16		3.77E-22	1.56E-15	
	1	2.41E-07	8.30E+05	2.90E-16		3.35E-22	1.39E-15	
	0.12	7.00E-08	6.71E+05	1.04E-16		4.97E-23	7.10E-16	
		7.00E-08						
		9.70E-08						
	1.3	1.54E-07	5.92E+05	2.60E-16		6.10E-22	3.96E-15	
	1.8	1.51E-07	5.29E+05	2.85E-16		9.45E-22	6.26E-15	
	0.61	2.26E-07	6.08E+05	3.72E-16		2.79E-22	1.23E-15	
	1.6	2.43E-07	7.41E+05	3.28E-16		6.00E-22	2.47E-15	
	1.2	2.15E-07	7.75E+05	2.77E-16		4.30E-22	2.00E-15	
	1.1	2.52E-07	7.16E+05	3.52E-16		4.27E-22	1.69E-15	
	0.86	2.78E-07	8.24E+05	3.37E-16		2.90E-22	1.04E-15	

	0.8	2.41E-07	8.28E+05	2.91E-16		2.68E-22	1.11E-15	
	1.2	2.96E-07	8.68E+05	3.41E-16		3.84E-22	1.30E-15	
	0.57	1.53E-07	7.55E+05	2.03E-16		2.10E-22	1.37E-15	
						6.72E-22	**3.11E-15**	**Average**
de Bruyn et al., 2020 Ethanol, coastal seawater								
	Observed rate	**[CH3OH]**	**Bacteria CFU**			**R2nd**	**kCFU**	
	min-1	mol L-1	mL-1			**mol/CFU/s**	**L CFU-1 s-1**	
9/14/2015	0.0143	8.90E-08	53	1.68E-12		4.00E-16	4.50E-09	
9/16/2015	0.0188	8.90E-08	540	1.65E-13		5.16E-17	5.80E-10	
9/28/2015	0.00065	8.90E-08	3	2.97E-11		3.21E-16	3.61E-09	
10/5/2015		8.90E-08	35	2.54E-12				
10/12/2015	0.00131	8.90E-08	3	2.97E-11		6.48E-16	7.28E-09	
10/26/2015	0.0005	8.90E-08	3	2.97E-11		2.47E-16	2.78E-09	
11/2/2015	8.80E-05	8.90E-08	1	8.90E-11		1.31E-16	1.47E-09	
11/13/2015	0.00097	8.90E-08	1	8.90E-11		1.44E-15	1.62E-08	
11/16/2015	0.00101	8.90E-08	9	9.89E-12		1.66E-16	1.87E-09	
12/7/2015	0.00113	8.90E-08	5	1.78E-11		3.35E-16	3.77E-09	
12/15/2015	0.00105	8.90E-08	9	9.89E-12		1.73E-16	1.94E-09	
1/8/2016	0.0017	8.90E-08	165	5.39E-13		1.53E-17	1.72E-10	
1/26/2016	0.00246	8.90E-08	6	1.48E-11		6.08E-16	6.83E-09	
2/4/2016	0.0163	8.90E-08	306	2.91E-13		7.90E-17	8.88E-10	
2/8/2016	0.00936	8.90E-08	80	1.11E-12		1.74E-16	1.95E-09	
2/15/2016	0.00411	8.90E-08	10	8.90E-12		6.10E-16	6.85E-09	
2/22/2016	0.00184	8.90E-08	14	6.36E-12		1.95E-16	2.19E-09	
3/2/2016	0.00146	8.90E-08	18	4.94E-12		1.20E-16	1.35E-09	
4/11/2016		8.90E-08	9	9.89E-12				
4/27/2016	0.000289	8.90E-08	13	6.85E-12		3.30E-17	3.71E-10	
						3.19E-16	**3.59E-09**	**Average**
Schaefer et al. 2010 Ethanol aquifer material								

	Observed rate		Cell			**R2nd**	**kbact**	
	day-1	mol L-1	mL-1			**mol/cell/s**	**L cell-1 s-1**	
	est based on Fig 2							
	0.15	1.10E-02	1.00E+07	1.10E-12		**1.91E-15**	**1.74E-16**	
Husarova et al. 2011 Formaldehyde Cloud water								
	Observed rate		**Cell**					
	mol cell-1 s-1	mol L-1	mL-1					
Pseudomonas graminis	1.90E-20	0.02	8.00E+04	2.50E-10			9.50E-19	
Pseudomonas sp.	1.40E-19	0.02	8.00E+04	2.50E-10			7.00E-18	
Frigoribacterium sp	6.40E-21	0.02	8.00E+04	2.50E-10			3.20E-19	
Bacillus sp	2.00E-20	0.02	8.00E+04	2.50E-10			1.00E-18	
	4.64E-20						**2.32E-18**	**Average**
Vaitilingom et al. 2013, Formaldehyde Cloud water								
	Observed rate					**mol/cell/s**	**L cell-1 s-1**	
	mol L-1 s-1							
Cloud water microorganisms	3.00E-12	2.70E-06	8.00E+04	3.38E-14		**3.75E-20**	**1.39E-14**	
Yamazaki et al 2001 formaldehyde seawater								
	Observed rate		**Cell**				**kCFU**	
	h-1		**mL-1**			**mol/CFU/s**	**L CFU-1 s-1**	
			est based on OD660					
HCHO resistant strain	1.13E-01	0.013	1.00E+09	1.30E-14		**4.06E-19**	**3.13E-17**	
Adroer et al 1990 formaldehyde in mineral salts medium								
	Observed rate	[HCHO]	**CFU**				**kCFU**	
	h-1	mg L-1	**mL-1**		mol L-1	**mol/CFU/s**	**L CFU-1 s-1**	

Pseudomonas putida	0.25	400	1.00E+08	1.33E-13	0.013	**9.25E-18**	**6.94E-16**	
Glancer-Šoljan et al., formaldehyde, waste water								
	Observed rate		**CFU**					
	h-1		**mL-1**				**kCFU**	
			converted from g		mol L-1	**mol/CFU/s**	**L CFU-1 s-1**	
	0.83	540	1.70E+10	1.06E-15	0.018	**2.44E-19**	**1.36E-17**	
de Bruyn et al. 2021 Acetaldehyde Estuary waters								
	Observed rate	**[CH3CHO]**	**Bacteria CFU**				**kCFU**	
	min-1	**mol L-1**	**mL-1**			**mol/CFU/s**	**L/CFU/s**	
9/29/2014	0.0056	1.85E-07	1900	9.74E-14		9.09E-18	4.91228E-11	
10/14/2014	0.0033	1.85E-07	4900	3.78E-14		2.08E-18	1.12245E-11	
10/28/2014	0.0007	1.85E-07	700	2.64E-13		3.08E-18	1.66667E-11	
11/3/2014	0.025	1.85E-07	50000	3.70E-15		1.54E-18	8.33333E-12	
11/10/2014	0.0044	1.85E-07						
11/17/2014	0.0009	1.85E-07	500	3.70E-13		5.55E-18	3E-11	
1/13/2015	0.011	1.85E-07	13200	1.40E-14		2.57E-18	1.38889E-11	
1/20/2015	0.0015	1.85E-07	7300	2.53E-14		6.34E-19	3.42466E-12	
1/22/2015	0.0006	1.85E-07	8200	2.26E-14		2.26E-19	1.21951E-12	
1/26/2015	0.0006	1.85E-07	1100	1.68E-13		1.68E-18	9.09091E-12	
2/3/2015	0.0013	1.85E-07						
2/9/2015	0.0018	1.85E-07	6900	2.68E-14		8.04E-19	4.34783E-12	
2/10/2015	0.0011	1.85E-07	2000	9.25E-14		1.70E-18	9.16667E-12	
2/17/2015	0.0009	1.85E-07	2600	7.12E-14		1.07E-18	5.76923E-12	
2/23/2015	0.0019	1.85E-07	25200	7.34E-15		2.32E-19	1.25661E-12	
3/2/2015	0.0082	1.85E-07	8700	2.13E-14		2.91E-18	1.57088E-11	

3/4/2015	0.0084	1.85E-07	6100	3.03E-14		4.25E-18	2.29508E-11	
3/9/2015	0.0012	1.85E-07	1300	1.42E-13		2.85E-18	1.53846E-11	
				8.72E-14		**2.52E-18**	**1.35972E-11**	**Average**

de Bruyn et al. 2017 Acetaldehyde Coastal Seawater

	Observed rate	**[CH3CHO]**	**Bacteria CFU**				**kCFU**	
	min-1	**mol L-1**	**mL-1**			**mol/CFU/s**	**L/CFU/s**	
1/21/2014	0.0005	3.72E-07						
1/27/2014	0.00073	3.72E-07						
2/4/2014	0.00151	3.72E-07	1350	2.76E-13		6.93481E-18	1.8642E-11	
2/11/2014	0.00077	3.72E-07	2110	1.76E-13		2.26256E-18	6.08215E-12	
2/17/2014	0.00175	3.72E-07	750	4.96E-13		1.44667E-17	3.88889E-11	
2/24/2014	0.0007	3.72E-07	340	1.09E-12		1.27647E-17	3.43137E-11	
3/3/2014	0.00536	3.72E-07	21500	1.73E-14		1.54567E-18	4.15504E-12	
3/5/2014	0.00391	3.72E-07	17300	2.15E-14		1.40127E-18	3.76686E-12	
3/10/2014	0.00202	3.72E-07	10200	3.65E-14		1.22784E-18	3.30065E-12	
3/13/2014	0.00212	3.72E-07	5100	7.29E-14		2.57725E-18	6.9281E-12	
3/18/2014	0.00127	3.72E-07	3900	9.54E-14		2.01897E-18	5.42735E-12	
3/20/2014	0.00122	3.72E-07	950	3.92E-13		7.96211E-18	2.14035E-11	
3/26/2014	0.00162	3.72E-07	4300	8.65E-14		2.33581E-18	6.27907E-12	
3/31/2014	0.00403	3.72E-07	10950	3.40E-14		2.28183E-18	6.13394E-12	
4/2/2014	0.00167	3.72E-07	31100	1.20E-14		3.32926E-19	8.94962E-13	
4/3/2014	0.00284	3.72E-07	9500	3.92E-14		1.85347E-18	4.98246E-12	
4/8/2014	0.00108	3.72E-07	350	1.06E-12		1.91314E-17	5.14286E-11	
4/10/2014	0.00242	3.72E-07	4700	7.91E-14		3.19234E-18	8.58156E-12	
4/17/2014	0.00244	3.72E-07	750	4.96E-13		2.01707E-17	5.42222E-11	
4/24/2014	0.00194	3.72E-07	750	4.96E-13		1.60373E-17	4.31111E-11	
4/28/2014	0.0044	3.72E-07	1500	2.48E-13		1.81867E-17	4.88889E-11	
5/1/2014	0.00106	3.72E-07	250	1.49E-12		2.6288E-17	7.06667E-11	
5/6/2014	0.00111	3.72E-07	500	7.44E-13		1.3764E-17	3.7E-11	

5/13/2014	0.00264	3.72E-07	1200	3.10E-13		1.364E-17	3.66667E-11	
5/19/2014	0.00292	3.72E-07	740	5.03E-13		2.44649E-17	6.57658E-11	
6/4/2014	0.0028	3.72E-07	633	5.88E-13		2.7425E-17	7.3723E-11	
6/9/2014	0.00235	3.72E-07	680	5.47E-13		2.14265E-17	5.7598E-11	
6/23/2014	0.00147	3.72E-07	733	5.08E-13		1.24338E-17	3.34243E-11	
				3.81E-13		**1.06202E-17**	**2.85491E-11**	**Average**
Pichon 2020 Estuary Waters								
	Observed rate	**[CH3CHO]**	Cell					
	day-1	**mol L-1**	mL-1					
	assuming 1s order loss during primary enrichment		est. from Fig 2.4					
Hythe	0.014	0.0027	3.00E+09	9.00E-16		1.46E-22	5.40E-20	
Wivenhoe	0.0058	0.0027	3.00E+08	9.00E-15		6.04E-22	2.24E-19	
Brightlingsea	0.013	0.0027	6.00E+08	4.50E-15		6.77E-22	2.51E-19	
Stickland 1929 formic acid								
	Observed rate	[HCHO]	CFU				**kCFU**	
	h-1	mol L-1	mL-1			**mol/CFU/s**	**L CFU-1 s-1**	
	estimate from figs							
	0.7	0.02	5.00E+09	4.00E-15		**7.78E-19**	**3.89E-17**	
Vaitilingom et al. 2010 Formic acid Cloud water								
	Observed rate						**kCFU**	
	mol/CFU/s						**L CFU-1 s-1**	
Sphingomonas sp	9.20E-21	0.02	1.00E+09	2.00E-14			4.60E-19	
Pseudomonas graminis	1.30E-19	0.02	1.00E+09	2.00E-14			6.50E-18	

Pseudomonas sp.	4.60E-20	0.02	1.00E+09	2.00E-14			2.30E-18	
Pseudomonas viridiflava	1.60E-19	0.02	1.00E+09	2.00E-14			8.00E-18	
	8.63E-20			**2.00E-14**			**4.32E-18**	**Average**
Vaitilingom et al. 2011 Formic acid Cloud water								
	Observed rate						**kCFU**	
	mol/CFU/s						**L CFU-1 s-1**	
Rhodococcus sp	8.00E-19	2.00E-05	1.00E+06	2.00E-14			4.00E-14	
Pseudomonas sp.	1.50E-18	2.00E-05	1.00E+06	2.00E-14			7.50E-14	
Pseudomona syringae	2.30E-18	2.00E-05	1.00E+06	2.00E-14			1.15E-13	
Pseudomonas graminis	5.00E-18	2.00E-05	1.00E+06	2.00E-14			2.50E-13	
	2.40E-18			**2.00E-14**			**1.20E-13**	**Average**
Vaitilingom et al. 2013 Formic acid Cloud water								
	Observed rate					**R2nd**	**kbact**	
	mol L-1 s-1					**mol/cell/s**	**L cell-1 s-1**	
Cloud water microorganisms	1.75E-10	4.27E-05	8.00E+04	5.34E-13		**2.19E-18**	**5.12E-14**	
Catalan et al. 2016 DOM intermittent river								
	Observed rate (LMWS)	**DOC**	**[Cell]**	**Org/Cell or Org/CFU**	**DOC**			
	h-1	**mg C L-1**	**mL-1**	**mol cell-1, mol CFU-1**	**mol/L**			
			(Fig S2)		assuming Mw(LMWS) = 100 g/mol			
A_Pool	0.0027	3.9	7.00E+06	5.57E-15	3.90E-05	4.18E-21	1.07E-16	
B_Pool	0.018	4.2	8.10E+06	5.19E-15	4.20E-05	2.59E-20	6.17E-16	
C_Run	0.0057	0.1	5.90E+06	1.69E-16	1.00E-06	2.68E-22	2.68E-16	

D_Run	0.0078	1.5	6.80E+06	2.21E-15	1.50E-05	4.78E-21	3.19E-16	
E_WTail	0.0055	2.4	8.20E+06	2.93E-15	2.40E-05	4.47E-21	1.86E-16	
F_WDam	0.0432	2.2	8.60E+06	2.56E-15	2.20E-05	3.07E-20	1.40E-15	
						1.17E-20	**4.82E-16**	**Average**
Chupakov et al 2024 DOM Boreal humic waters (oligotrophic)								
	Observed rate	**DOC**	**CFU**		**DOC**	**R2nd**	**kbact**	
	mg C L-1 d-1	**mg L-1**	**mL-1**		mol L-1	**mol/cell/s**	**L CFU-1 s-1**	
					assumption: Mw = 1000 g/mol			
Piezometer water	0.17	87.6	5.46E+04	1.61E-12	8.76E-05	3.61E-20	4.12E-16	
Peatland pool	0.029	12.7	3.79E+04	3.35E-13	1.27E-05	8.86E-21	6.97E-16	
Outlet stream	0.0555	38.4	2.16E+04	1.78E-12	3.84E-05	2.97E-20	7.74E-16	
						2.49E-20	**6.28E-16**	**Average**
Forest lake (Jun)	0.02	19.2	5.00E+01	3.84E-10	1.92E-05	4.63E-18	2.41E-13	
Forest lake (Aug)	0.031	19.5	1.90E+02	1.03E-10	1.95E-05	1.89E-18	9.68E-14	
Forest lake (Oct)	0.042	20.6	1.50E+02	1.37E-10	2.06E-05	3.24E-18	1.57E-13	
						3.25E-18	**1.65E-13**	**Average**

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