

INHIBITORY CHEMICALS

BIOLOGICAL WASTEWATER TREATMENT

Potential toxicity

There are a number of substances that can be toxic or inhibitory to the activated sludge process. Tables 11.1 and 11.2 provide information on concentrations that can be inhibitory or lethal to the biomass.

Inhibitory chemicals		
Pollutant	Reported range of activated sludge inhibition threshold levels, mg/L	References*
Metals/nonmetal inorganics		
Ammonia	480	(4)
Arsenic	0.1	(1), (2), (3)
Cadmium	1-10	(2), (3)
Chromium (VI)	1	(2), (3)
Chromium (III)	10 -50	(2), (3)
Chromium (Total)	1 - 100	(1)
Copper	1	(2), (1), (3)
Cyanide	0.1 - 5 5	(1), (2), (3) (1)
Iodine	10	(4)
Lead	1.0 - 5.0 10 - 100	(3) (1)
Mercury	0.1 - 1 2.5 as Hg (II)	(2), (3) (1)
Nickel	1.0 - 2.5 5	(2), (3) (1)
Sulfide	25 - 30	(4)
Zinc	0.3 - 5	(3), (1)
Organics		
Anthracene	500	(1)
Benzene	100 - 500, 125 - 500	(3), (1)
2-Chlorophenol	5, 20 - 200	(2), (3)
1,2 Dichlorobenzene	5	(2)
1,3 Dichlorobenzene	5	(2)
1,4 Dichlorobenzene	5	(2)
2,4 Dichlorophenol	64	(3)
2,4 Dimethylphenol	40 - 200	(3)
2,4 Dinitrotoluene	5	(2)
1,2 Diphenylhydrazine	5	(2)
Ethylbenzene	200	(3)
Hexachlorobenzene	5	(2)
Naphthalene	500, 500, 500	(1), (2), (3)
Nitrobenzene	30 - 500, 500, 500	(3), (1), (2)

Table 1. Chemicals inhibitory to biological treatment

* = References are listed at the end of this document.

Inhibitory chemicals		
Pollutant	Reported range of activated sludge inhibition threshold Levels, mg/L	References
Pentachlorophenol	0.95, 50, 75 - 150	(2), (3), (1)
Phenanthrene	500, 500	(1), (2)
Phenol	50 - 200, 200, 200	(3), (2), (1)
Toluene	200	(3)
2, 4, 6 Trichlorophenol	50 - 100	(1)
Surfactants	100 - 500	(4)

Table 2. Chemicals inhibitory to biological treatment

Inhibitory chemicals		
Pollutant	Reported range of trickling Filter Inhibition Threshold Levels, mg/L	References
Chromium (III)	3.5 - 67.6	(1)
Cyanide	30	(1)

Table 3. Chemicals inhibitory to biological treatment

Inhibitory chemicals		
Pollutant	Reported range of nitrification inhibition threshold levels, mg/L	References
Arsenic	1.5	(2)
Cadmium	5.2	(1), (2)
Chloride	180	(4)
Chromium (VI)	1 - 10 [as (CrO ₄) ²⁻]	(1)
Copper	0.05 - 0.48	(2), (3)
Cyanide	0.34 - 0.5	(2), (3)
Lead	0.5	(2), (3)
Nickel	0.25 - 0.5, 5	(2), (3), (1)
Zinc	0.08 - 0.5	(2), (3)
Organics		
Chloroform	10	(2)
2,4 Dichlorophenol	64	(3)
2,4 Dinitrophenol	150	(2)
Phenol	4, 4 - 10	(2), (3)

Table 4. Chemicals inhibitory to biological treatment

Inhibitory chemicals		
Pollutant	Reported range of anaerobic digestion inhibition threshold levels, mg/L	References
Metals/Nonmetal inorganics		
Ammonia	1500 - 8000	(4)
Arsenic	1.6	(1)
Cadmium	20	(3)
Chromium (III)	130	(3)
Chromium (VI)	110	(3)
Copper	40	(3)
Cyanide	4 - 100, 1 - 4	(1), (2), (3)
Lead	340	(3)
Nickel	10, 136	(2), (3), (1)
Silver	13 - 65**	(3)
Sulfate	500 - 1000	(4)
Sulfide	50 - 100	(4)
Zinc	400	(3)
Organics		
Acrylonitrile	5, 5	(3), (2)
Carbon Tetrachloride	2.9 - 159.4, 10 - 20, 2.0	(1), (3), (2)
Chlorobenzene	0.96 - 3, 0.96	(1), (2)
Chloroform	1, 5 - 16, 10 - 16	(2), (1), (3)
1,2 Dichlorobenzene	0.23 - 3.8, 0.23	(1), (2)
1,4 Dichlorobenzene	1.4 - 5.3, 1.4	(1), (2)
Methyl chloride	3.3 - 536.4, 100	(1), (2)
Pentachlorophenol	0.2, 0.2 - 1.8	(2), (1)
Tetrachloroethylene	20	(2)
Trichloroethylene	1 - 20, 20, 20	(1), (2), (3)
Trichlorofluoromethane	-	(2)

Table 5. Chemicals inhibitory to biological treatment

* = Total pollutant inhibition levels, unless otherwise dictated.

** = Dissolved metal inhibition levels.

References

EPA's Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, December 1987, pp. 3-44 to 3-49.

(1) Jenkins, D.I., and Associates. 1984. *Impact of Toxics on Treatment Literature Review*.

(2) Russell, L. L., C. B. Cain, and D.I. Jenkins. 1984. *Impacts of Priority Pollutants on Publicly Owned Treated Works Processes: A Literature Review*. 1984 Purdue Industrial Waste Conference.

(3) Anthony, R. M., and L. H. Briemburst. 1981. *Determining Maximum Influent Concentrations of Priority Pollutants for Treatment Plants*. *Journal Water Pollution Control Federation* 53(10):1457-1468. \

(4) U.S. EPA. 1986, *Working Document; Interferences at Publicly Owned Treatment Works*. September 1986

Activated Sludge, Manual of Practice OM-9; Water Pollution Control Federation, 1987.



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