

## Pollutant Removal Efficiencies for Wastewater Treatment Unit Processes (Dataset)

This dataset presents the removal efficiency of 37 unit processes for 11 parameters in [%]. For each parameter, 3 removal efficiencies are indicated: min, average and max, referring to minimal, average or maximal performance of unit processes.

Most data are from WASWARPLAMO (Adewumi 2011) that is based on WTRNet (Joksimović 2006). The data have been reviewed and updated in the frame of an expert workshop that took place at FHNW, on 6.11.2013 in Muttenz, Switzerland. Experts included: Prof. Thomas Wintgens, Dr Christian Kazner, Dr Rita Hochstrat, Thomas Gross and Emmanuel Oertlé. Additional data input from (Asano, Burton, and Leverenz 2007; Salgot and Huertas 2006; Hammer and Hammer 2012) and estimations.

**Table for the First 6 Parameters**

Name	Turbidity			TSS			BOD			COD			TN			TP		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max
Bar screen	0	0	0	0	2	5	0	2	2.50	0	1.30	1.50	0	0	0	0	0	0
Coarse screen	0	0	0	0	5	15	2	4	6	1	2	3	0	0	0	0	0	0
Grit Chamber	1	2	3	1	2	3	0	2	5	0	2	5	0	0	0	0	0	0
Equalization Basin	0	0	0	0	0	0	4	12	15	4	12	15	0	0	0	0	0	0
Sedimentation without coagulant	0	0	0	30	50	60	20	25	30	20	25	30	5	7	9	5	7	9

Name	Turbidity			TSS			BOD			COD			TN			TP		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max
Sedimentation with coagulant	50	70	80	60	70	80	40	50	60	40	50	60	0	15	30	40	50	60
Anaerobic stabilization ponds	15	70	75	30	45	60	40	65	90	30	58	85	25	48	70	5	7	10
Activated sludge	80	90	99	50	70	99	50	70	99	60	80	94	10	30	96	10	23	45
Low Loaded Activated Sludge w/o de-N + Sec Sedim.	89	98	99	90	97	98	95	97	98	87	90	94	10	30	50	10	22.50	45
Low Loaded Activated Sludge w de-N + sec. Sedim.	93	98	99	90	97	99	93	98	99	87	90	94	68	87	96	10	27.50	45
High Loaded Activated Sludge + Sec. Sedim.	89	97	99	86	96	98	89	95	99	85	90	94	10	20	30	10	17.50	25
Extended aeration	90	99	99	82	88	79	85	90	95	89	90	95	50	72	90	90	99.90	99.90

Name	Turbidity			TSS			BOD			COD			TN			TP		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max
Trickling filter with secondary sedimentation	20	30	45	50	70	85	50	70	85	65	80	90	20	30	40	20	30	40
Rotating biological contactor (RBC)	50	70	85	35	60	70	35	60	70	65	70	85	20	30	35	20	30	40
Stabilization ponds: Aerobic	50	60	75	30	45	60	40	60	80	35	40	60	25	45	60	20	40	50
Stabilization ponds: Facultative	40	50	60	50	70	85	50	70	85	60	80	90	20	40	60	25	50	70
Membrane bioreactor (MBR)	90	92	95	90	92	100	90	92	95	75	80	85	30	40	50	60	70	80
Constructed wetland	10	15	40	60	75	85	25	35	50	10	15	20	50	60	80	50	60	80
Enhanced biological phosphorus removal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	95	98

Name	Turbidity			TSS			BOD			COD			TN			TP		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max
(EBPR)																		
P-Precipitation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	95	98
Denitrification	0	0	0	0	0	0	0	0	0	0	0	0	50	95	98	0	0	0
Dual media filter	80	90	95	80	90	95	65	75	80	60	70	75	5	10	12	6	10	12
Microfiltration	85	90	95	80	90	95	65	75	80	60	70	75	5	10	12	6	10	12
Ultrafiltration	80	90	95	80	90	95	65	75	80	60	70	75	5	10	12	6	10	12
Nanofiltration	30	50	70	99	99.95	99.90	80	90	95	80	90	95	40	40	40	90	95	99
Reverse osmosis	30	50	70	80	90	95	20	35	50	60	70	75	40	40	40	80	90	95
Activated Carbon	20	40	60	40	45	50	40	45	50	20	30	40	0	0	0	8	15	25
Ion exchange	10	20	30	40	45	50	10	20	30	0	0	0	60	70	80	70	80	90



**Table for the Last 6 Parameters**

Name	FC			TC			Conductivity			Nitrate			Virus			Virus (log removed)		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	av	max
Bar screen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse screen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grit Chamber	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equalization Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedimentation without coagulant	0	0	0	0	0	0	0	0	0	0	0	0	0	68.38	90	0	0.50	1
Sedimentation with coagulant	10	15	30	5	10	20	-10	-5	0	0	0	0	0	68.38	90	0	0.50	1
Anaerobic stabilization ponds	30	50	60	20	35	45	0	0	0	90	95	100	90	99.68	99.99	1	2.50	4
Activated sludge	50	90	99.90	90	95	99.90	0	0	0	-20	0	20	0	90	99	0	1	2
Low Loaded Activated Sludge w/o de-N + Sec Sedim.	99.50	99.80	99.92	99.90	99.95	99.99	0	0	0	-20	0	20	0	90	90	0	1	1
Low Loaded Activated Sludge w de-N + sec. Sedim.	99.50	99.80	99.92	99.90	99.95	99.99	0	0	0	-20	0	20	0	90	90	0	1	1
High Loaded Activated Sludge + Sec. Sedim.	50	90	98	90	95	99.90	0	0	0	-20	0	20	0	90	68.38	0	1	0.50

Name	FC			TC			Conductivity			Nitrate			Virus			Virus (log removed)		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	av	max
Extended aeration	90	94.95	99.90	90	94.95	99.90	0	0	0	-20	0	20	0	90	99	0	1	2
Trickling filter with secondary sedimentation	60	80	90	50	60	75	0	0	0	0	0	0	0	90	99	0	1	2
Rotating biological contactor (RBC)	60	80	90	50	60	75	0	0	0	0	0	0	0	43.77	68.38	0	0.25	0.50
Stabilization ponds: Aerobic	10	15	30	5	10	20	0	0	0	-10	-5	0	90	96.84	99	1	1.50	2
Stabilization ponds: Facultative	10	15	30	10	20	30	0	0	0	-10	-5	0	90	99.68	99.99	1	2.50	4
Membrane bioreactor (MBR)	80	85	90	70	75	80	0	0	0	0	50	90	99.68	99.99	100	2.50	4.25	6
Constructed wetland	0	50	99	0	0	0	0	0	0	0	50	90	90	96.84	99	1	1.50	2
Enhanced biological phosphorus removal (EBPR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P-Precipitation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denitrification	0	0	0	0	0	0	0	0	0	70	90	100	0	0	0	0	0	0
Dual media filter	80	85	90	80	85	90	0	0	0	5	10	12	90	99	99.90	1	2	3
Microfiltration	90	93	99	80	85	90	0	0	0	0	0	0	0	90	99	0	1	2

Name	FC			TC			Conductivity			Nitrate			Virus			Virus (log removed)		
	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	% av.	max	min	av	max
Ultrafiltration	99	99.90	99.99	80	85	90	0	0	0	0	0	0	99	100	100	2	4.50	7
Nanofiltration	99	100	100	90	93	95	20	60	90	20	50	80	99.90	99.99	100	3	4	5
Reverse osmosis	90	95	98	90	93	95	80	90	99	65	75	80	99.99	100	100	4	5.50	7
Activated Carbon	15	30	40	10	20	30	0	0	0	0	0	0	0	43.77	68.38	0	0.25	0.50
Ion exchange	0	0	0	0	0	0							0	0	0	0	0	0
Advanced oxidation process	90	92.50	95	55	65	75	0	0	0	0	0	0	90	96.84	99	1	1.50	2
Soil-aquifer treatment (SAT)	70	90	100	65	70	75	0	0	0	80	90	100	29.21	91.59	99	0.15	1.08	2
Maturation pond	30	50	70	20	35	50	0	0	0	-20	-10	0	99.90	99.97	99.99	3	3.50	4
Flocculation	10	20	40	5	15	20	0	0	0	0	0	0	90	99	99.90	1	2	3
Electrodialysis	0	0	0	0	0	0	60	75	90	20	40	50	0	0	0	0	0	0
Ozonation	90	95	98	90	92	95	0	0	0	0	0	0	99.90	100	100	3	4.50	6
Chlorine gas	90	95	100	100	100	100	0	0	0	0	0	0	99	99.90	100	2	3	6
Chlorine dioxide	90	95	100	100	100	100	0	0	0	0	0	0	99	99.90	100	2	3	6
Ultraviolet disinfection	90	95	100	55	65	80	0	0	0	0	0	0	99	99.90	100	2	3	6



## References

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