

Exercises III: organic micropollutant treatment II

Applied wastewater engineering

Exercise 1: Ozone contactor

The wastewater treatment plant of Terre Sainte is mandating you to design an ozone contactor to treat their secondary clarified wastewater. The current plant treats a maximum flowrate during rainy weather of 229 L/s. The average flow rate in 2015 was 6'000 m³/day.

- What is the required volume of the ozone contactor for a minimal residence time of 15 minutes?
- The community would like to know how much ozone the installation would use per day (kgO₃/d) for average and design DOC levels and average flow in 2020. Use the values of 2015 and assume an increase of 10 % of the average flowrate value. You decide that the ozone should be dosed at 0.5 g O₃/ g DOC. The ozone transfer efficiency will be 98 %. For a first estimation, you neglect the ozone consumption of nitrites.

Table 1: Average pollutant concentrations of the secondary clarified wastewater of the wastewater treatment plant of Terre Sainte, 2015.

pollutant	unit	concentration
TSS	mg/L	5.5
COD	mg/L	16.0
DOC	mg/L	6.1

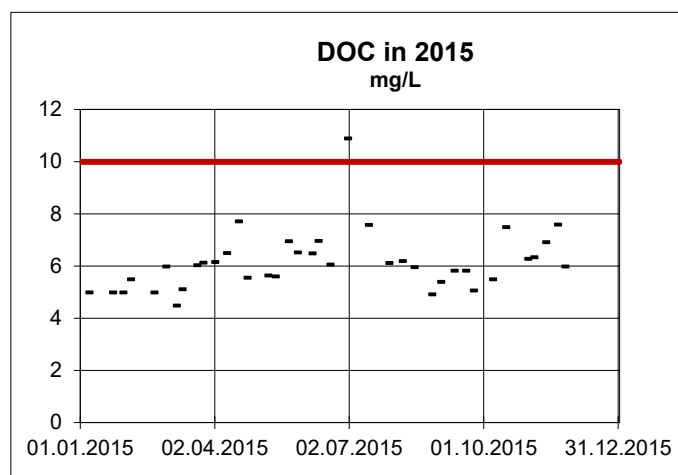


Figure 1: Measured DOC content of the secondary clarified wastewater of the wastewater treatment plant of Terre Sainte, 2015.

Exercise 2: The legislation about micropollutants

- a) What are the main differences between the old (before 2016) and the new legislation concerning organic micropollutants?
- b) By what means does the Swiss law reduce the introduction of inorganic micropollutants into the environment?

Exercise 3: Activated carbon dosage

A wastewater treatment plant treating the wastewater of 25'000 PE is planning to construct an organic micropollutant treatment using powdered activated carbon. In average, each PE evacuates 150 L of wastewater per day. Furthermore, the wastewater contains 40 % infiltration water. The average DOC concentration after biological treatment is 7 mg/L.

- a) The community contracts you to compute how much activated carbon they will use per day and per year. You estimated that they will require a maximum of 2 mg of powdered activated carbon/mg DOC.
- b) Furthermore, they would like to know how much additional sludge (expressed in %) would be generated in average due to powdered activated carbon treatment in summer (water temperature 20°C). Use the following table to estimate the actual sludge production (the residence time in the primary clarifier is 2.0 hours):

Table 2: Sludge production [g/(PE·d)] for a nitrifying activated sludge plant with a sludge age of 10 day.

nitrifying activated sludge plant (minimal sludge age 10 days)					
residence time in primary clarifier	temperature	sludge production		volatile solids fraction	
		85 th percentile	50 th percentile	85 th percentile	50 th percentile
[h]	[°C]	[g/(PE·d)]	[g/(PE·d)]	[%]	[%]
0.5	10	49	37	73	73
0.5	20	43	34	70	70
1.0	10	43	33	73	72
1.0	20	39	31	70	70
2.0	10	29	29	72	71
2.0	20	28	28	69	71