

Influent characteristics

SI = 27.2262 mg COD/l
SS = 58.1762 mg COD/l
XI = 92.499 mg COD/l
XS = 363.9435 mg COD/l
XBH = 50.6833 mg COD/l
XBA = 0 mg COD/l
XP = 0 mg COD/l
SO = 0 mg -COD/l
SNO = 0 mg N/l
SNH = 23.8595 mg N/l
SND = 5.6516 mg N/l
XND = 16.1298 mg N/l
SALK = 7 mol HCO3/m3
TSS = 380.3443 mg SS/l
Flow rate = 20648.3612 m3/d
Temperature = 14.8581 degC

Flow conditions

Influent flow rate to WWTP = 20648.3612 m3/d
Primary clarifier feed flow rate = 21086.3838 m3/d
Primary clarifier sludge flow rate = 147.6047 m3/d
Primary clarifier effluent flow rate = 20938.7791 m3/d
Influent flow rate to AS = 103530.7791 m3/d
Internal recirculation flow rate = 61944 m3/d
Settler feed flow rate = 41588.7791 m3/d
Settler effluent flow rate = 20640.7791 m3/d
Returned sludge flow rate = 20648 m3/d
Wastage sludge flow rate = 300 m3/d
Thickener feed flow rate = 300 m3/d
Thickener sludge flow rate = 30.8628 m3/d
Thickener effluent flow rate = 269.1372 m3/d
Digester feed flow rate = 178.4674 m3/d
Digester output flow rate = 178.4674 m3/d
Dewatering feed flow rate = 178.4674 m3/d
Dewatering sludge flow rate = 9.5821 m3/d
Dewatering effluent flow rate = 168.8853 m3/d
Storage tank feed flow rate (not bypass) = 0 m3/d
Storage tank effluent flow rate = 0 m3/d
Storage tank bypass flow rate = 168.8853 m3/d
Effluent flow rate = 20640.7791 m3/d
Sludge disposal flow rate = 9.5821 m3/d

Primary clarifier effluent

SI = 28.067 mg COD/l
SS = 59.0473 mg COD/l
XI = 49.3363 mg COD/l
XS = 186.5845 mg COD/l
XBH = 26.6115 mg COD/l
XBA = 0.049484 mg COD/l
XP = 0.34149 mg COD/l
SO = 0.017547 mg -COD/l
SNO = 0.11736 mg N/l
SNH = 34.9215 mg N/l
SND = 5.5457 mg N/l
XND = 8.2683 mg N/l
SALK = 7.6965 mol HCO3/m3

TSS = 197.1925 mg SS/l
Flow rate = 20938.7791 m3/d
Temperature = 14.8581 degC

Primary clarifier underflow

SI = 28.067 mg COD/l
SS = 59.0473 mg COD/l
XI = 6480.6885 mg COD/l
XS = 24509.2827 mg COD/l
XBH = 3495.6259 mg COD/l
XBA = 6.5001 mg COD/l
XP = 44.8572 mg COD/l
SO = 0.017547 mg -COD/l
SNO = 0.11736 mg N/l
SNH = 34.9215 mg N/l
SND = 5.5457 mg N/l
XND = 1086.1057 mg N/l
SALK = 7.6965 mol HCO3/m3
TSS = 25902.7158 mg SS/l
Flow rate = 147.6047 m3/d
Temperature = 14.8581 degC

Input to AS

SI = 28.0648 mg COD/l
SS = 12.4793 mg COD/l
XI = 1532.2905 mg COD/l
XS = 69.4433 mg COD/l
XBH = 2232.9521 mg COD/l
XBA = 166.7684 mg COD/l
XP = 964.1366 mg COD/l
SO = 1.1003 mg -COD/l
SNO = 7.3589 mg N/l
SNH = 7.1892 mg N/l
SND = 1.5679 mg N/l
XND = 4.0493 mg N/l
SALK = 5.198 mol HCO3/m3
TSS = 3724.1931 mg SS/l
Flow rate = 103530.7791 m3/d
Temperature = 14.8581 degC

AS reactor 1

SI = 28.0643 mg COD/l
SS = 3.0503 mg COD/l
XI = 1532.2609 mg COD/l
XS = 63.0433 mg COD/l
XBH = 2245.0634 mg COD/l
XBA = 166.6699 mg COD/l
XP = 964.8992 mg COD/l
SO = 0.0093422 mg -COD/l
SNO = 3.935 mg N/l
SNH = 6.8924 mg N/l
SND = 0.95797 mg N/l
XND = 3.8453 mg N/l
SALK = 5.4213 mol HCO3/m3
TSS = 3728.9525 mg SS/l
Flow rate = 103532.7791 m3/d
Temperature = 14.8581 degC

AS reactor 2

SI = 28.0643 mg COD/l
SS = 1.3412 mg COD/l
XI = 1532.2609 mg COD/l
XS = 58.8579 mg COD/l
XBH = 2245.3852 mg COD/l
XBA = 166.5512 mg COD/l
XP = 965.6805 mg COD/l
SO = 0.00010907 mg -COD/l
SNO = 2.2207 mg N/l
SNH = 7.2028 mg N/l
SND = 0.68624 mg N/l
XND = 3.7424 mg N/l
SALK = 5.5659 mol HCO3/m3
TSS = 3726.5518 mg SS/l
Flow rate = 103532.7791 m3/d
Temperature = 14.8581 degC

AS reactor 3

SI = 28.0643 mg COD/l
SS = 0.95531 mg COD/l
XI = 1532.2609 mg COD/l
XS = 46.2983 mg COD/l
XBH = 2246.7994 mg COD/l
XBA = 167.3077 mg COD/l
XP = 967.2442 mg COD/l
SO = 0.46635 mg -COD/l
SNO = 5.5141 mg N/l
SNH = 3.4247 mg N/l
SND = 0.65129 mg N/l
XND = 3.1405 mg N/l
SALK = 5.0608 mol HCO3/m3
TSS = 3719.9329 mg SS/l
Flow rate = 103532.7791 m3/d
Temperature = 14.8581 degC

AS reactor 4

SI = 28.0643 mg COD/l
SS = 0.78055 mg COD/l
XI = 1532.2609 mg COD/l
XS = 37.3881 mg COD/l
XBH = 2245.6315 mg COD/l
XBA = 167.8339 mg COD/l
XP = 968.8072 mg COD/l
SO = 1.4284 mg -COD/l
SNO = 8.4066 mg N/l
SNH = 0.69216 mg N/l
SND = 0.60938 mg N/l
XND = 2.6815 mg N/l
SALK = 4.659 mol HCO3/m3
TSS = 3713.9412 mg SS/l
Flow rate = 103532.7791 m3/d
Temperature = 14.8581 degC

AS reactor 5

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l

XI = 1532.2609 mg COD/l
XS = 31.9144 mg COD/l
XBH = 2242.1274 mg COD/l
XBA = 167.8482 mg COD/l
XP = 970.3678 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 2.3926 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 3708.389 mg SS/l
Flow rate = 103532.7791 m3/d
temperature = 14.8581 degC

Settler underflow

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l
XI = 3036.2175 mg COD/l
XS = 63.2392 mg COD/l
XBH = 4442.8377 mg COD/l
XBA = 332.5958 mg COD/l
XP = 1922.8108 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 4.7411 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 7348.2757 mg SS/l
Flow rate = 20648 m3/d
Temperature = 14.8581 degC

Settler effluent

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l
XI = 5.9191 mg COD/l
XS = 0.12329 mg COD/l
XBH = 8.6614 mg COD/l
XBA = 0.6484 mg COD/l
XP = 3.7485 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 0.0092428 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 14.3255 mg SS/l
Flow rate = 20640.7791 m3/d
Temperature = 14.8581 degC

Settler internal (1 is top layer)

TSS1 = 14.3255 mg SS/l
TSS2 = 20.8756 mg SS/l
TSS3 = 34.2948 mg SS/l
TSS4 = 81.0276 mg SS/l
TSS5 = 423.2035 mg SS/l
TSS6 = 423.2035 mg SS/l

TSS7 = 423.2035 mg SS/l
TSS8 = 423.2035 mg SS/l
TSS9 = 3710.5517 mg SS/l
TSS10 = 7348.2757 mg SS/l

Thickener effluent

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l
XI = 67.6878 mg COD/l
XS = 1.4098 mg COD/l
XBH = 99.0462 mg COD/l
XBA = 7.4147 mg COD/l
XP = 42.8661 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 0.10569 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 163.8185 mg SS/l
Flow rate = 269.1372 m3/d
Temperature = 14.8581 degC

Thickener underflow

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l
XI = 28923.142 mg COD/l
XS = 602.4198 mg COD/l
XBH = 42322.6689 mg COD/l
XBA = 3168.3222 mg COD/l
XP = 18316.7804 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 45.1636 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 70000 mg SS/l
Flow rate = 30.8628 m3/d
Temperature = 14.8581 degC

Anaerobic digester influent (pre ASM2ADM interface)

SI = 28.0665 mg COD/l
SS = 48.9526 mg COD/l
XI = 10361.7101 mg COD/l
XS = 20375.0176 mg COD/l
XBH = 10210.0698 mg COD/l
XBA = 553.2808 mg COD/l
XP = 3204.6601 mg COD/l
SO = 0.25225 mg -COD/l
SNO = 1.6871 mg N/l
SNH = 28.9098 mg N/l
SND = 4.6834 mg N/l
XND = 906.0933 mg N/l
SALK = 7.1549 mol HCO3/m3
TSS = 33528.5538 mg SS/l
Flow rate = 178.4674 m3/d
Temperature = 14.8581 degC

ADM1 influent (post ASM2ADM interface)

Ssu = monosacharides (kg COD/m3) = 0
Saa = amino acids (kg COD/m3) = 0.04388
Sfa = long chain fatty acids (LCFA) (kg COD/m3) = 0
Sva = total valerate (kg COD/m3) = 0
Sbu = total butyrate (kg COD/m3) = 0
Spro = total propionate (kg COD/m3) = 0
Sac = total acetate (kg COD/m3) = 0
Sh2 = hydrogen gas (kg COD/m3) = 0
Sch4 = methane gas (kg COD/m3) = 0
Sic = inorganic carbon (kmole C/m3) = 0.0079326
Sin = inorganic nitrogen (kmole N/m3) = 0.0019721
Si = soluble inerts (kg COD/m3) = 0.028067
Xc = composites (kg COD/m3) = 0
Xch = carbohydrates (kg COD/m3) = 3.7236
Xpr = proteins (kg COD/m3) = 15.9235
Xli = lipids (kg COD/m3) = 8.047
Xsu = sugar degraders (kg COD/m3) = 0
Xaa = amino acid degraders (kg COD/m3) = 0
Xfa = LCFA degraders (kg COD/m3) = 0
Xc4 = valerate and butyrate degraders (kg COD/m3) = 0
Xpro = propionate degraders (kg COD/m3) = 0
Xac = acetate degraders (kg COD/m3) = 0
Xh2 = hydrogen degraders (kg COD/m3) = 0
Xi = particulate inerts (kg COD/m3) = 17.0106
Scat+ = cations (base) (kmole/m3) = 0
San- = anions (acid) (kmole/m3) = 0.0052101
Flow rate (m3/d) = 178.4674
Temperature (degC) = 35

ADM1 effluent (prior ADM2ASM interface)

Ssu = monosacharides (kg COD/m3) = 0.012394
Saa = amino acids (kg COD/m3) = 0.0055432
Sfa = long chain fatty acids (LCFA) (kg COD/m3) = 0.10741
Sva = total valerate (kg COD/m3) = 0.012333
Sbu = total butyrate (kg COD/m3) = 0.014003
Spro = total propionate (kg COD/m3) = 0.017584
Sac = total acetate (kg COD/m3) = 0.089315
Sh2 = hydrogen gas (kg COD/m3) = 2.5055e-07
Sch4 = methane gas (kg COD/m3) = 0.05549
Sic = inorganic carbon (kmole C/m3) = 0.095149
Sin = inorganic nitrogen (kmole N/m3) = 0.094468 (= 1.3226 kg
N/m3)
Si = soluble inerts (kg COD/m3) = 0.13087
Xc = composites (kg COD/m3) = 0.10792
Xch = carbohydrates (kg COD/m3) = 0.020517
Xpr = proteins (kg COD/m3) = 0.08422
Xli = lipids (kg COD/m3) = 0.043629
Xsu = sugar degraders (kg COD/m3) = 0.31222
Xaa = amino acid degraders (kg COD/m3) = 0.93167
Xfa = LCFA degraders (kg COD/m3) = 0.33839
Xc4 = valerate and butyrate degraders (kg COD/m3) = 0.33577
Xpro = propionate degraders (kg COD/m3) = 0.10112
Xac = acetate degraders (kg COD/m3) = 0.67724
Xh2 = hydrogen degraders (kg COD/m3) = 0.28484
Xi = particulate inerts (kg COD/m3) = 17.2162
Scat+ = cations (base) (kmole/m3) = -4.0789e-34
San- = anions (acid) (kmole/m3) = 0.0052101

Flow rate (m3/d) = 178.4674
 Temperature (degC) = 35
 pH = pH within AD system = 7.2631
 S_H+ = protons (kmole/m3) = 5.4562e-08
 Sva- = valerate (kg COD/m3) = 0.012284
 Sbu- = butyrate (kg COD/m3) = 0.013953
 Spro- = propionate (kg COD/m3) = 0.017511
 Sac- = acetate (kg COD/m3) = 0.089035
 Shco3- = bicarbonate (kmole C/m3) = 0.08568
 Sco2 = carbon dioxide (kmole C/m3) = 0.0094689
 Snh3 = ammonia (kmole N/m3) = 0.001884
 Snh4+ = ammonium (kmole N/m3) = 0.092584
 Sgas,h2 = hydrogen concentration in gas phase (kg COD/m3) =
 1.1032e-05
 Sgas,ch4 = methane concentration in gas phase (kg COD/m3) = 1.6535
 Sgas,co2 = carbon dioxide concentration in gas phase (kmole C/m3)
 = 0.01354
 pgas,h2 = partial pressure of hydrogen gas (bar, true value i.e.
 not normalized) = 1.7666e-05
 pgas,ch4 = partial pressure of methane gas (bar, true value i.e.
 not normalized) = 0.66195
 pgas,co2 = partial pressure of carbon dioxide gas (bar, true
 value, i.e. not normalized) = 0.34691
 pgas,total = total head space pressure of H2+CO2+CH4+H2O (bar,
 true value, i.e. not normalized) = 1.0645
 qgas = gas flow rate normalized to atmospheric pressure (m3/d) =
 2708.3431

Extra calculated outputs

 Produced hydrogen gas (kg H2/d) = 0.0035541
 Produced methane gas (kg CH4/d) = 1065.3523
 Produced carbon dioxide gas (kg CO2/d) = 1535.4118
 Energy content of methane gas (MJ/d) = 53282.5305
 Energy content of methane gas (kWh/d) = 14800.7029

Anaerobic digester output (post ADM2ASM interface)

SI = 130.867 mg COD/l
 SS = 258.5789 mg COD/l
 XI = 17216.2434 mg COD/l
 XS = 2611.4843 mg COD/l
 XBH = 0 mg COD/l
 XBA = 0 mg COD/l
 XP = 626.0652 mg COD/l
 SO = 0 mg -COD/l
 SNO = 0 mg N/l
 SNH = 1442.7882 mg N/l
 SND = 0.54323 mg N/l
 XND = 100.8668 mg N/l
 SALK = 97.8459 mol HCO3/m3
 TSS = 15340.3447 mg SS/l
 Flow rate = 178.4674 m3/d
 Temperature = 14.8581 degC

Dewatering effluent (reject water)

SI = 130.867 mg COD/l
 SS = 258.5789 mg COD/l
 XI = 363.861 mg COD/l
 XS = 55.1931 mg COD/l
 XBH = 0 mg COD/l

XBA = 0 mg COD/l
XP = 13.2317 mg COD/l
SO = 0 mg -COD/l
SNO = 0 mg N/l
SNH = 1442.7882 mg N/l
SND = 0.54323 mg N/l
XND = 2.1318 mg N/l
SALK = 97.8459 mol HCO3/m3
TSS = 324.2144 mg SS/l
Flow rate = 168.8853 m3/d
Temperature = 14.8581 degC

Storage tank effluent

SI = 136.0888 mg COD/l
SS = 253.4258 mg COD/l
XI = 363.2948 mg COD/l
XS = 56.0649 mg COD/l
XBH = 0 mg COD/l
XBA = 0 mg COD/l
XP = 13.5135 mg COD/l
SO = 0 mg -COD/l
SNO = 0 mg N/l
SNH = 1512.3975 mg N/l
SND = 0.4663 mg N/l
XND = 2.1557 mg N/l
SALK = 102.7732 mol HCO3/m3
TSS = 324.6548 mg SS/l
Flow rate = 0 m3/d
Temperature = 14.6913 degC
Storage tank water volume = 144.1608 m3

Storage tank bypass

SI = 130.867 mg COD/l
SS = 258.5789 mg COD/l
XI = 363.861 mg COD/l
XS = 55.1931 mg COD/l
XBH = 0 mg COD/l
XBA = 0 mg COD/l
XP = 13.2317 mg COD/l
SO = 0 mg -COD/l
SNO = 0 mg N/l
SNH = 1442.7882 mg N/l
SND = 0.54323 mg N/l
XND = 2.1318 mg N/l
SALK = 97.8459 mol HCO3/m3
TSS = 324.2144 mg SS/l
Flow rate = 168.8853 m3/d
Temperature = 14.8581 degC

Storage tank output + bypass

SI = 130.867 mg COD/l
SS = 258.5789 mg COD/l
XI = 363.861 mg COD/l
XS = 55.1931 mg COD/l
XBH = 0 mg COD/l
XBA = 0 mg COD/l
XP = 13.2317 mg COD/l
SO = 0 mg -COD/l

SNO = 0 mg N/l
SNH = 1442.7882 mg N/l
SND = 0.54323 mg N/l
XND = 2.1318 mg N/l
SALK = 97.8459 mol HCO3/m3
TSS = 324.2144 mg SS/l
Flow rate = 168.8853 m3/d
Temperature = 14.8581 degC

WWTP effluent

SI = 28.0643 mg COD/l
SS = 0.67336 mg COD/l
XI = 5.9191 mg COD/l
XS = 0.12329 mg COD/l
XBH = 8.6614 mg COD/l
XBA = 0.6484 mg COD/l
XP = 3.7485 mg COD/l
SO = 1.3748 mg -COD/l
SNO = 9.1948 mg N/l
SNH = 0.15845 mg N/l
SND = 0.55943 mg N/l
XND = 0.0092428 mg N/l
SALK = 4.5646 mol HCO3/m3
TSS = 14.3255 mg SS/l
Flow rate = 20640.7791 m3/d
Temperature = 14.8581 degC

WWTP sludge disposal

SI = 130.867 mg COD/l
SS = 258.5789 mg COD/l
XI = 314239.8855 mg COD/l
XS = 47666.1788 mg COD/l
XBH = 0 mg COD/l
XBA = 0 mg COD/l
XP = 11427.269 mg COD/l
SO = 0 mg -COD/l
SNO = 0 mg N/l
SNH = 1442.7882 mg N/l
SND = 0.54323 mg N/l
XND = 1841.0745 mg N/l
SALK = 97.8459 mol HCO3/m3
TSS = 280000 mg SS/l
Flow rate = 9.5821 m3/d
Temperature = 14.8581 degC

Other variables

Trad. sludge age (XS + XP + XI + XBH + XBA in reactors) = 17.8428 days
Spec. sludge age (XBH + XBA in reactors and settler) = 20.9128 days
Spec. sludge age 2 (XS + XP + XI + XBH + XBA in reactors and settler) = 20.9391 days
Primary clarifier hydraulic retention time = 1.0461 hours
Hydraulic retention time in AS + settler = 20.9218 hours
AS reactors hydraulic retention time = 13.9478 hours
Anaerobic digester retention time = 19.0511 days
Thickening factor at bottom of settler (TSSu/TSSfeed) = 1.9815
Thinning factor at top of settler (TSSeff/TSSfeed) = 0.003863

Dimensions

Primary clarifier volume = 900 m³
Reactor 1 is anoxic
Volume reactor 1 = 1500 m³
Reactor 2 is anoxic
Volume reactor 2 = 1500 m³
Reactor 3 is aerobic
Volume reactor 3 = 3000 m³
Reactor 4 is aerobic
Volume reactor 4 = 3000 m³
Reactor 5 is aerobic
Volume reactor 5 = 3000 m³
Settler height = 4 m
Settler area = 1500 m²
Settler volume = 6000 m³
Anaerobic digester volume (liquid) = 3400 m³
Anaerobic digester head space volume = 300 m³
Total storage tank volume (10-90% used) = 160 m³