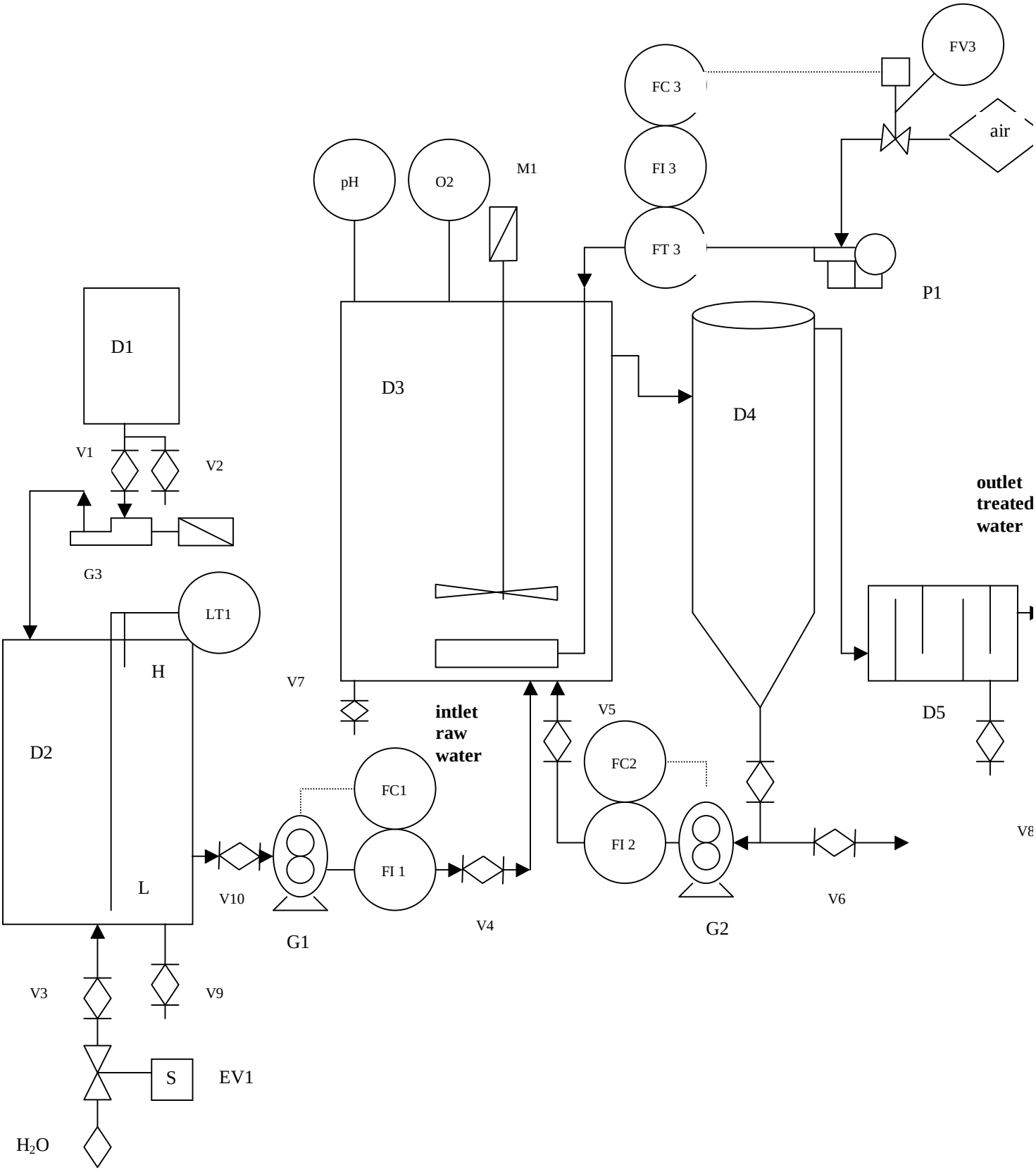
# Activated sludge : sizing

## 1. Flow sheet



## 2. Sizing

*I've written, in blue, some addresses or firms names that could be useful*

| code | general data | more specific data |
|---|---|---|
| D1 | tank for concentrated raw water | 100 L |
| D2 | tank for raw water | 1000 L |
| D3 | aeration tank | Plexiglas, cylinder, 400L |
| D4 | settling tank | plexiglas, 150L, , cylindroconical, surface 0.8$m^2$ |
| D5 | tank for treated water | plexiglas, 40L, 4 baffles |
| G1 | magnet drive gear pump for raw water | 0-60L/h ;<br>*Fluid-o-Tech srl*<br>*20143 Milano-Via Lombardini,6/a*<br>*tel (39)028360451*<br>*fzx (02)8375397* |
| FI1 | flowmeter for raw water | transmitter, magnetic induction electronic indicator, 0- 60L/h<br>*Endress Hauser Promag 30* |
| FC1 | flow control | |
| G2 | magnet drive gear pump for sludge recirculation | 0-60L/h |
| FI2 | flowmeter for sludge recirculation | transmitter, magnetic induction electronic indicator, 0- 60L/h |
| FC2 | flow control | |
| G3 | dosing (metering) pump for concentrated raw water | 0-10L/h |
| P1 | air compressor | maximum flow ; 1.5$Nm^3$ / h |
| FI3 | flowmeter for air | electric transmitter, scale 0-1500Nl/h<br>calibration : 600mm $H_2O$ |
| FV3 | electric valve for inlet air flow regulation in P1 | |
| M1 | moto agitator for aeration tank | |
| EV1 | electrovalve for drinking water inlet | |
| PH | pH meter | *Endress Hauser* |
| O2 | Oxymeter | *Endress Hauser* |
| LT1 | electronic indicator for High and Low level in D2 | |

## 3. Preparation

1. This pilot could be simplified : pH and oxygen can be measured without those probes.
2. The most important is to have a large autonomy with inlet raw water in the aeration tank ; G1 pumps 10L/h and then D2 is empty in 4 days (100h) !
here is our method :

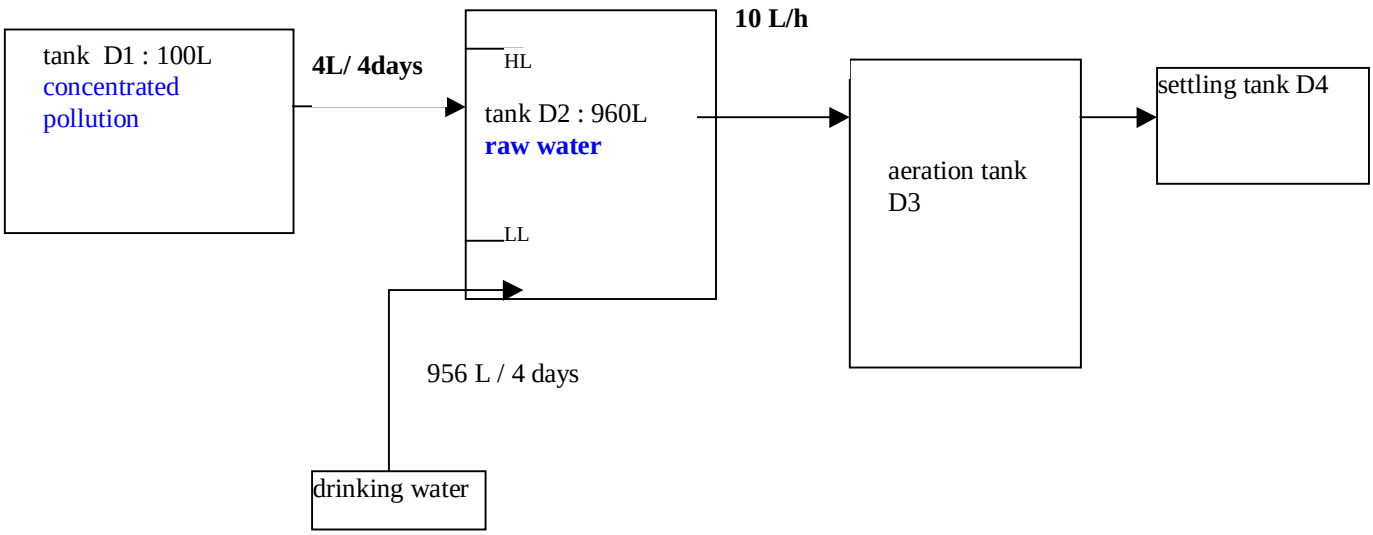
**Hypotheses :**

F/M ratio = 0.1 kg BOD / MLSS / d (very low load)
$V_{D3}$ = 400 L
[VSS] = 1 g/L
$q_{v\ G1}$ = 10 L/h = 240 L/d
that is 0.04 kg BOD / d / 240 L
and $BOD_{inlet\ raw\ water}$ = 0.04 / 240 = 166 mg $O_2$ / L with methanol :

$CH_3OH + 3/2\ O_2 \longrightarrow CO_2 + H_2O$
32 g 48 g
0.66g 1g
1g 1.5 g COD
and the ratio COD / BOD for methanol = 1.4
then : 1 g BOD = 1g methanol
now, $d_{methanol}$ = 0.7
**then 1g BOD = 1g methanol = 1.42 ml methanol**

then $BOD_{inlet\ raw\ water}$ = 166 mg $O_2$ / L = 0.237 ml methanol / L

**pilot flow sheet :**




D2 is empty in 4 days : low level LL is reached (level controller) : then 4L from D1 are injected in D2 and in the same time D2 is filling with drinking water (the peristaltic pump G3 is programmed to inject during a fixed time, with a fixed flow, every 4 days) : D1 concentrated pollution is diluted 240 times in D2 ; this injection stops when HL is reached : we have 100 days of autonomy with D1.

Now, how to prepare concentrated pollution in D1 ?
We've chosen a ratio BOD / N / P = 100 / 10 / 2 to study nitrification et to check assimilation :

240

| | BOD $mgO_2$ / L | N mg/L | P mg/L | methanol L | $NH_4Cl$ g | $Na_2HPO_4$ g |
|---|---|---|---|---|---|---|
| D1 complete until 100L with drinking water | | | | 5.7 | 1520 | 361 |
| D2 | 166 | 16.6 | 3.32 | | | |

<u>calculation for $NH_4Cl$ :</u>
0.166 x 240 = 3.98 gN / L
then 398 gN / 100L or 1520 g $NH_4Cl$ / 100 L in D1

<u>for phosphorus salt :</u>
0.332 * 240 = 0.79 g P / L
then 79 g P / 100L that is 361 g $Na_2HPO_4$ / 100L in D1

We can add different salts ($FeCl_3$, $MgSO_4$, $CaCl_2$…) to complete D1…but we may have problems with dissolution.

<u>Seeding :</u>
Lyophilised sludge (Biolen IG 30, Gamlen industry : see our fold called "biorequirement") or real activated sludge (with the risk of integrating filamentous bacteria or sand which could clog the pumps)