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SLUDGE TREATMENT AND GAS LINE

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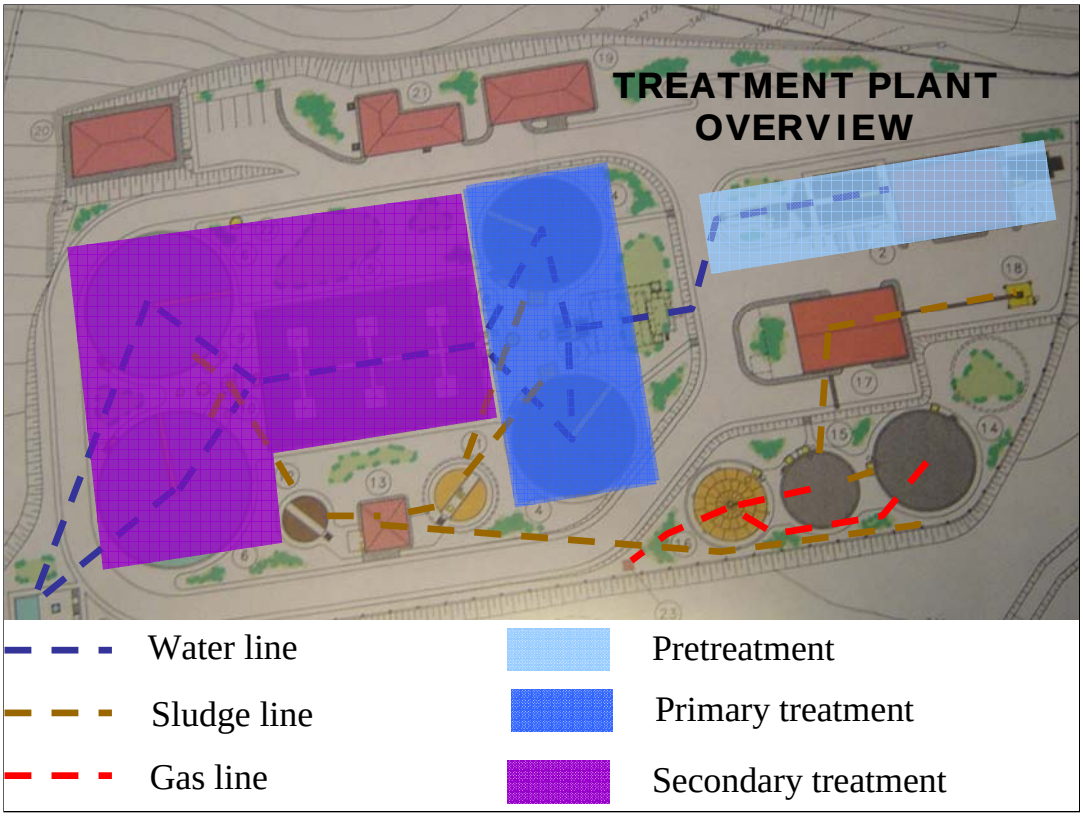
Sludge is removed from the primary and secondary treatments. After removal, sludge is dehydrated and must be disposed of by an authorised company. The final used of sludge depends on the chemical and biological contents, as happens with waste in general.

Waste produced is classified as:

-Toxic and Dangerous Hazardous Waste (corresponding to *Residuos Tóxicos y Peligrosos – RPTs*).

-Municipal Solid Waste and Non-Hazardous Waste (corresponding to Residuos Sólidos Urbanos - RSUs).

Usually sludge is classified as Hazardous Waste.


TREATMENT PLANT
OVERVIEW
Water line
Sludge line
Gas line
Pretreatment
Primary treatment
Secondary treatment

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TREATMENT PLANT

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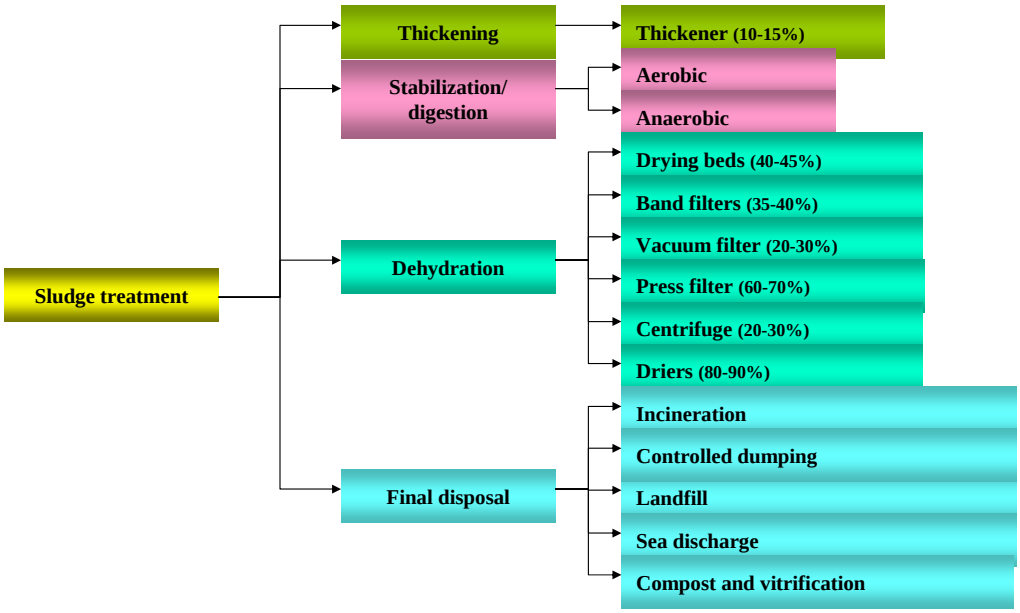
SLUDGE TREATMENT



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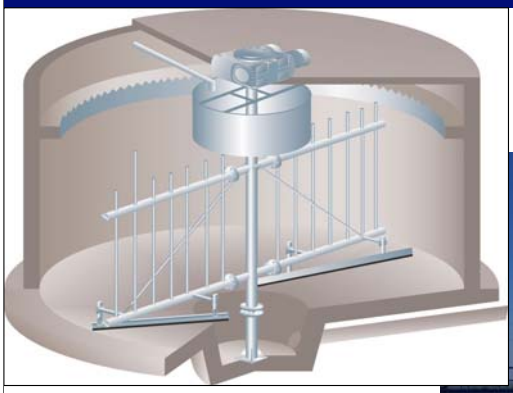
SLUDGE THICKENER (FLOTATION)



Sludge from the secondary treatment is also thickened after removal. The mechanism is flotation.

Thickening by sedimentation was performed for sludge produced in the primary treatment (note the different design).

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SLUDGE THICKENER: REMOVAL

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SLUDGE THICKENER: BAFFLE

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SLUDGE PUMPS

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GAS LINE: ANAEROBIC DIGESTERS

Anaerobic digesters at the bottom of the image, gasholder in front.

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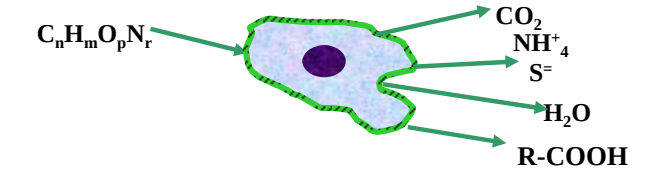
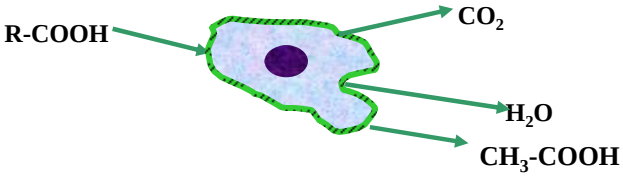
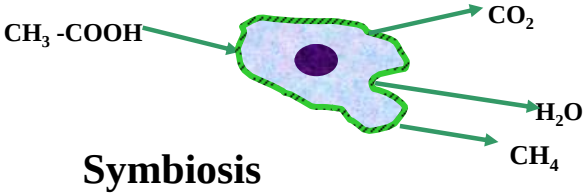
ANAEROBIC METABOLIC PROCESS



ACIDOGENESIS (FERMENTATION)



ACETOGENESIS



METHANOGENESIS

Symbiosis

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ANAEROBIC DIGESTER: RELIEF VALVE

The relief valve on top of the digester prevents an increase of pressure exceeding design values. Some space for the gas is allowed at the top of the dome.

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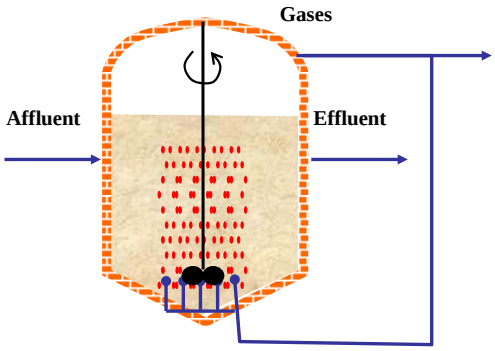
HIGH LOAD ANAEROBIC DIGESTERS



- **Closed systems (No O2)**
- **τ_r (anaerobic) > τ_r (aerobic)**
- **C_m (anaerobic) > C_m (aerobic)**
- **T^e (anaerobic) ≥ T^e (aerobic)**
- **Sludge production ↓**
- **Biogas production**

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DESIGN PARAMETERS OF A HIGH LOAD ANAEROBIC

$t_{residence}$ = 10-30 h

H_{free} (m) H_{backg} (m)

$[SS_V]_{input}$ = 40 – 70 %

SS_V Reduction = 30-60 %

Q_{sludge} (m^3/h)

SS_{sludge} (kg/d)

Q_{sludge} (m^3/h) =	$[SS]_{digester} = \frac{SS_{sludge}/24}{Q_{sludge}}$
SSv_{sludge} (kg/d) =	$SS_v = SS_{sludge} \cdot [SS_v]_{input}/100$
$V_{digester}$ (m^3) =	$V_{digester} = t_{residence} \cdot Q_{sludge}$
C_{SSv} (kg/m^3d) =	$C_{SSv} = \frac{SS_{sludge} \cdot [SS]_{input}/100}{V_{digester}}$
ϕ_{inner} (m)=	$\phi_{inner} = \sqrt{\frac{V_{digester}}{(\pi \cdot H_{free}/4)+(\pi \cdot H_{backg}/12)}}$

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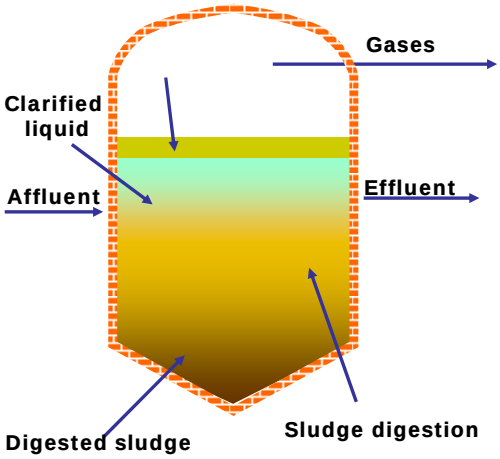
LOW LOAD DISCONTINUOUS REACTOR



- ✓ $t_{RH} \approx t_{RS}$ (30-60 days)
- ✓ Mass load (Kg COD / m^3 / d): 0,4-1,6
- ✓ There are no mixing devices. Small turbulence created by the gas bubbles produced.
- ✓ Raw liquid enters through the digestion area.
- ✓ Feeding influent must include anaerobic bacteria (manure).
- ✓ A foam layer is formed at the surface favored by the ascending gas that carries sludge and floating mat.
- ✓ Digested sludge and supernatant is periodically purged.
- ✓ 57-85 l/hab sludge 1^{ry} 113-170 l/hab sludge 1^{ry}+ active sludge.
- ✓ Free reactor volume = approx 50 % total digester volume.

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GASHOLDER

Gasholder sometimes called gasmeter.

ENERGETIC CONSUMPTION

•Pumping	10-20%
•Primary sedimentation	2-5%
•Active sludge	30-70%
•Sludge processing	10-50%
•Electricity, monitoring, controls	1-3%
•Disinfection	1-3%
•Odor control	1-2%

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TORCH

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THICKENER: FLOCCULANT ADDITION

- **Flocculants may be needed to enhance thickening**
- **The image shows the proportioner**

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DEHYDRATION: BELT FILTER

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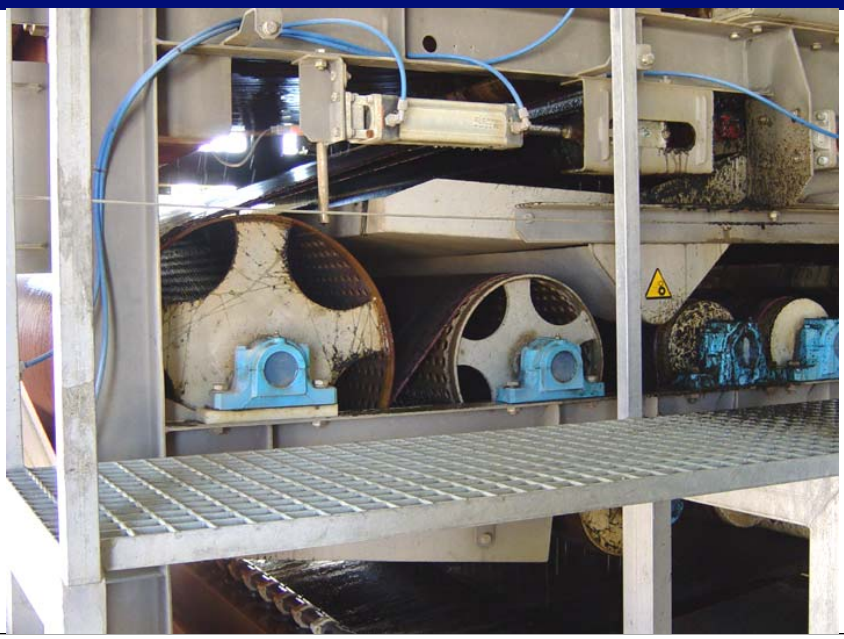
DEHYDRATION: BELT FILTER



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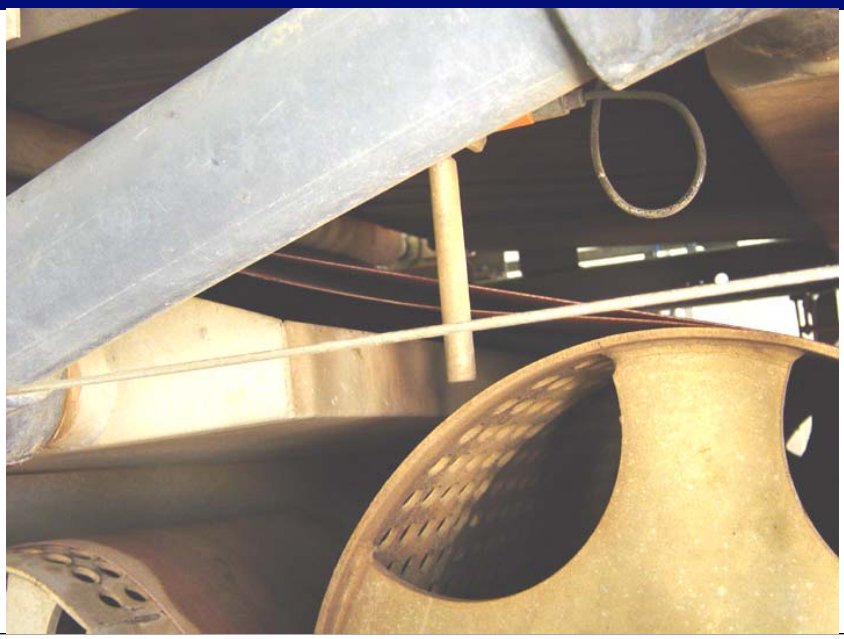
DEHYDRATION: BELT FILTER



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DRY SLUDGE

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SLUDGE STORAGE

- **Sludge is stored temporarily.**
- **Disposal must be performed by an authorized company**
- **Sludge may be hazardous waste!**