Anaerobic Treatments

Advanced Technologies for Wastewater Treatment and Waste Sludge Stabilization and Valorization Small Urban Settlements

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CENTRO DE INVESTIGAÇÃO MARINHA E AMBIENTAL

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PROGRAMA
COOPERACIÓN TRANSFRONTERIZA
ESPAÑA ~ PORTUGAL

Domestic Wastewater Treatment

Conventional paradigm:

https://www.aguasdoalgarve.pt/content/mapa-do-sistema-de-saneamento accessed 19/03/2021

Domestic Wastewater Treatment

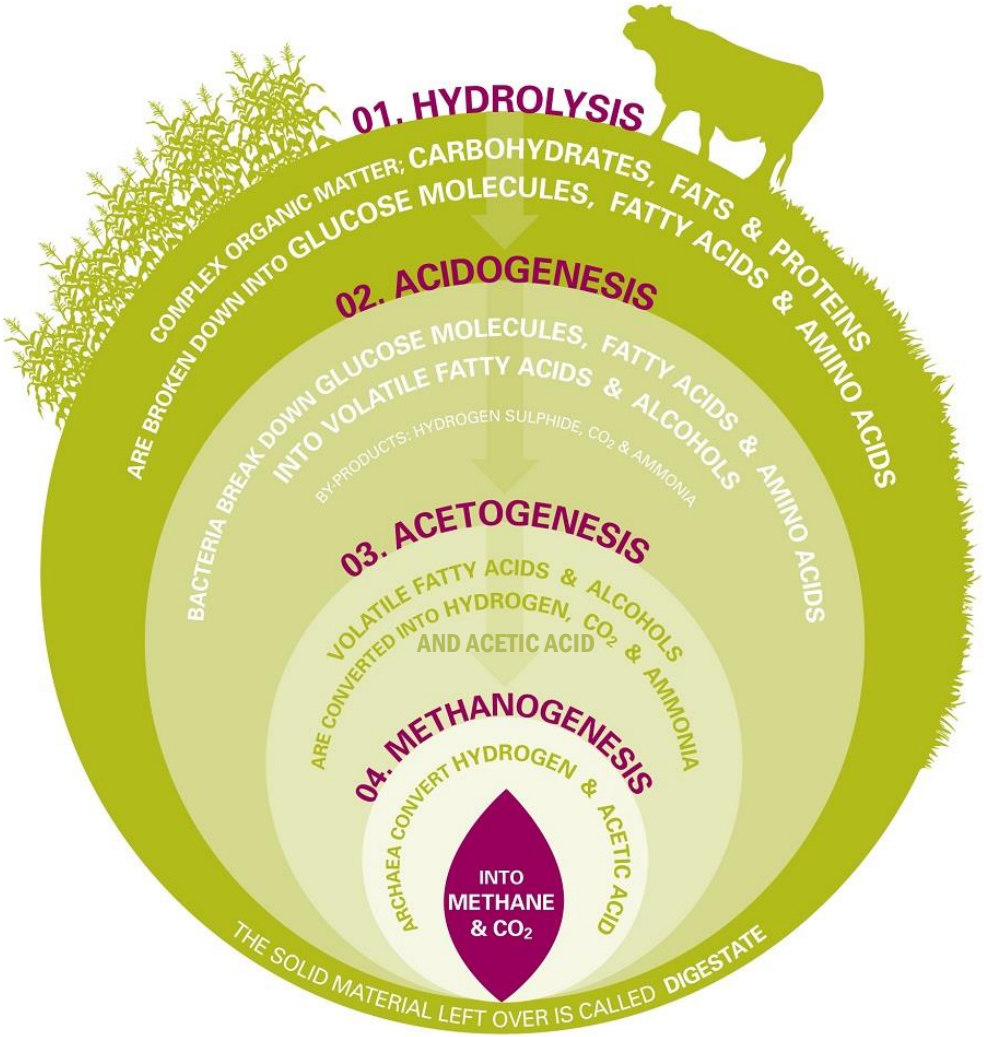
Conventional paradigm:

http://www.fma2018.pt/pt/entity/aguas-do-norte-sa accessed 19/03/2021

Anaerobic processes

https://www.conserve-energy-future.com/effects-wastewater-environment.php accessed 19/03/2021

Anaerobic processes



Anaerobic wastewater treatment

Biodegradable organic matter

$CH_4 + CO_2$ Biogas

Biomass Sludge

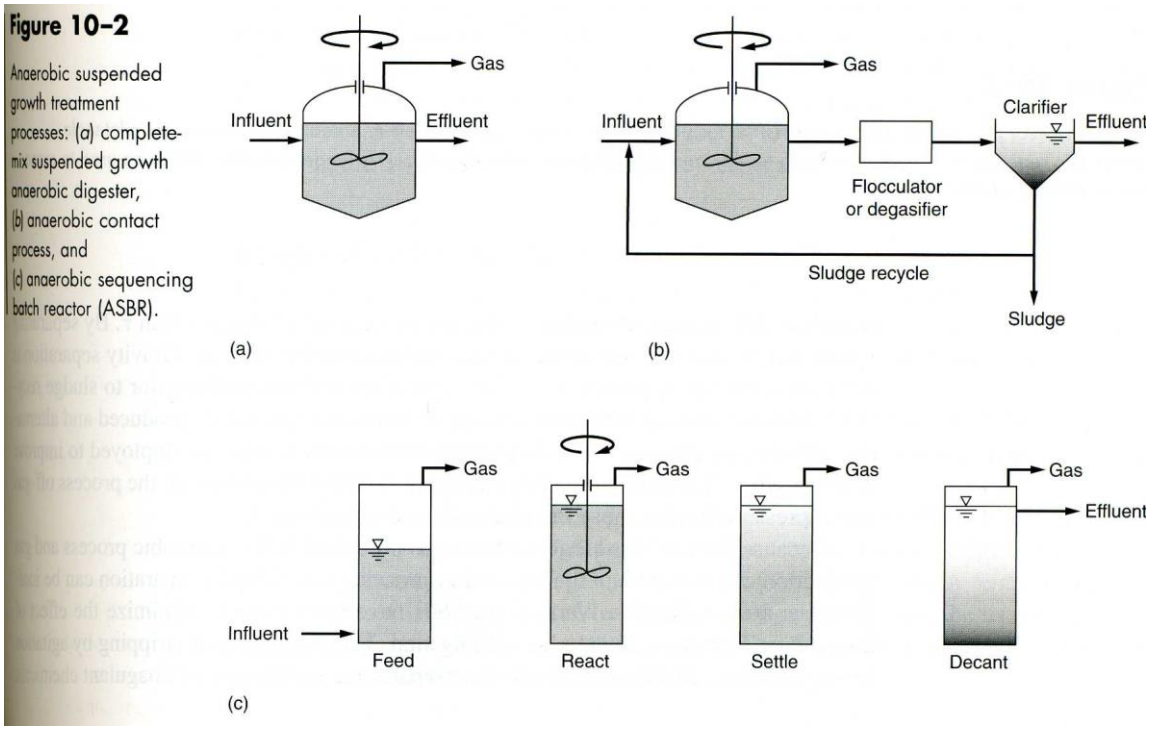
N + P Soluble nutrients

Anaerobic processes

https://www.vekamaf.com/equipment/anaerobic-uasb-wastewater-treatment/ accessed 19/03/2021

Typical designs

Suspended growth processes:



Metcalf & Eddy, Wastewater engineering, 2004

Only adapted to highly loaded (industrial) wastewaters

Typical designs

Attached growth processes:

Figure 10–7

Upflow anaerobic attached growth treatment reactors: (a) anaerobic upflow packed-bed reactor, (b) anaerobic expanded-bed reactor, and (c) anaerobic fluidized-bed reactor.

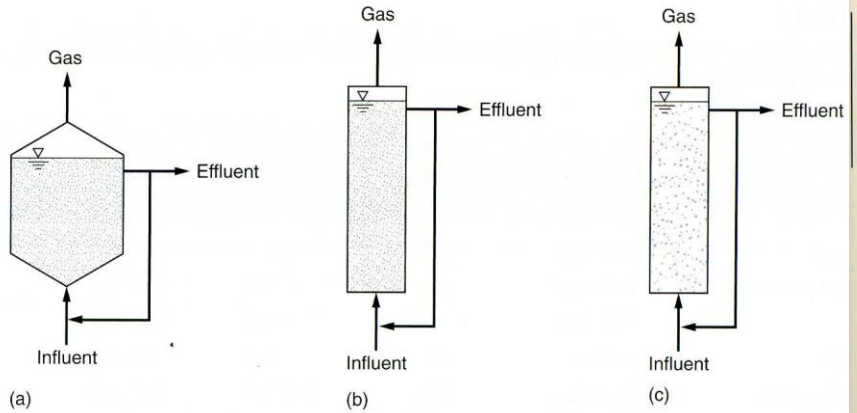
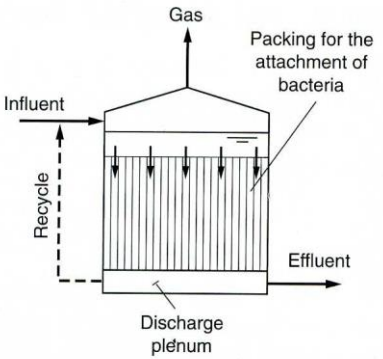


Figure 10–8

Downflow attached growth anaerobic treatment reactor with plastic packing.



Metcalf & Eddy, Wastewater engineering, 2004

Only adapted to highly loaded (industrial) wastewaters

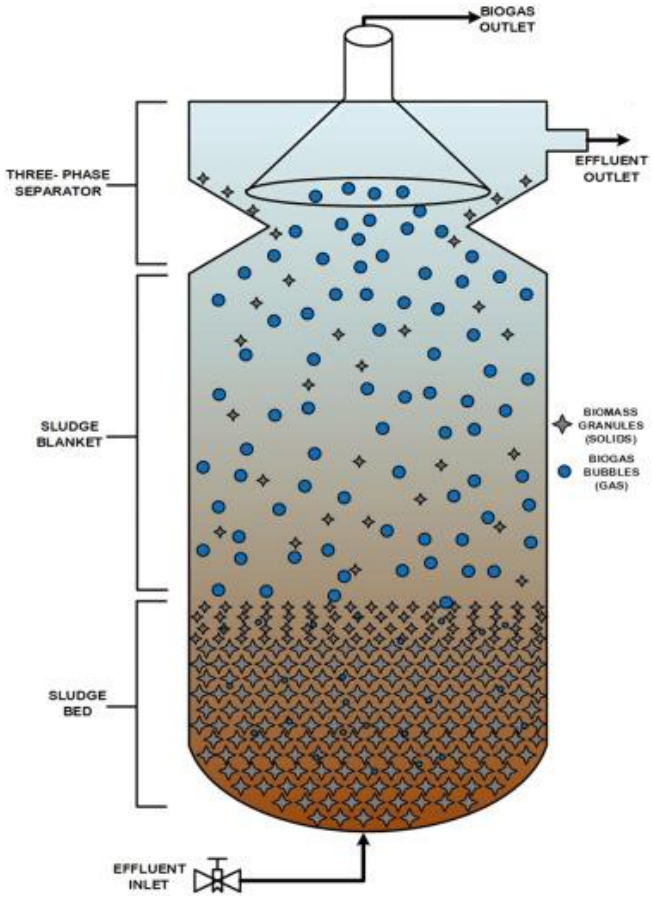
Advanced designs

Uflow Anaerobic Sludge Blanket (UASB) Reactors

The largest tank is a UASB reactor located near Tel Aviv, Israel

https://www.wikiwand.com/en/Upflow_anaerobic_sludge_blanket_digestion accessed 19/03/2021

Advanced designs



D´Bastiani *et al*., 2021

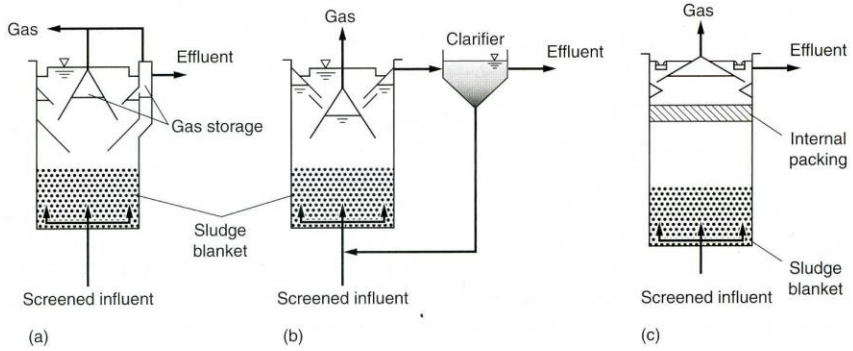
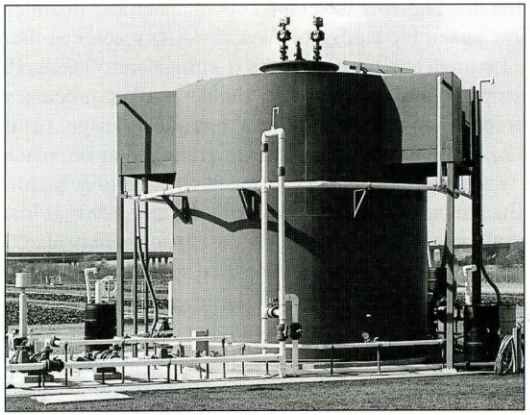


Figure 10–4

Schematic of the UASB process and some modifications: (*a*) original UASB process, (*b*) UASB reactor with sedimentation tank and sludge recycle, and (*c*) UASB reactor with internal packing for fixed-film attached growth, placed above the sludge blanket.

Figure 10–5

View of UASB reactor equipped with internal packing above the sludge blanket. The exterior physical appearance of a UASB reactor without and with internal packing is the same (see Fig. 10–4*c* for location of internal packing).



Metcalf & Eddy, Wastewater engineering, 2004

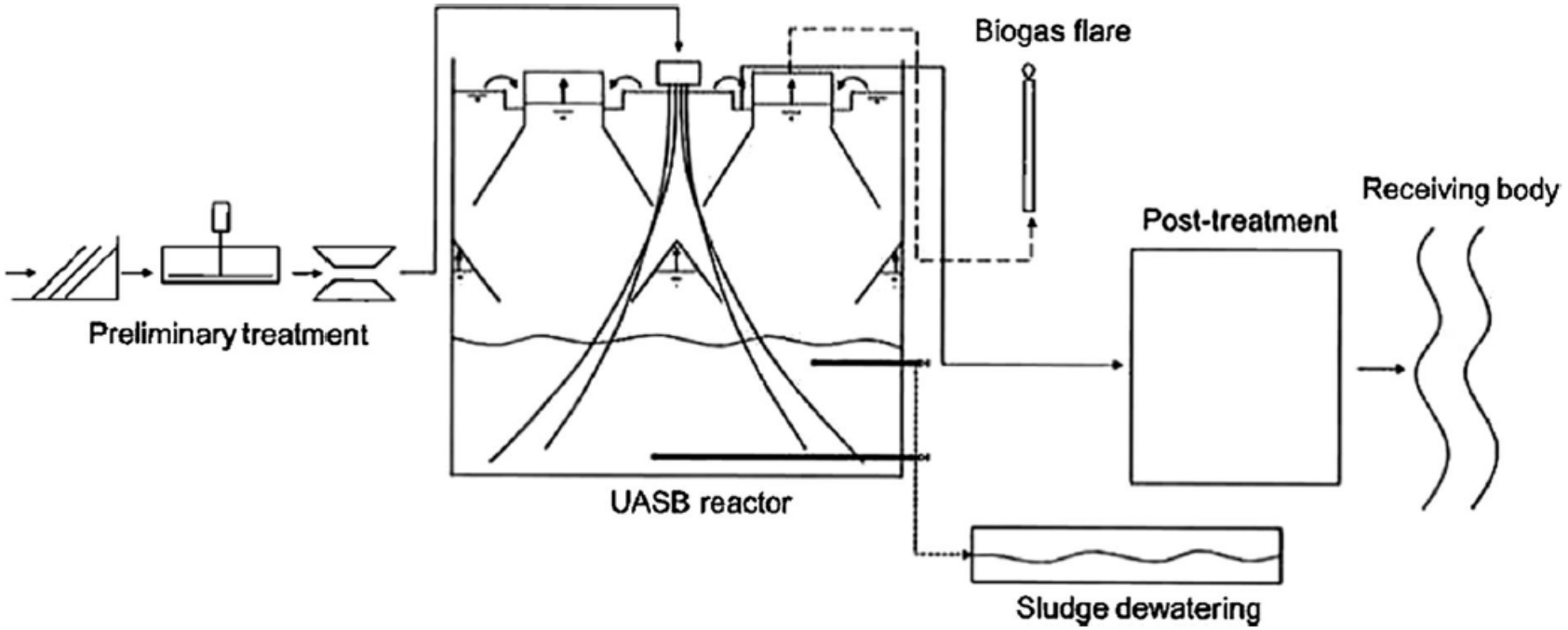
UASB reactor schemes

Advanced designs

PUSH® prototypes installed in Lagos and Loulé

Águas do Algarve, 2020/21

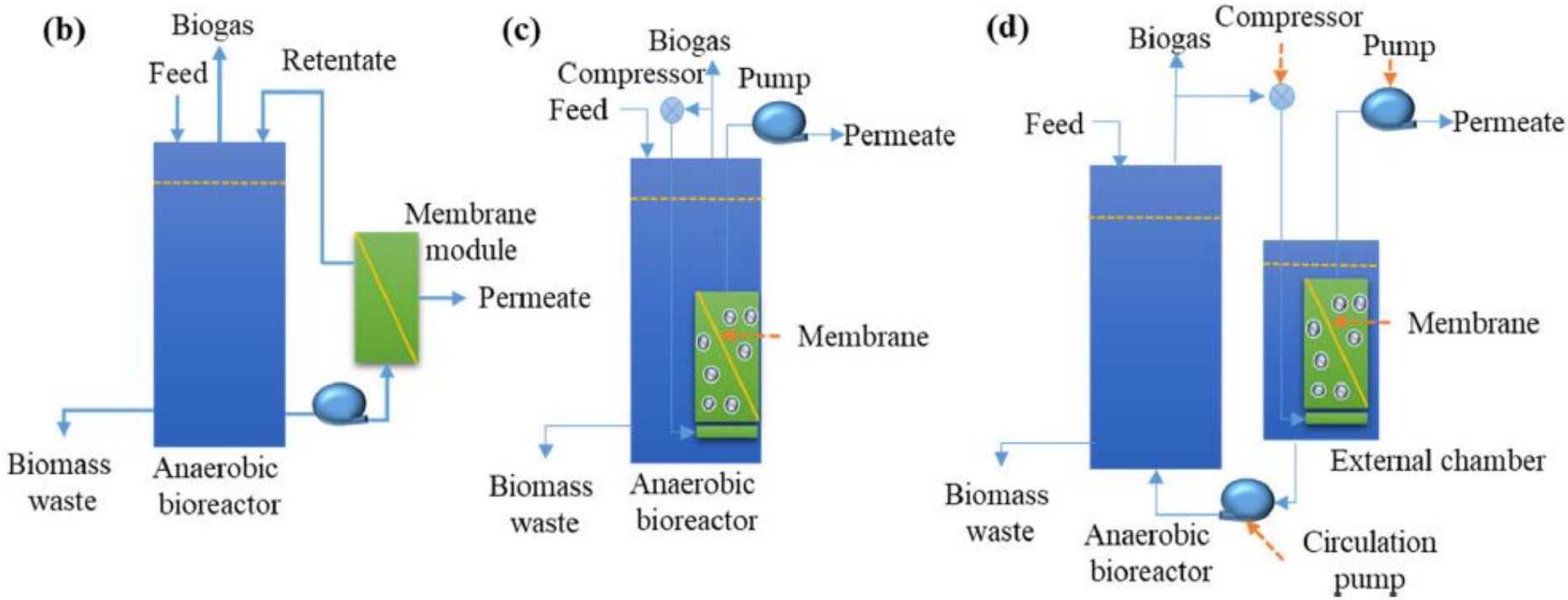
Advanced designs



UASB based WWTP

Chernicharo *et al*., 2015

Advanced designs



Anaerobic Membrane BioReactor (AnMBR) schemes

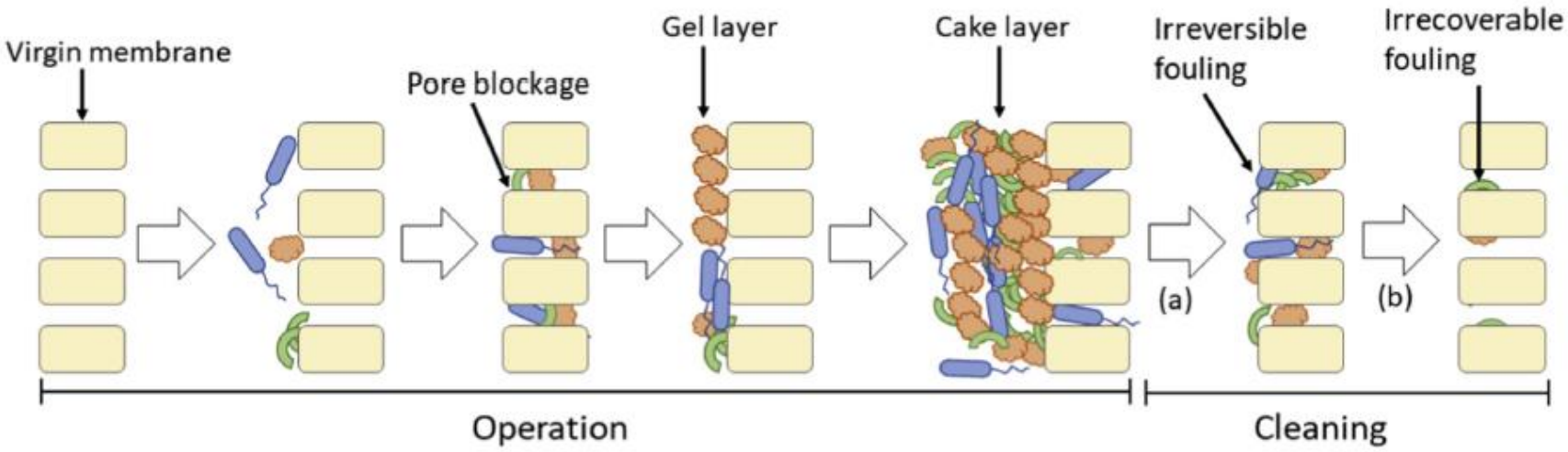
Maaz *et al.*, 2019

Advanced designs

Anaerobic Membrane BioReactor (AnMBR)

https://www.directindustry.com/prod/suez-water-technology-solutions/product-34162-1601638.html accessed 19/03/2021

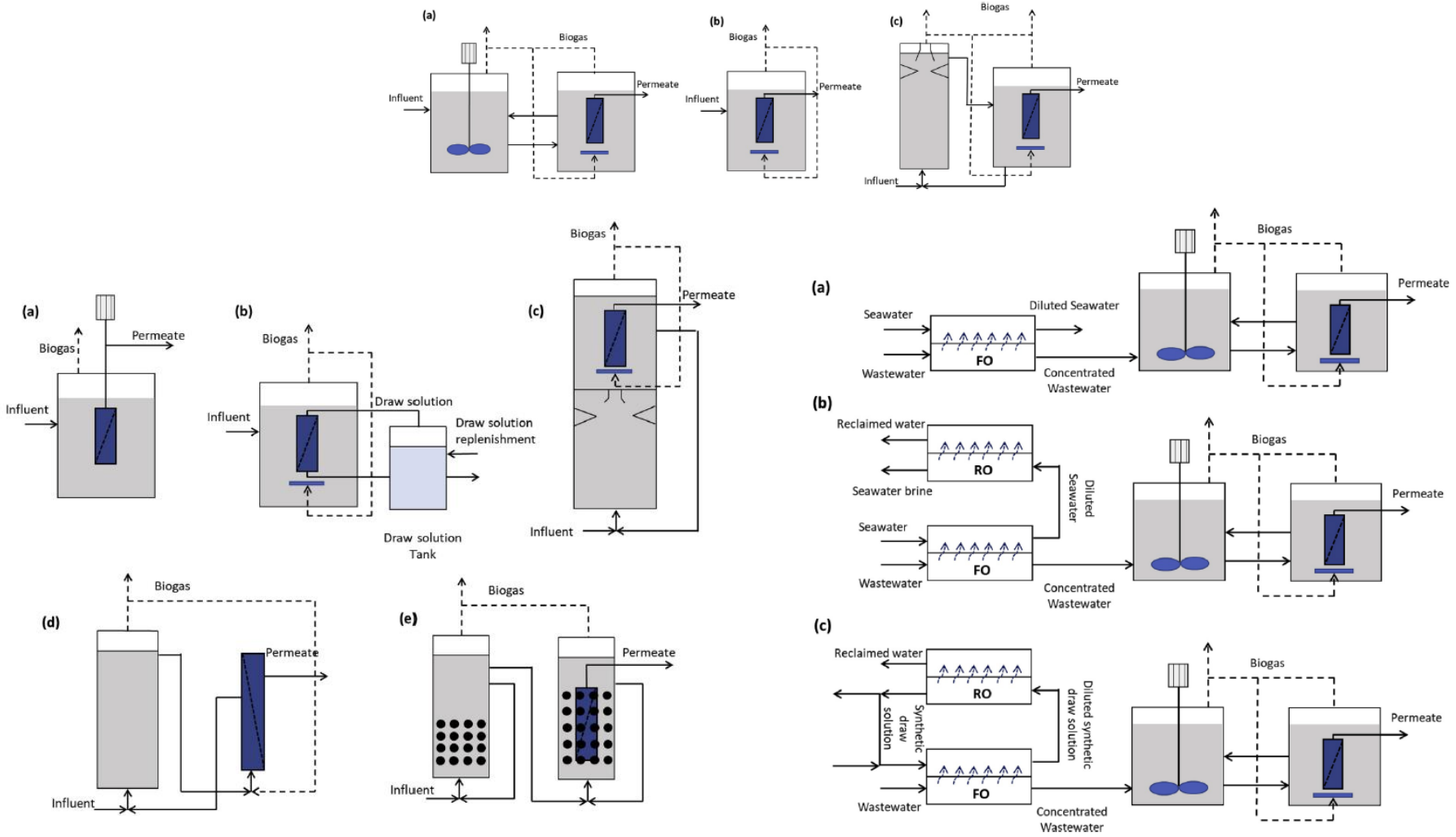
Advanced designs



Membrane fouling schematic

Shahid *et al*., 2020

Advanced designs



Novel designs using AnMBR for sewage treatment

Vinardell *et al.*, 2020

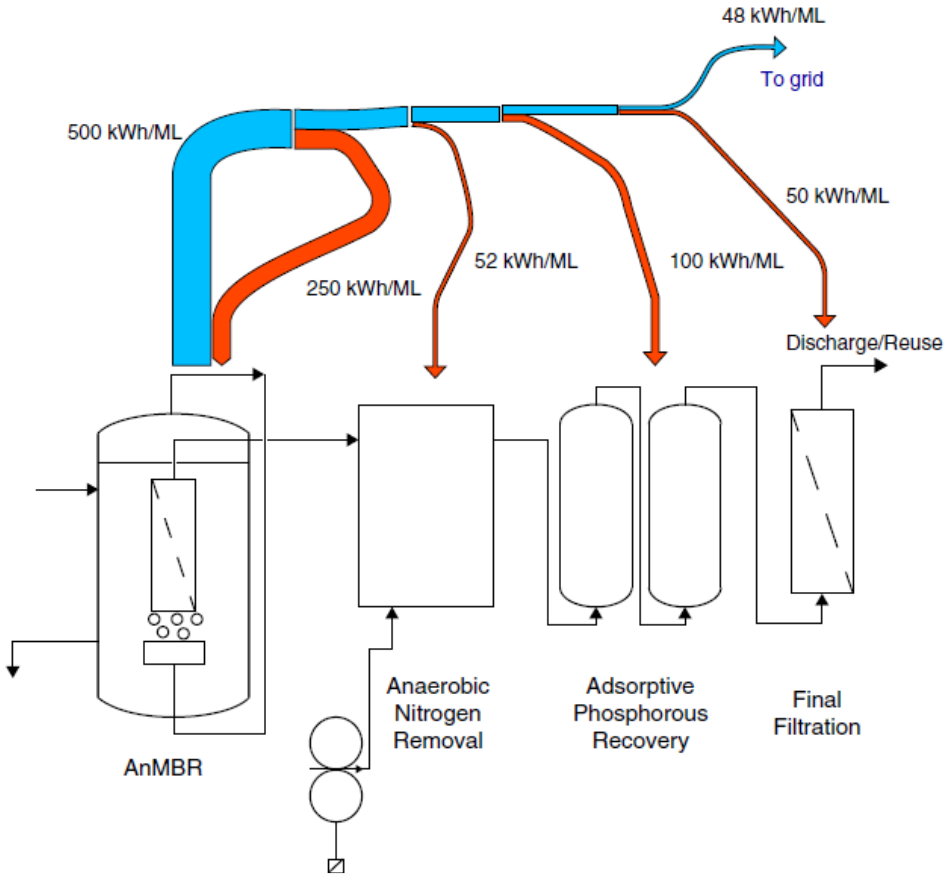
Waste sludge management

https://neighborwebsj.com/news/864390/global-anaerobic-digester-market-2020-by-future-developments-paques-veolia-ge-water-process-technologies-purac-bossco-shandong-meiquan/ accessed 21/03/2021

https://www.water-technology.net/projects/reading_sewage/ accessed 19/03/2021

Anaerobic digesters for waste sludge management

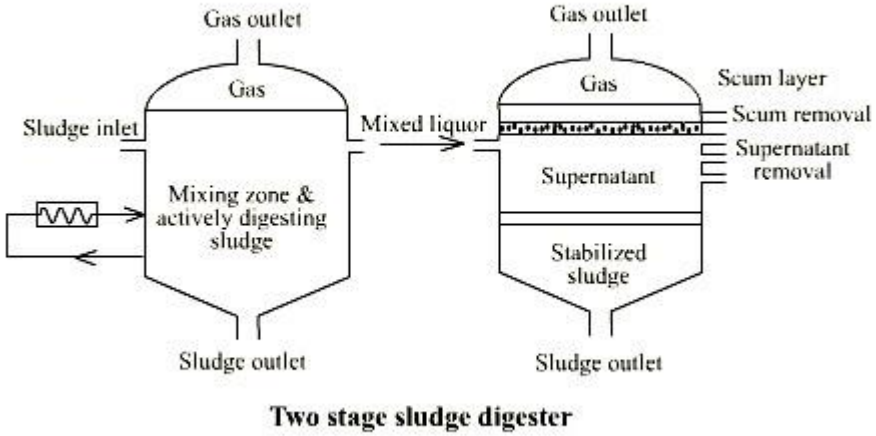
Waste sludge management



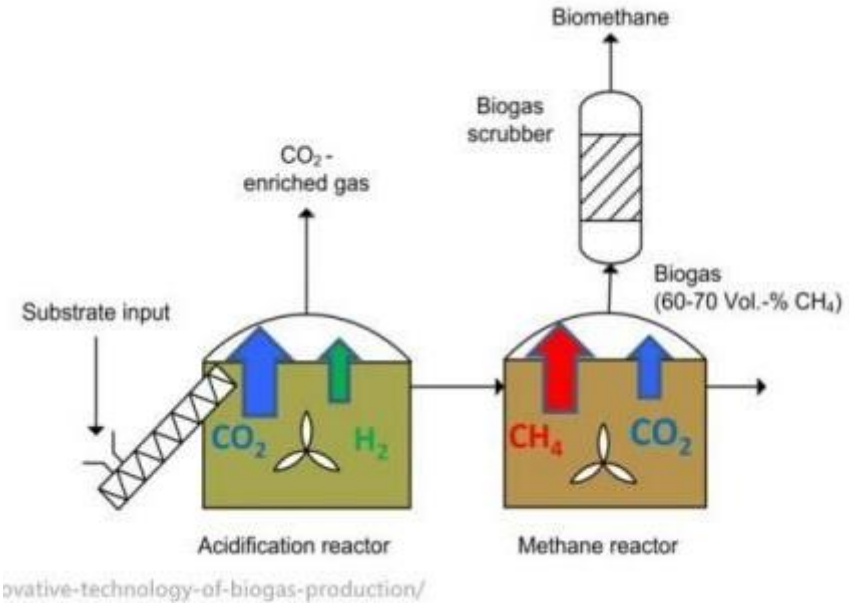
Batstone and Virdis, 2014

Energy balance on anaerobic wastewater process

Waste sludge management



Two stage sludge digester

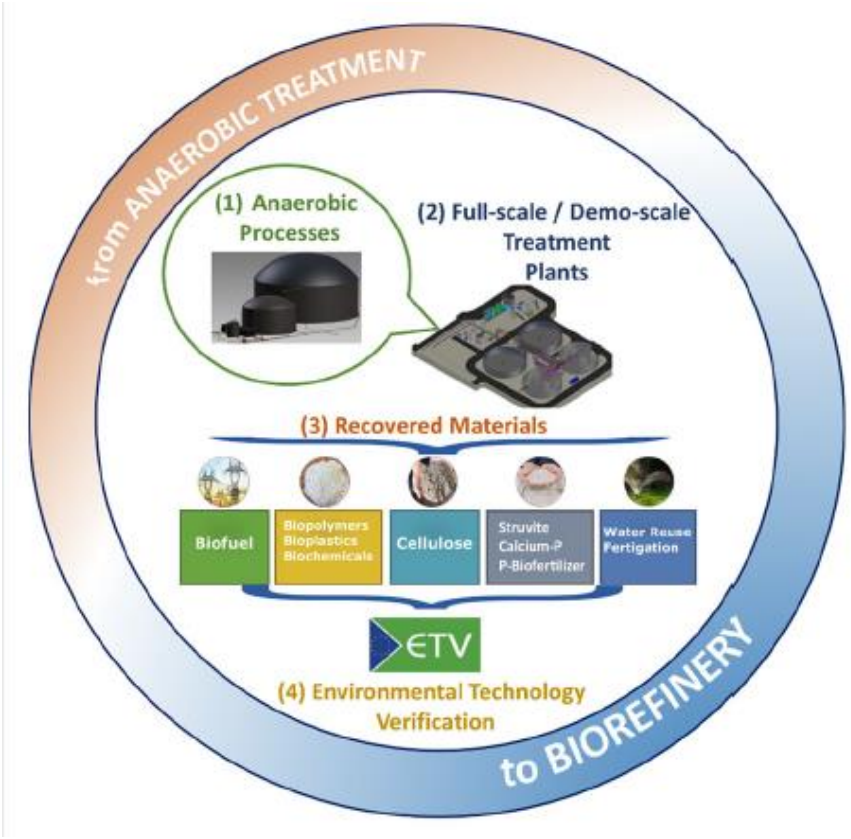


http://www.c2biotechnologies.com/index.php/about/faqs/119-single-and-multi-stage-digesters accessed 21/03/2021

https://anaerobic-digestion.com/anaerobic-digestion-technology/two-stage-anaerobic-digestion/ accessed 19/03/2021

Multi-staged Anaerobic digestion

Extracting value from waste

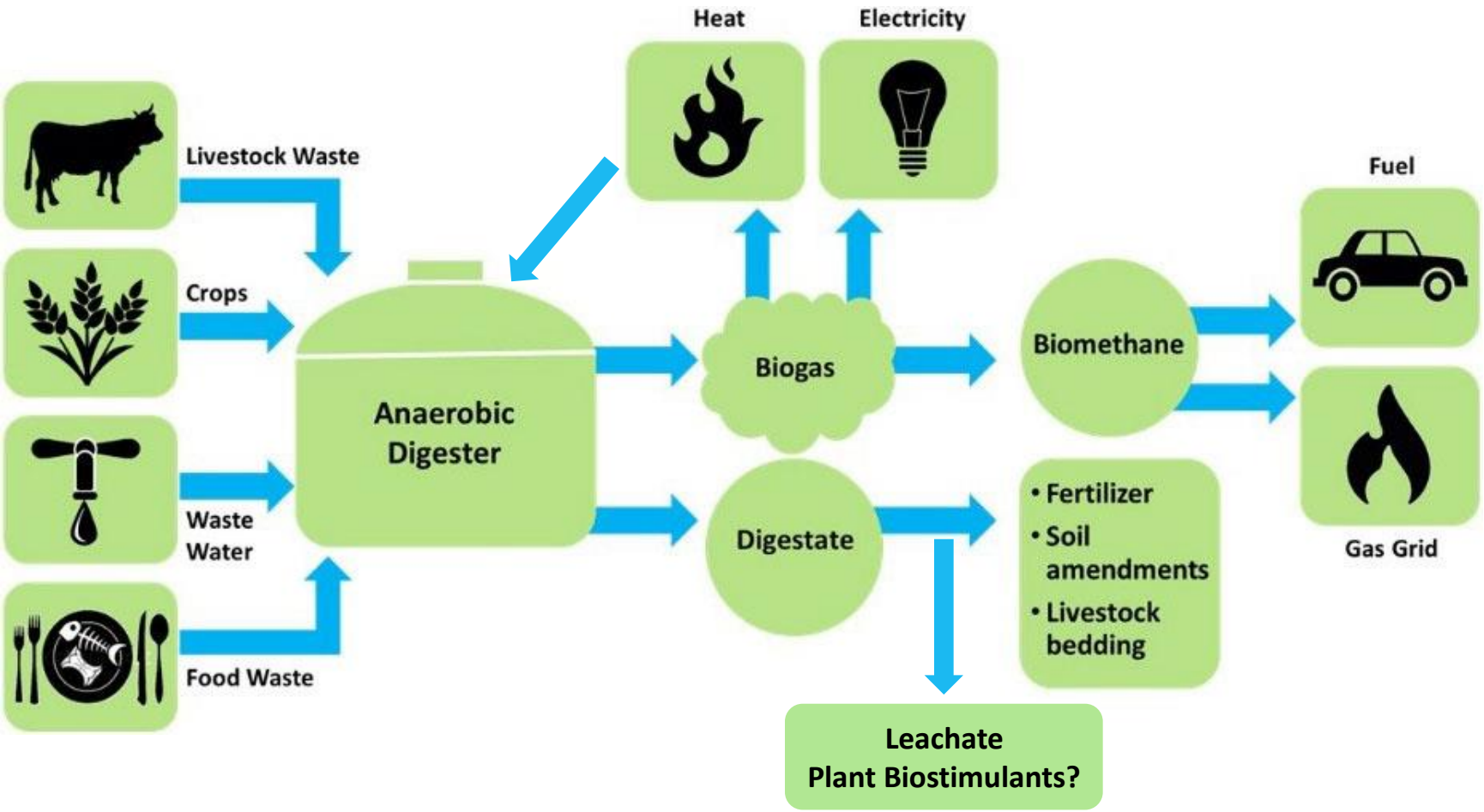


Akyol *et al*., 2019

Biorefinery concept applied to waste management

A vision for integrated treatment

Within rural areas / Small urban settlements



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- AGUASRESIDUALES.INFO

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