ANAEROBIC TREATMENTS: ADVANCED TECHNOLOGIES FOR WASTEWATER TREATMENT IN SMALL URBAN SETTLEMENTS

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Domestic Wastewater Treatment
Conventional paradigm:

https://www.aguasdoalgarve.pt/content/mapa-do-sistema-de-saneamento accessed 19/03/2021
Domestic Wastewater Treatment
Conventional paradigm:

Anaerobic processes

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

Chen et al., 2016
Anaerobic wastewater treatment

Biodegradable organic matter

\[ \text{CH}_4 + \text{CO}_2 \]  

Biogas

Biomass  

Sludge

N + P  

Soluble nutrients

4th SmallWat 21
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:

Only adapted to highly loaded (industrial) wastewaters

Metcalf & Eddy, Wastewater engineering, 2004
Advanced designs

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. 10-4c for location of internal packing].

D’Bastiani et al., 2021

Metcalf & Eddy, Wastewater engineering, 2004

UASB reactor schemes
Advanced designs

Uflow Anaerobic Sludge Blanket (UASB) Reactors

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

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)

Advanced designs

Membrane fouling schematic

Shahid et al., 2020
Advanced designs

Novel designs using AnMBR for sewage treatment

Vinardell et al., 2020
Extracting value from waste

Biorefinery concept applied to waste management

Akyol et al., 2019
A vision for integrated treatment

Within rural areas / Small urban settlements

- Livestock Waste
- Crops
- Waste Water
- Food Waste

Anaerobic Digester

- Biogas
- Digestate
- Leachate

Bidirectional processes:
- Heat
- Electricity

Products:
- Biomethane
- Fuel
- Gas Grid
- Fertilizer
- Soil amendments
- Livestock bedding

Plant Biostimulants?
References

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