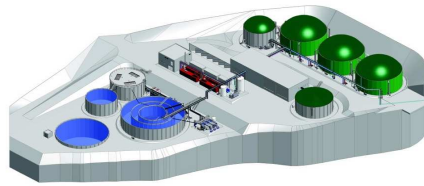


ENVIRONMENT & ENERGY



Colsen – Environmental engineering – www.colsen.nl - info@colsen.nl

**World class expertise in water-
and waste management**

**Successful in numerous projects for
industrial and communal customers**



**Continuous improving our
technologies through intensive R&D**

**Collaboration with global partners in
designing/supervising/monitoring
under a turn-key approach**

**Biological digestate treatment with
nutrient recovery**

**Biogas plants for manure and organic
biomass treatment**



Environment and energy

Colsen International b.v.

**Renewable energy production
from biogas**

Wastewater treatment technology

Wastewater treatment technology



Wastewater treatment technology

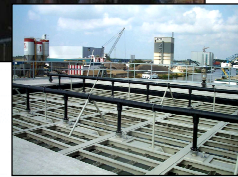
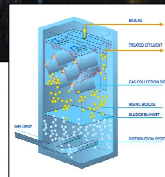
Technologies;

- ❖ UASB anaerobic WWT
- ❖ Phosphorus removal by ANPHOS®
- ❖ Enhanced Nitrogen removal by NAS®
- ❖ Water reuse applications

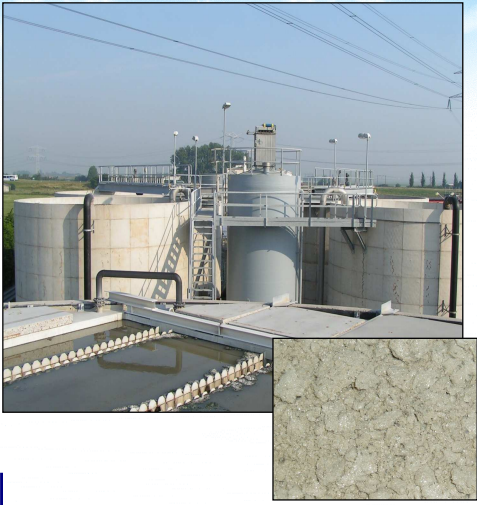
Wastewater treatment technology

Technologies;

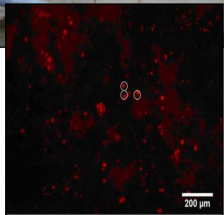
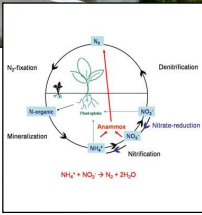
- ❖ UASB anaerobic WWT
- ❖ Phosphorus removal by ANPHOS®
- ❖ Enhanced Nitrogen removal by NAS®
- ❖ Water reuse applications



Wastewater treatment technology	
Technologies;	Advantages / performance;
❖ UASB anaerobic WWT	
❖ Phosphorus removal by ANPHOS®	➡ Reduction COD > 85%
❖ Enhanced Nitrogen removal by NAS®	➡ Compact building
❖ Water reuse applications	➡ Robust system
	➡ Energy revenues
	➡ Very low running costs

Wastewater treatment technology	
Technologies;	
❖ UASB anaerobic WWT	
❖ Phosphorus removal by ANPHOS®	
❖ Enhanced Nitrogen removal by NAS®	
❖ Water reuse applications	

Wastewater treatment technology	
Technologies;	Advantages / performance;
✦ UASB anaerobic WWT	➡ Reduction P > 90 %
❖ Phosphorus removal by ANPHOS®	➡ Reduction COD and N
✦ Enhanced Nitrogen removal by NAS®	➡ Struvite (MgNH_4PO_4) production; 7 kg / kg P
✦ Water reuse applications	➡ Value Struvite € 150,- / ton
	➡ Reduction running costs due to reduction; FeCl_3 , aeration requirements, sludge production
	➡ Robust system

Wastewater treatment technology	
Technologies; ✦ UASB anaerobic WWT ✦ Phosphorus removal by ANPHOS® ❖ Enhanced Nitrogen removal by NAS® ✦ Water reuse applications	  

Wastewater treatment technology	
Technologies;	Advantages / performance;
✦ UASB anaerobic WWT	➡ Reduction N > 95 %
✦ Phosphorus removal by ANPHOS®	➡ Reduction energy requirements
❖ Enhanced Nitrogen removal by NAS®	➡ Reduction sludge production
✦ Water reuse applications	➡ No need for organic carbon source
	➡ Proven technology also in MBR-configuration

Wastewater treatment technology	
Technologies;	
✦ UASB anaerobic WWT	 
✦ Phosphorus removal by ANPHOS®	
✦ Enhanced Nitrogen removal by NAS®	
❖ Water reuse applications	

Wastewater treatment technology

Technologies;

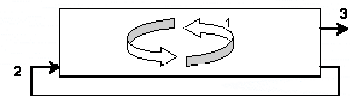
- ✦ UASB anaerobic WWT
- ✦ Phosphorus removal by ANPHOS®
- ✦ Enhanced Nitrogen removal by NAS®

❖ Water reuse applications

Advantages / performance;

➡ Production various kind of water qualities

➡ Water reuse possibilities;



1. Re-use; ⇒ Reuse of water within the process
2. Recycling; ⇒ Reuse of water over the process
3. Second use; ⇒ Reuse of water outside the process

Biogas plants for organic biomass conversion



Biogas plants for organic biomass conversion

Treatment strategy;

- ❖ Reception of organic biomass
- ❖ Enhanced thermophilic digestion
- ❖ Biogas desulphurisation
- ❖ Energy production
- ❖ Separation digestate
- ❖ Nitrogen removal MBR-NAS®
- ❖ Production various water qualities

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- ❖ Separation digestate
- ❖ Nitrogen removal MBR-NAS®
- ❖ Production various water qualities

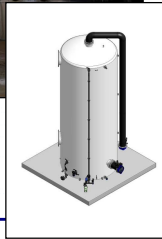
Advantages / performance;

- ➡ Increased conversion by:
 - ➡ Thermophilic conditions
 - ➡ Fiber circulation
 - ➡ Ammonia control
 - ➡ Enhanced mixing system
- ➡ Retention times of 20 days compared to over 40-50 days in conventional systems
- ➡ Proven technology in various applications world-wide

Biogas plants for organic biomass conversion

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- ✦ Enhanced thermophilic digestion
- ❖ **Biogas desulphurisation**
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- ❖ **Biogas desulphurisation**
- ✦ Energy production
- ✦ Separation digestate
- ✦ Nitrogen removal MBR-NAS®
- ✦ Production various water qualities

Advantages / performance;

- ➡ Conversion $H_2S > 95\%$
- ➡ Full biological process no chemicals addition
- ➡ Significant reduction maintenance- and lifetime of CHP-units
- ➡ No sludge/waste production
- ➡ Production of 'light' H_2SO_4 discharge for possible reuse
- ➡ Operational costs < € 2.000/y

Biogas plants for organic biomass conversion

Treatment strategy;

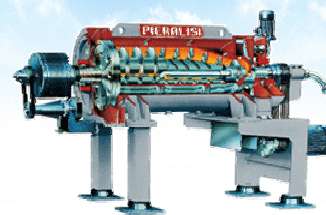
- ❖ Reception of organic biomass
- ❖ Enhanced thermophilic digestion
- ❖ Biogas desulphurisation
- ❖ **Energy production**
- ❖ Separation digestate
- ❖ Nitrogen removal MBR-NAS®
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Biogas plants for organic biomass conversion

Treatment strategy;

- ❖ Reception of organic biomass
- ❖ Enhanced thermophilic digestion
- ❖ Biogas desulphurisation
- ❖ Energy production
- ❖ **Separation digestate**
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Solid fraction → organic fertiliser

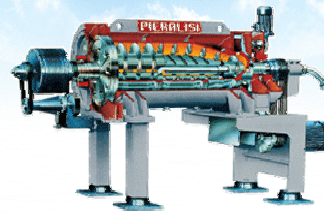


- ➔ 60% organic matter
- ➔ 5 – 10% P-total
- ➔ 11 – 23% P_2O_5
- ➔ 3 – 5% N-total

Biogas plants for organic biomass conversion

Treatment strategy;

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- ❖ Biogas desulphurisation
- ❖ Energy production
- ❖ **Separation digestate**
 - ❖ Nitrogen removal MBR-NAS®
 - ❖ Production various water qualities



Liquid fraction → for treatment

- ➡ < 20.000 ppm COD
- ➡ 20% of the initial P
- ➡ 85% of the initial N
- ➡ Small solid content

Biogas plants for organic biomass conversion

Treatment strategy;

- ❖ Reception of organic biomass
- ❖ Enhanced thermophilic digestion
- ❖ Biogas desulphurisation
- ❖ Energy production
- ❖ Separation digestate
- ❖ **Nitrogen removal MBR-NAS®**
 - ❖ Production various water qualities



Biogas plants for organic biomass conversion	
Treatment strategy;	Advantages / performance;
✦ Reception of organic biomass	➡ Reduction N < 500 ppm
✦ Enhanced thermophilic digestion	➡ Reduction COD < 2.000 ppm
✦ Biogas desulphurisation	
✦ Energy production	➡ Reduction sludge production
✦ Separation digestate	➡ No need for organic carbon source
❖ Nitrogen removal MBR-NAS®	
✦ Production various water qualities	➡ Proven technology also in MBR-configuration

Biogas plants for organic biomass conversion	
Treatment strategy;	
✦ Reception of organic biomass	
✦ Enhanced thermophilic digestion	
✦ Biogas desulphurisation	
✦ Energy production	
✦ Separation digestate	
✦ Nitrogen removal MBR-NAS®	
❖ Production various water qualities	Production of water depending on (local) requirements; ➡ Irrigation water with significant N and P content ➡ Water for discharge on sewer system ➡ Water for discharge on surface water ➡ Water for reuse in process operations

Project view Colsen world-wide

**Overview of various projects within the industrial,
communal and agricultural sector**

Project view Colsen world-wide



Project view Colsen world-wide



Project view Colsen world-wide



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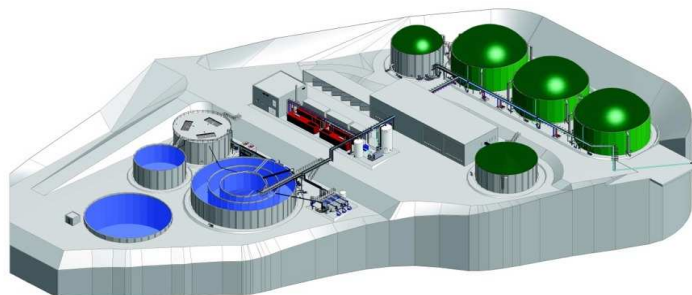
Project view Colsen world-wide



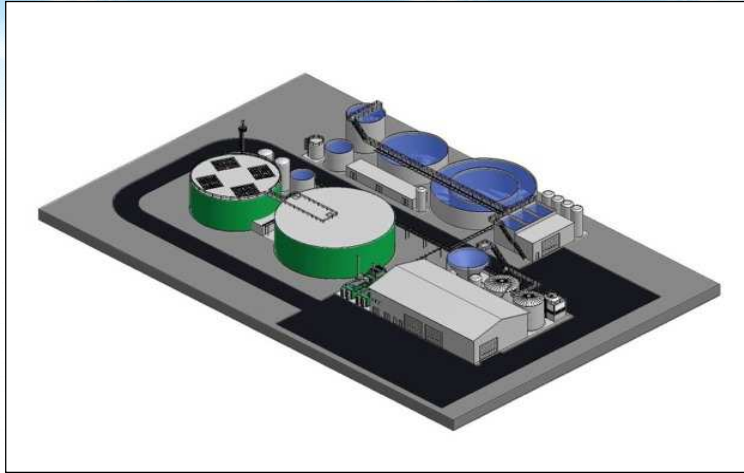
Project view Colsen world-wide



Project view Colsen world-wide



Project view Colsen world-wide



Project view Colsen world-wide



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**Your partner in sustainable waste- and
wastewater treatment**

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