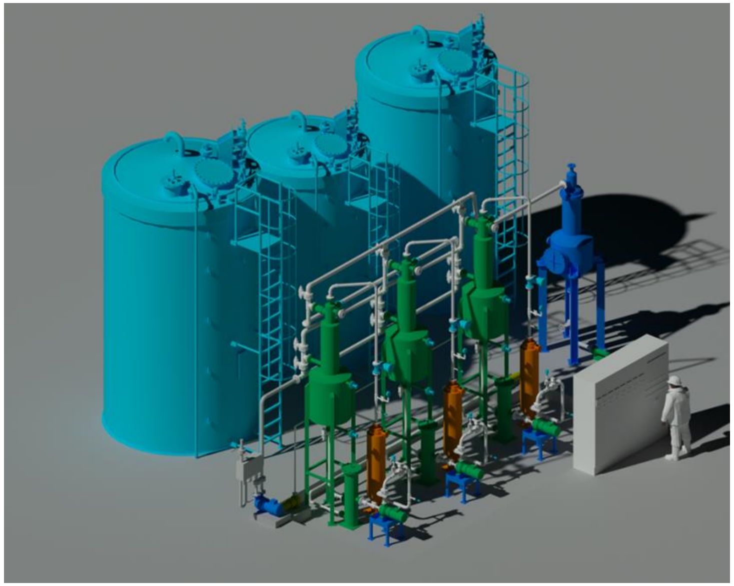
Nutrient reduction and recovery,
Kalmar 2018

PONDUS Verfahrenstechnik GmbH

Activating of the digester with thermal chemical hydrolysis and recovery of nitrogen

Thermal-Chemical Hydrolysis process (TCHP)



PONDUS-N: Recovery of nitrogen

PONDUS Verfahrenstechnik GmbH
Teltow, Germany
Dr.-Ing. Andreas Dünnebeil

Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND
IWAMA Interactive Water Management

Nutrient reduction and recovery, Kalmar 2018

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Thermal-chemical Hydrolysis

Degassing for digested sludge

Drying plants

Mechanical defoamers

Pasteurization

Substrate receiving and processing

Different plants/systems of the company PONDUS

Nutrient reduction and recovery,
Kalmar 2018

PONDUS® Verfahrenstechnik GmbH

PONDUS Verfahrenstechnik GmbH
near the capital Berlin
in Teltow

Mr. Dr.-Ing. Andreas Dünnebeil

Where we are

PONDUS® Verfahrenstechnik GmbH

Why we hydrolyse sludge ?

- The gas production of activated sludge in comparison to the primary sludge is very low
- We separate the process of hydrolysis out of the digester
- We relieve the overloaded digester
- We reduce the sludge production
- We boost the gas production

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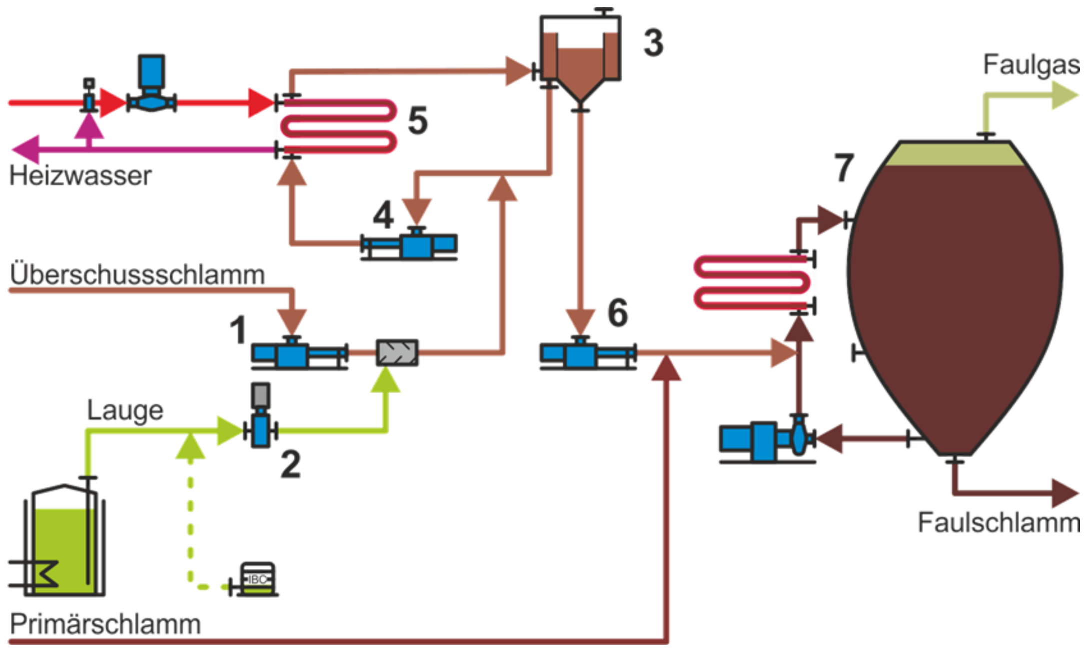
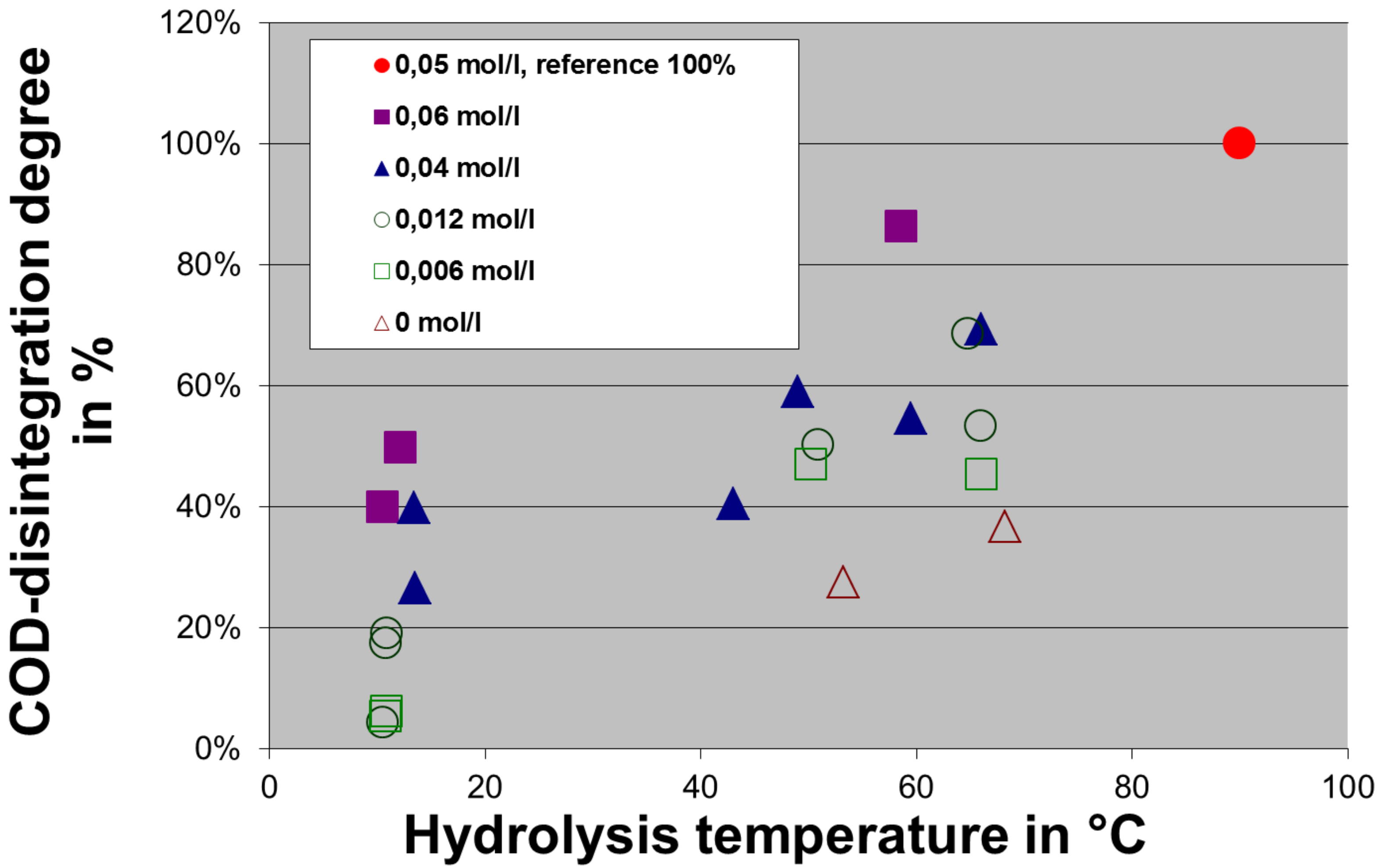
1 Feed pump WAS
2 Dosing pump caustic soda
3 Reactor
4 Circulation pumpe
5 Heat exchanger
6 Discharge pump
7 Circulation digester



Process for thermal-chemical hydrolysis

The process

Nutrient reduction and recovery,
Kalmar 2018



Process for thermal-chemical hydrolysis

COD disintegration degree, f(T, NaOH)

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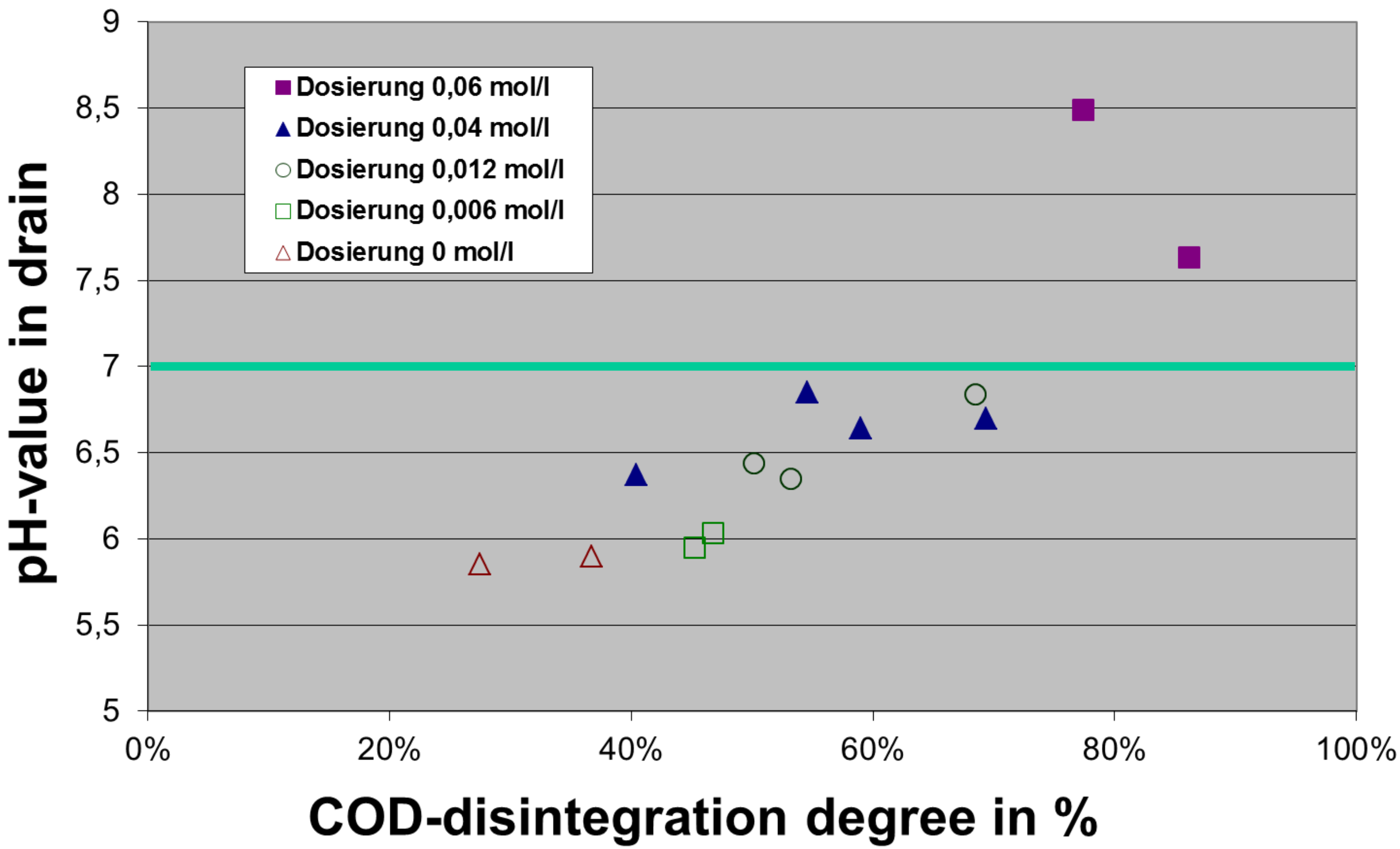

Process for thermal-chemical hydrolysis

pH-Level in drain

Nutrient reduction and recovery,
Kalmar 2018

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Untreated waste activated sludge before hydrolysis

Treated sludge after thermal chemical hydrolysis

Process for thermal-chemical hydrolysis

Destruction of flakes and cells

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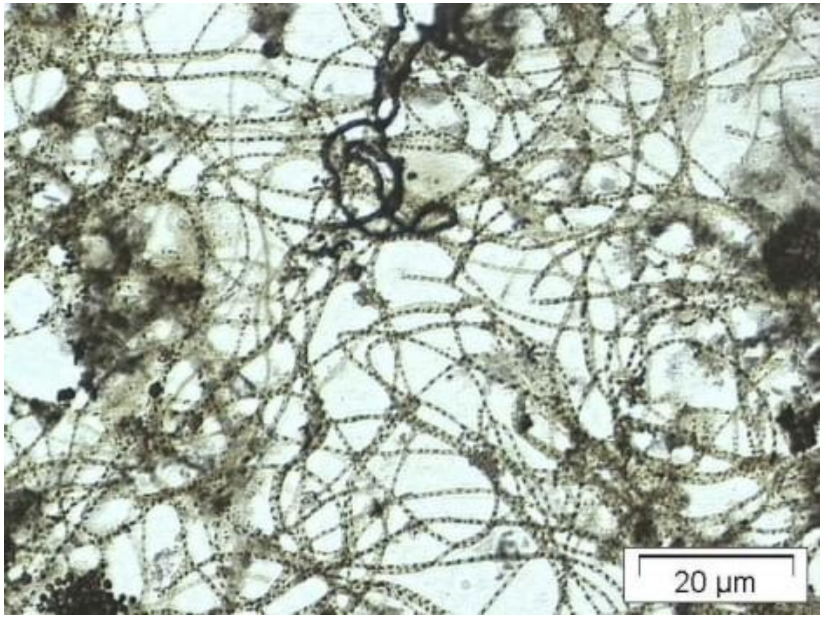
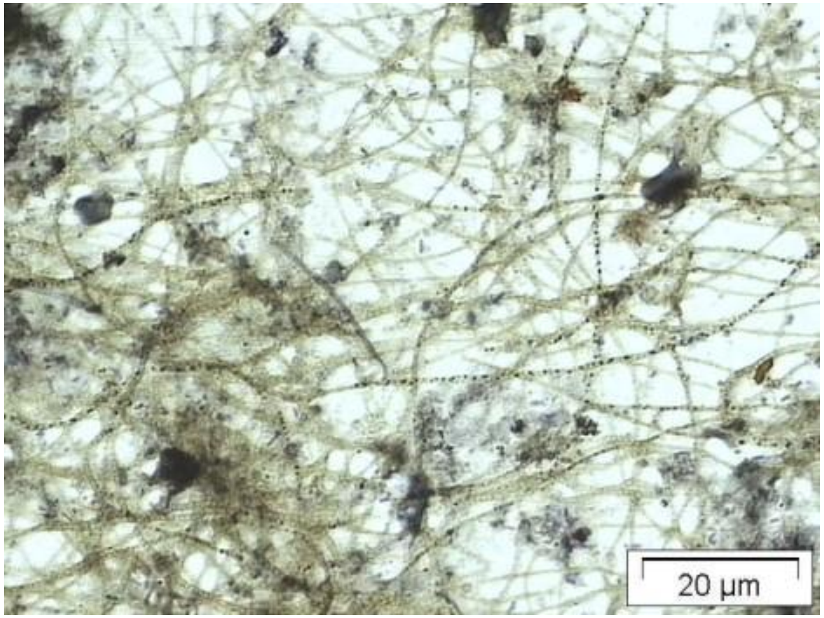


Untreated waste activated sludge before hydrolysis with phosphorus (black points)



Treated sludge after thermal chemical hydrolysis without phosphorus inside

At
Chemisch-thermische Desintegration von Schwimmschlamm, Bernd Heinzmann, Gerd Engel, KA 2007, Nr. 4

Process for thermal-chemical hydrolysis

Discharge of phosphorus with hydrolysis

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- Increase of biogas production between 20 to 35%
- Reduction of sludge quantity
- Savings in polymer consumption at least 10 – 20%
- Reduction of sludge viscosity by up to 80% leading to better mixing with less energy
- Reduction or elimination of digester foaming
- Atmospheric pressure system, heating source is hot water from CHP- no steam or hot oil required
- Low energy requirement, no additional heat necessary
- Flexible adaptation of the process to changing operating conditions
- Simple operation and low O&M costs

Process for thermal-chemical hydrolysis

Benefits of thermal-chemical Hydrolysis

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for 30 – 40 m³/h

for 2,2 m³/h

Process for thermal-chemical hydrolysis

Reactor for big and small systems

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High performance
pipe in pipe
Heat exchanger 1900 kW

Conventional pipe in pipe
heat exchanger 135 kW

Spiral
heat exchanger
260 kW

Process for thermal-chemical hydrolysis

Different kind of heat exchanger

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PE-Tank 20 m²

2 x IBC-Container

Process for thermal-chemical hydrolysis

Storage of caustic soda

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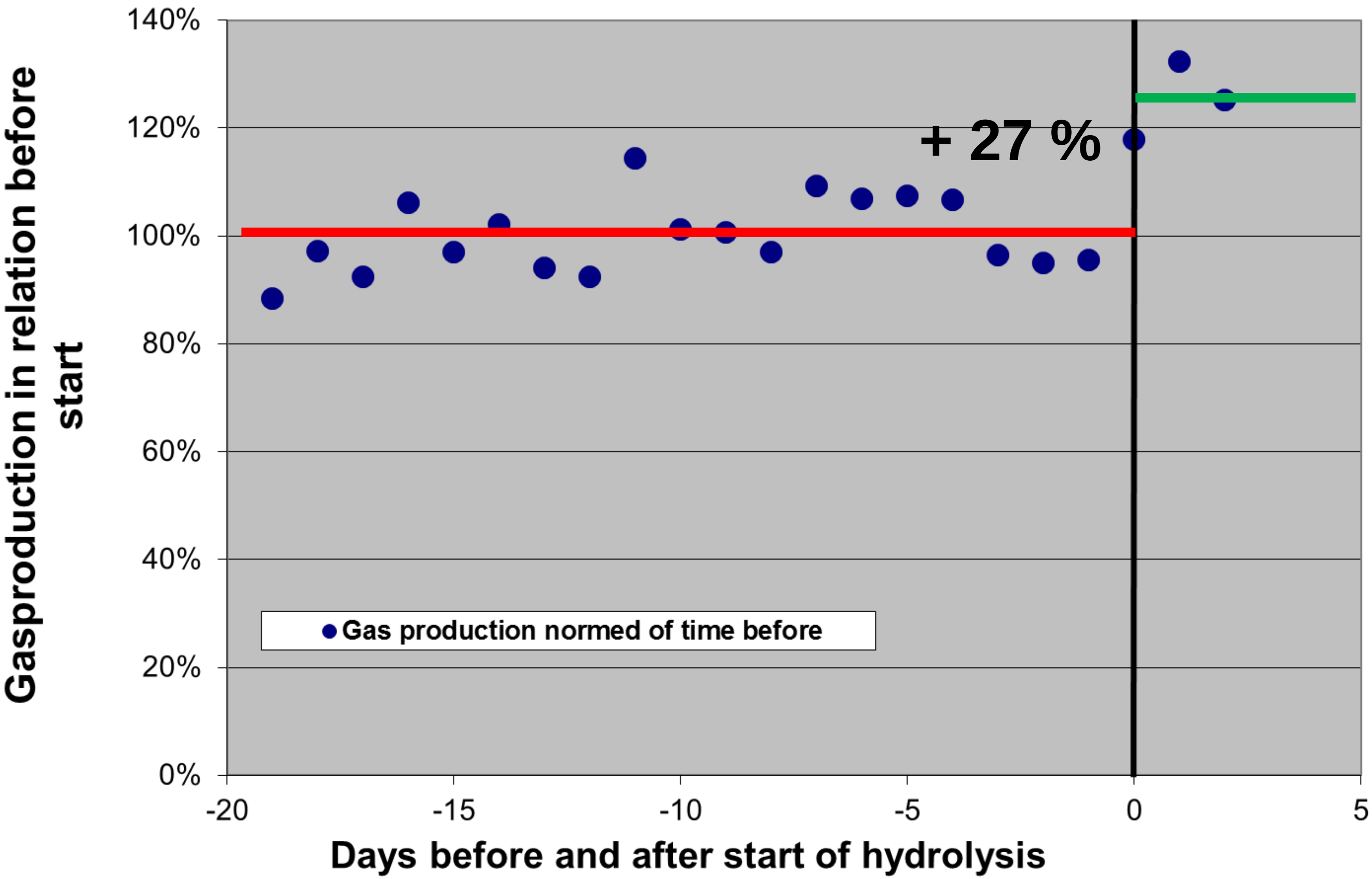

Process for thermal-chemical hydrolysis

Increase of biogas production, Gifhorn

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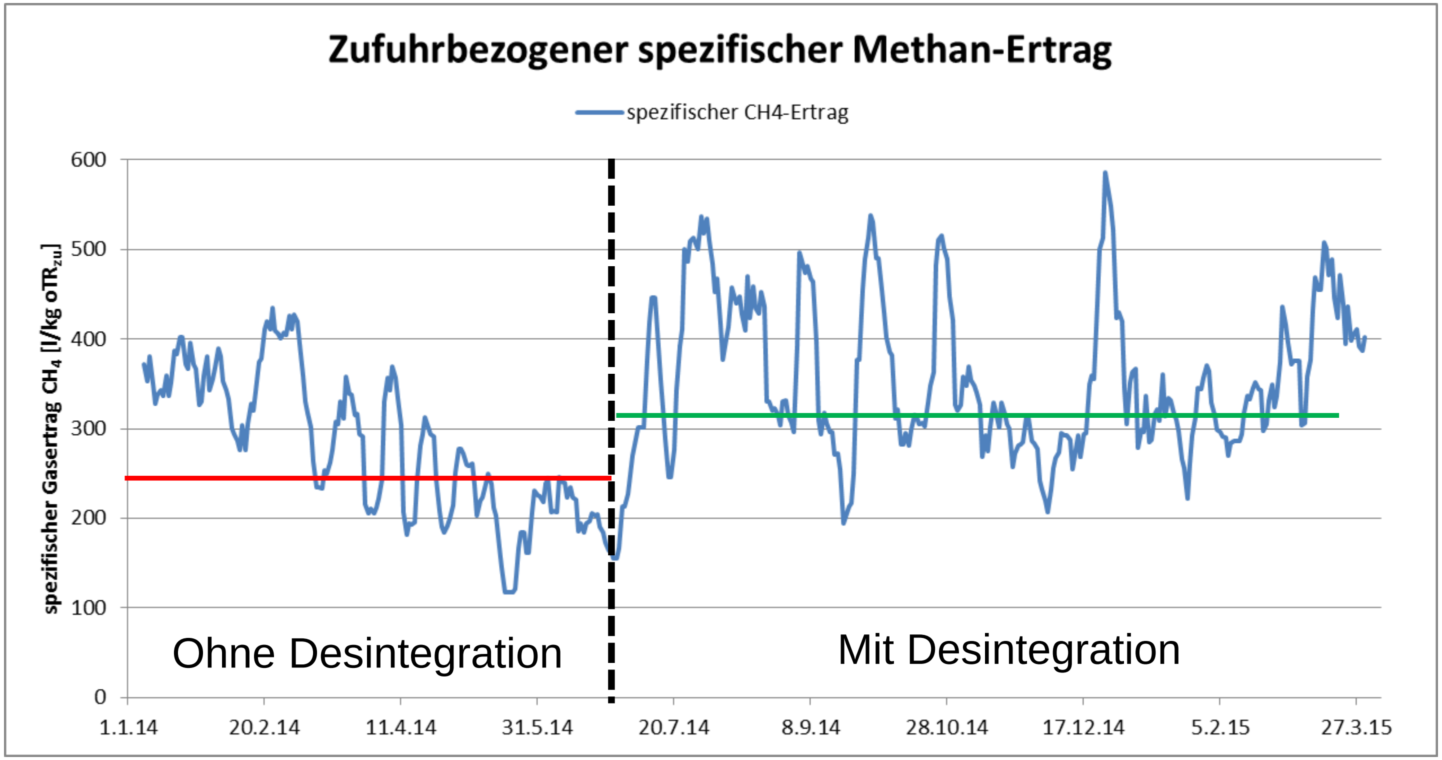


- Methanproduction without hydrolysis: i.m. 239 l/kg oTR_{zu}
- Methanproduction with hydrolysis: i.m. 312 l/kg oTR_{zu}

+ 31 %

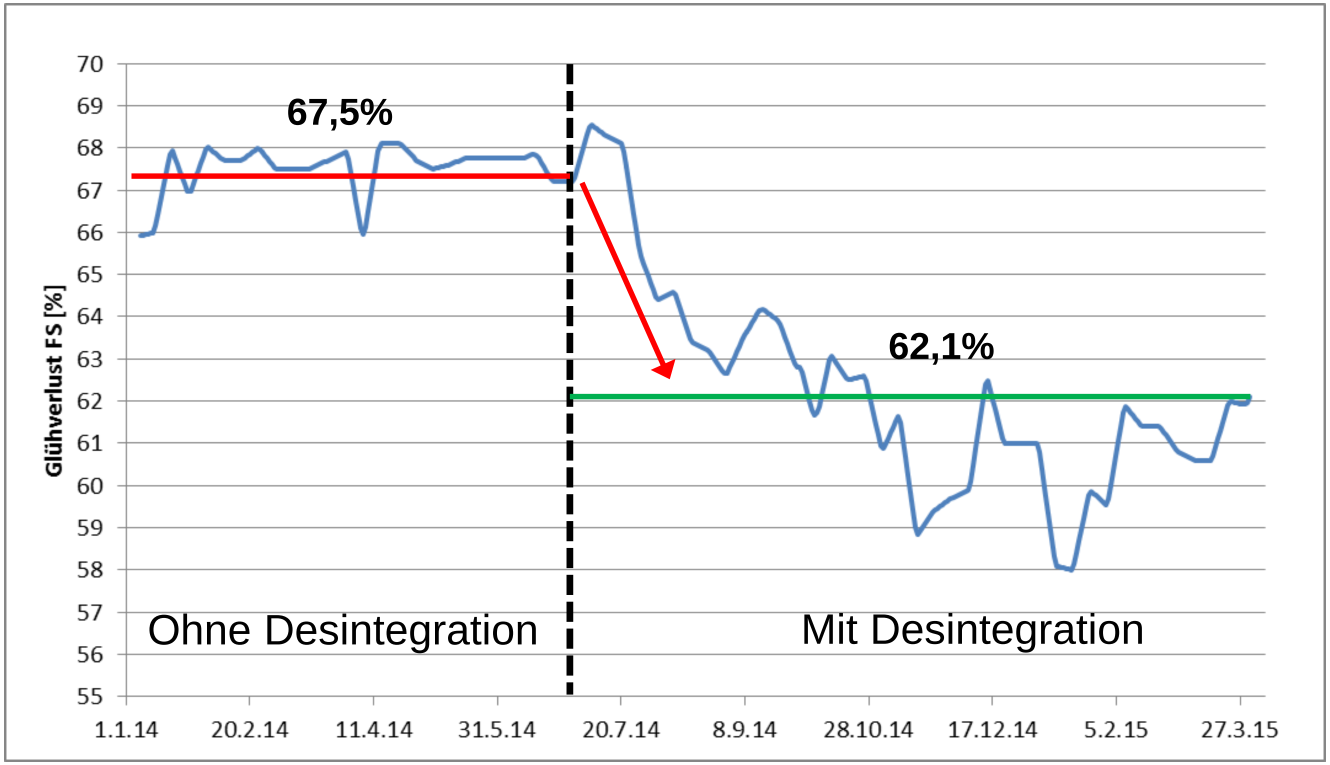
Mit freundlicher Genehmigung
der PFI Planungsgemeinschaft
Hannover
nach Herrn Hermanussen

PFI

Process for thermal-chemical hydrolysis

Increase of gas production, Uelzen

PONDUS® Verfahrenstechnik GmbH



Glühverlust (berechnet) im Rohschlamm vergleichbar (ohne/mit Des.: 87,5/87,9%)

- Loss of lost ignition in digested sludge 5,4 %-point (-9% relativ)

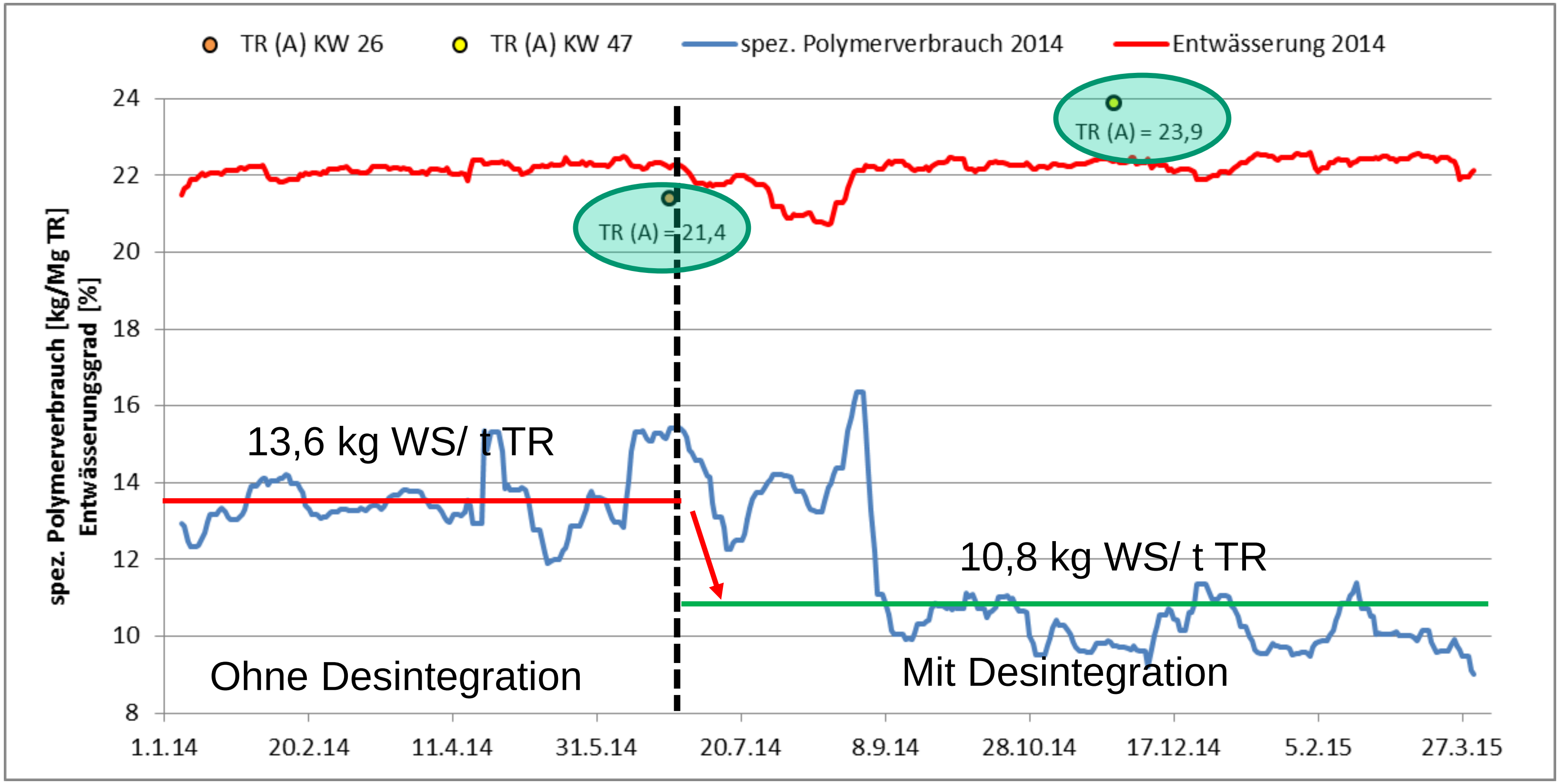
Mit freundlicher Genehmigung
der PFI Planungsgemeinschaft
Hannover
nach Herrn Hermanussen

PFI

Process for thermal-chemical hydrolysis

Loss of lost ignition in digester, Uelzen

PONDUS® Verfahrenstechnik GmbH



- Dewatering nearly constant (rd. 22 % solids)
- Reducing of the polymer consumption rd. 3 kg WS/ t TR, **- 21 %**

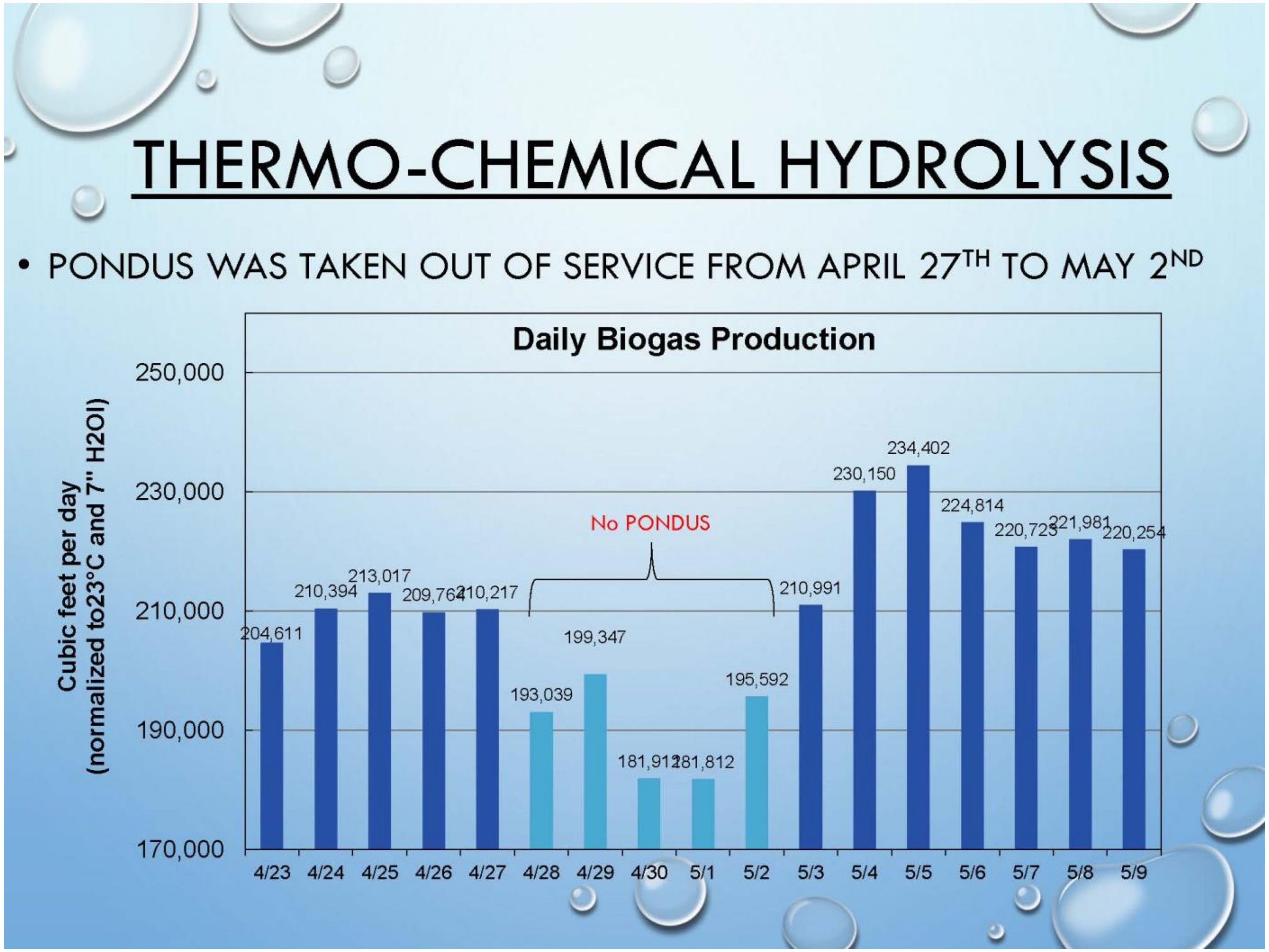
Mit freundlicher Genehmigung
der PFI Planungsgemeinschaft
Hannover
nach Herrn Hermanussen

PFI

Process for thermal-chemical hydrolysis

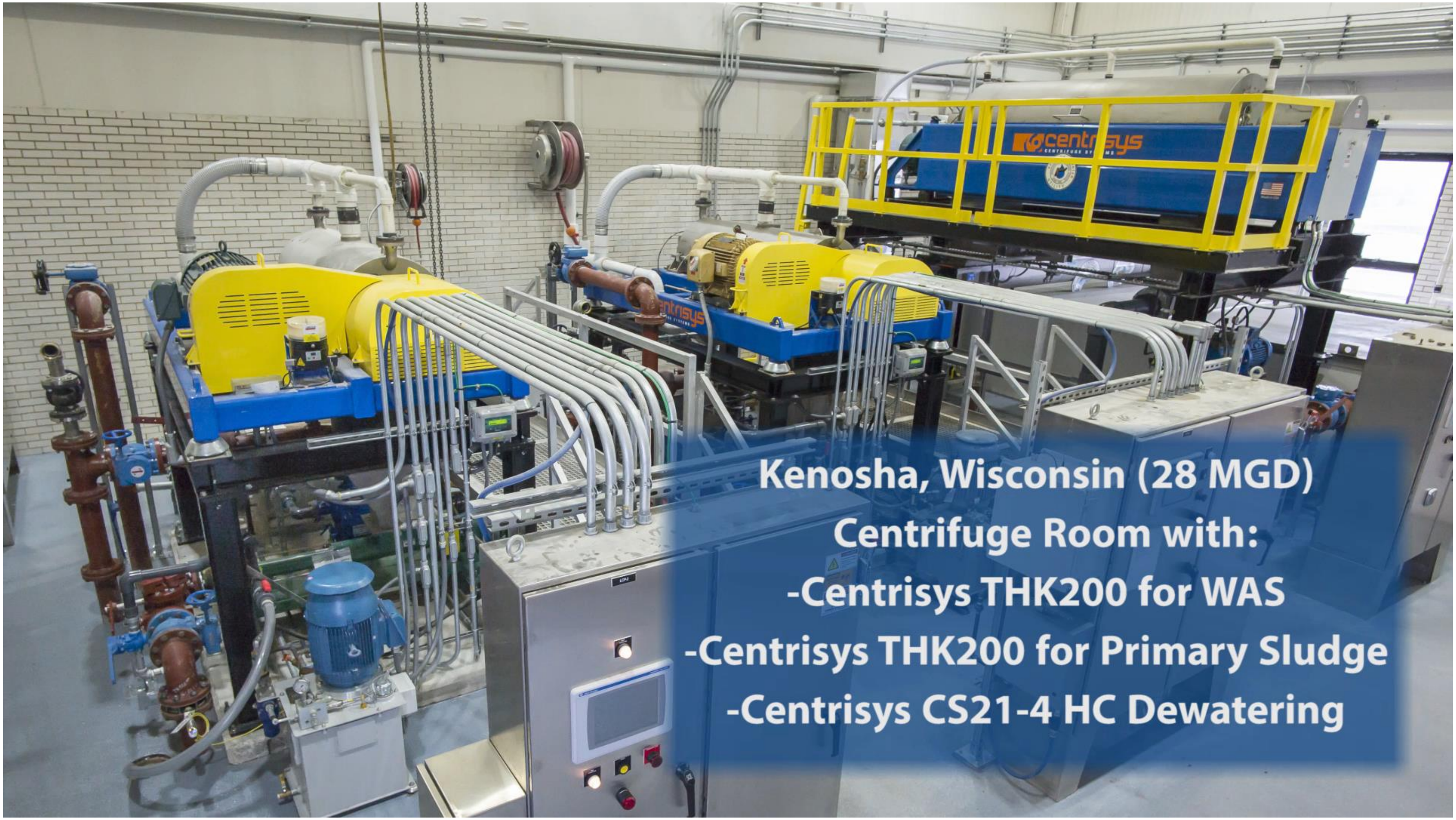
Reducing of the polymer consumption , Uelzen

Nutrient reduction and recovery, Kalmar 2018



Process for thermal-chemical hydrolysis

Gas production in Kenosha, USA in a break



Process for thermal-chemical hydrolysis

Reduction of the viscosity, Kenosha, Centrysis/CNP

Nutrient reduction and recovery, Kalmar 2018

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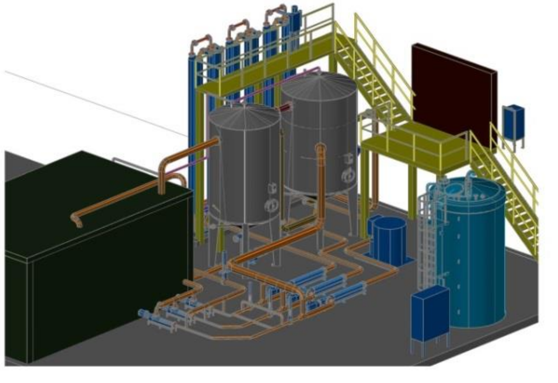
Ort	Durchsatz	EGW	Baujahr	Anmerkungen	Anlass
Kläranlage Gifhorn	2,2 m³/h	65.000	2005	24-h Betrieb	Nicht ausreichende Wärme vorhanden und überschäumende Faulung
Kläranlage Ratekau	2,0 m³/h	45.000	2007	Über Nacht Standby	Faulung überlastet
Kläranlage Nordhorn	2,5 m³/h	70.000	2013	Auch als Hygienisierung KAT 3 nutzbar	Faulung überlastet und geringe Mengen KAT3 Material
Kläranlage Köln-Stammheim	30 m³/h	1.500.000	2014	PONDUS nur Lizenzgeber, noch in der Optimierung	Besser Ausnutzung der Faulung
Kläranlage Uelzen	3,7 m³/h	80.000	2013	24-h Betrieb	Erhöhte Stromerzeugung und überlastete Faulung
Kläranlage Kenosha (USA)	5,6 m³/h	100.000	2014	24-h Betrieb	Erhöhte Gas- und Stromerzeugung bei gleichzeitiger Reduktion der betriebenen Faulbehälter
Kläranlage Wolfsburg	5,3 m³/h	135.000	2014/17	24-h Betrieb	Mehrgasproduktion für den Betrieb der Trocknung
Testanlage Kompetenzzentrum Berlin	15 l/h	2.000.000	2018	Fertiggestellt	Testanlage für den Schlamm aus Berlin Waßmannsdorf
Entsorgungszentrum Wuwei (VR China)	16,7 m³/h		2018/19	in Bau	Reduktion der Schlammmenge

für 2018: Löhne und Göppingen in Vorbereitung



Process for thermal-chemical hydrolysis

Reference

Plant in Wolfsburg

Design flow	5,3 m³/h
Heat power	370 kW
temperature	65 °C
Retention time 1.+2. Stufe	2,1 h

1. results:

start April 2017,
With new digester

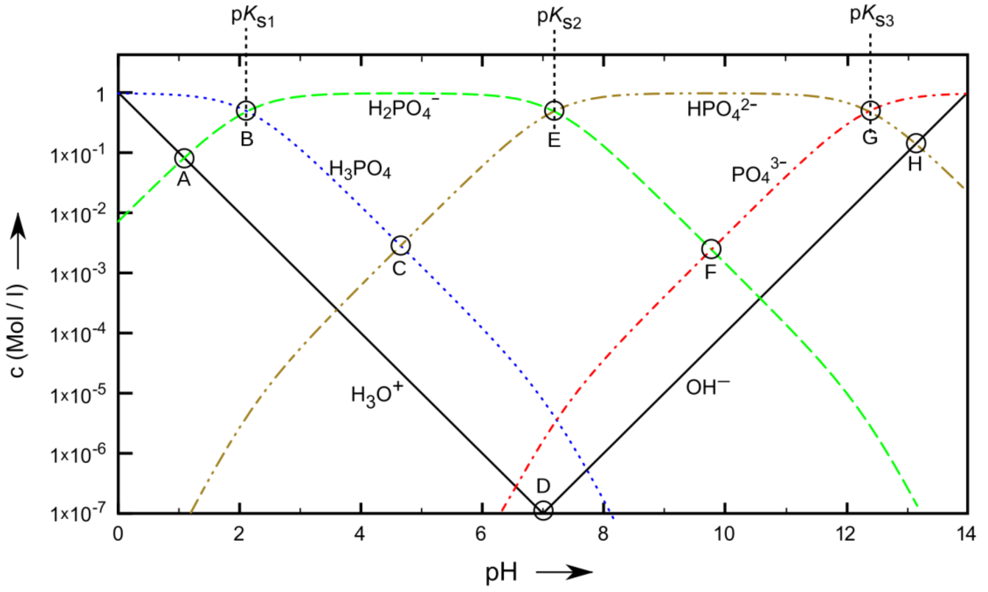
PO_4-P 40 => 480 mg/l (total 960)
NH_4-N 8 => 440 mg/l (total 3500)

Process for thermal-chemical hydrolysis

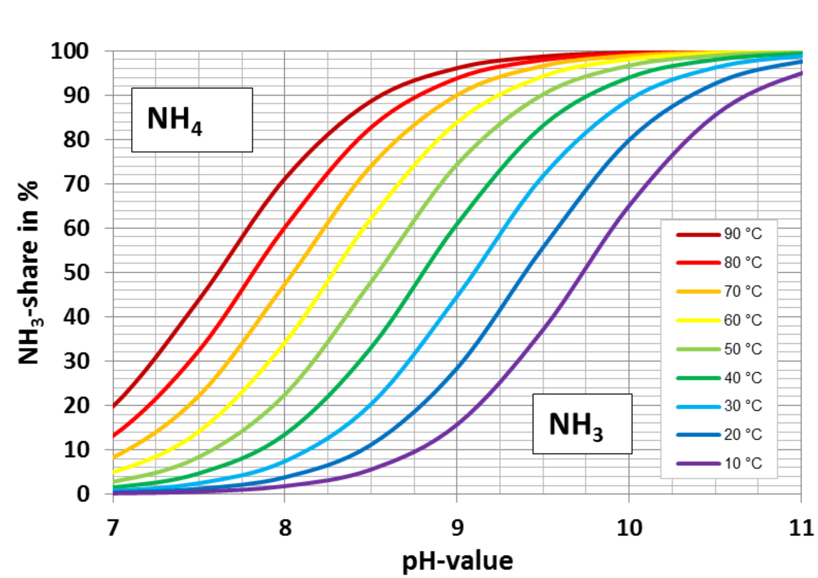
Release of phosphorus by hydrolysis

But phosphorus alone does not make happy, either

Can we also talk a little bit abaout nitrogen???



ammonium-ammonia



Which diagram is more beautiful ?

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Everyone talks about phosphorus, the next is nitrogen

Nutrient reduction and recovery,
Kalmar 2018

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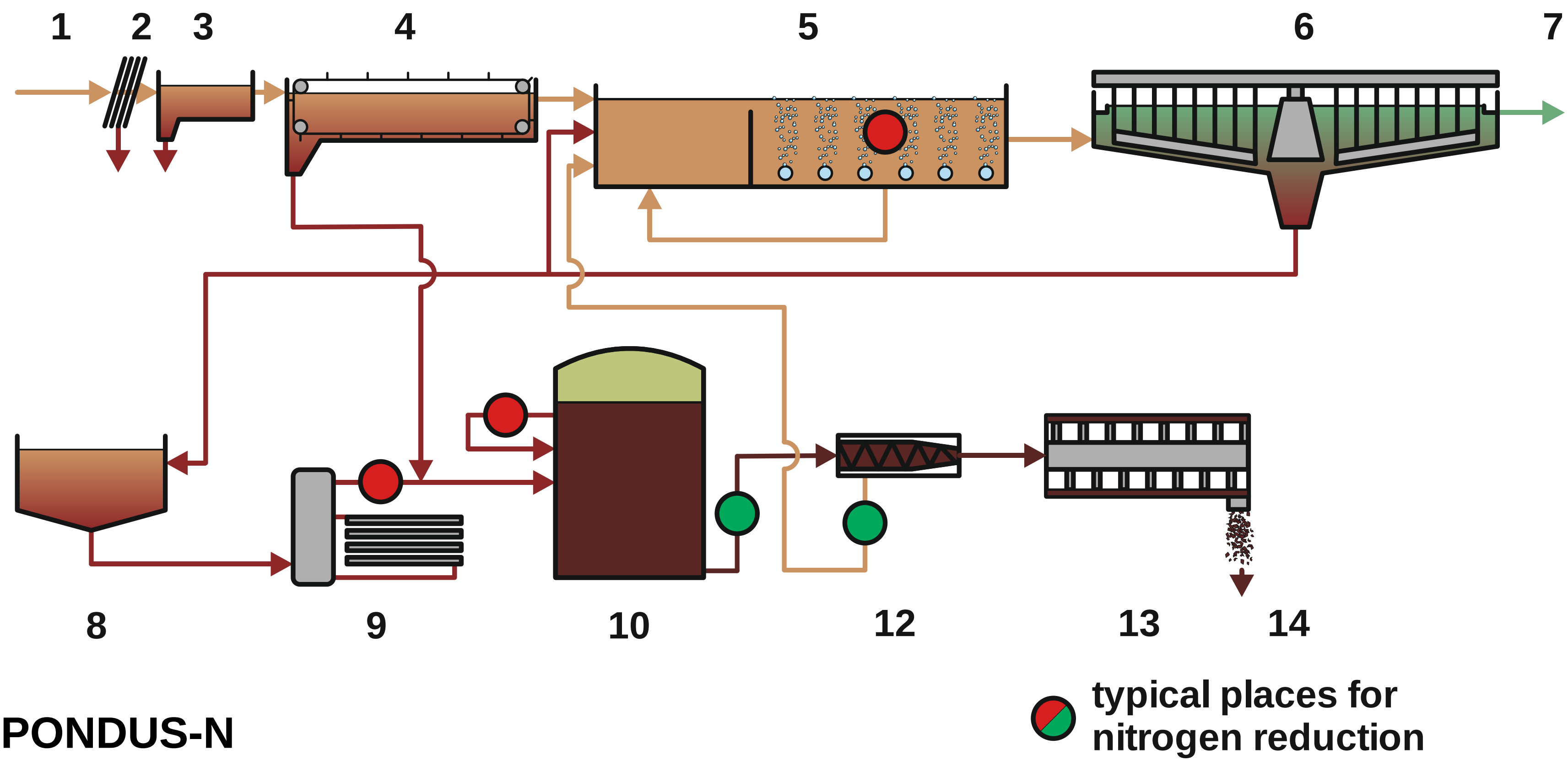
A little trip to nitrogen,

the PONDUS-N process



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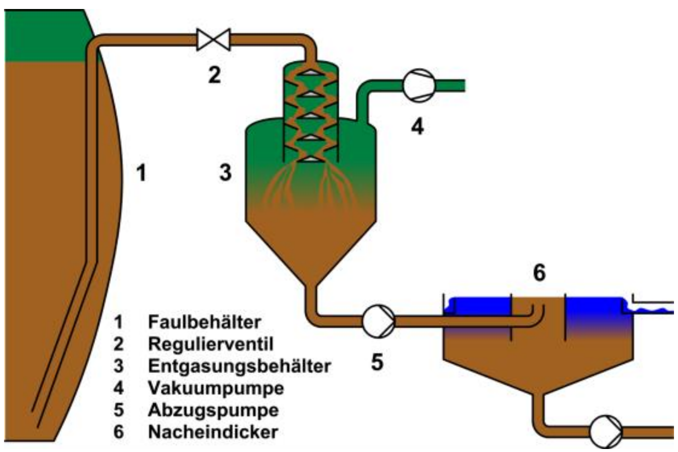
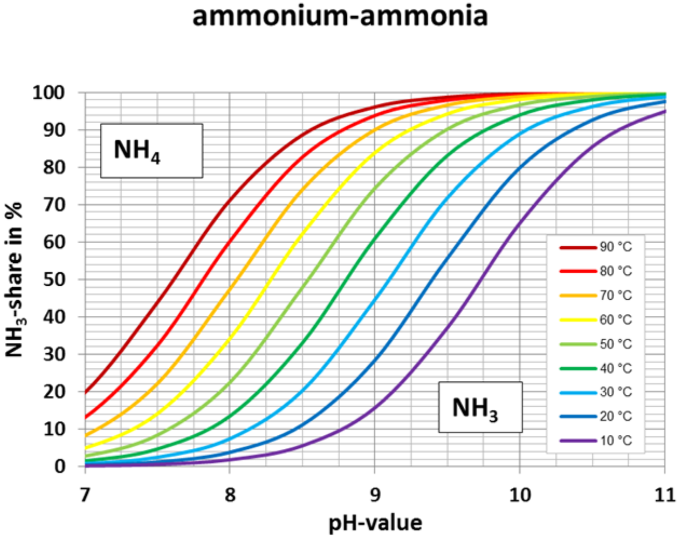
Typical places for nitrogen reduction

PONDUS-N,
a system for nitrogen recovery

Based on the proven sludge vacuum degassing



The chemical is typical



but the process is different

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The base of our system

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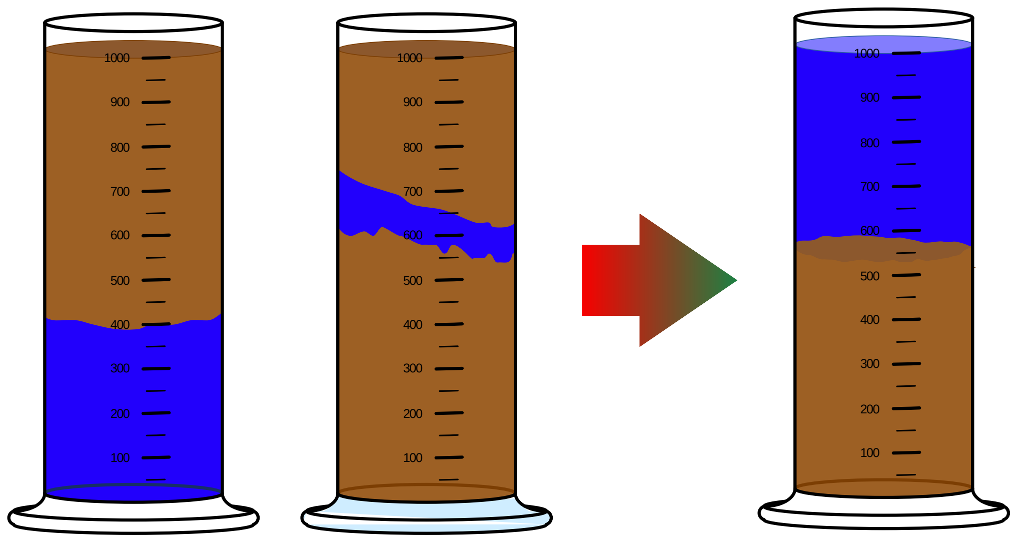
PONDUS-N, the base
digested sludge degassing

The problem in
the post thickener

Sedimentation of digested sludge



without degassing

with degassing

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The reason for digested sludge degassing

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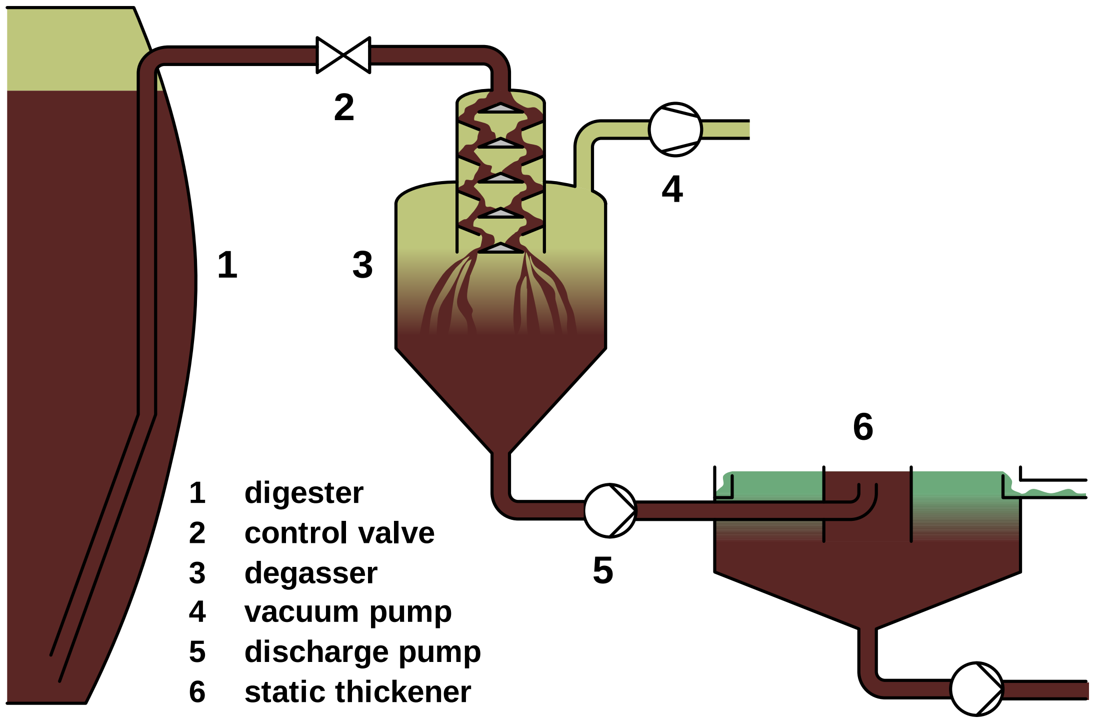
PONDUS-N, the base process
digested sludge vacuum degassing



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The process of digested sludge degassing

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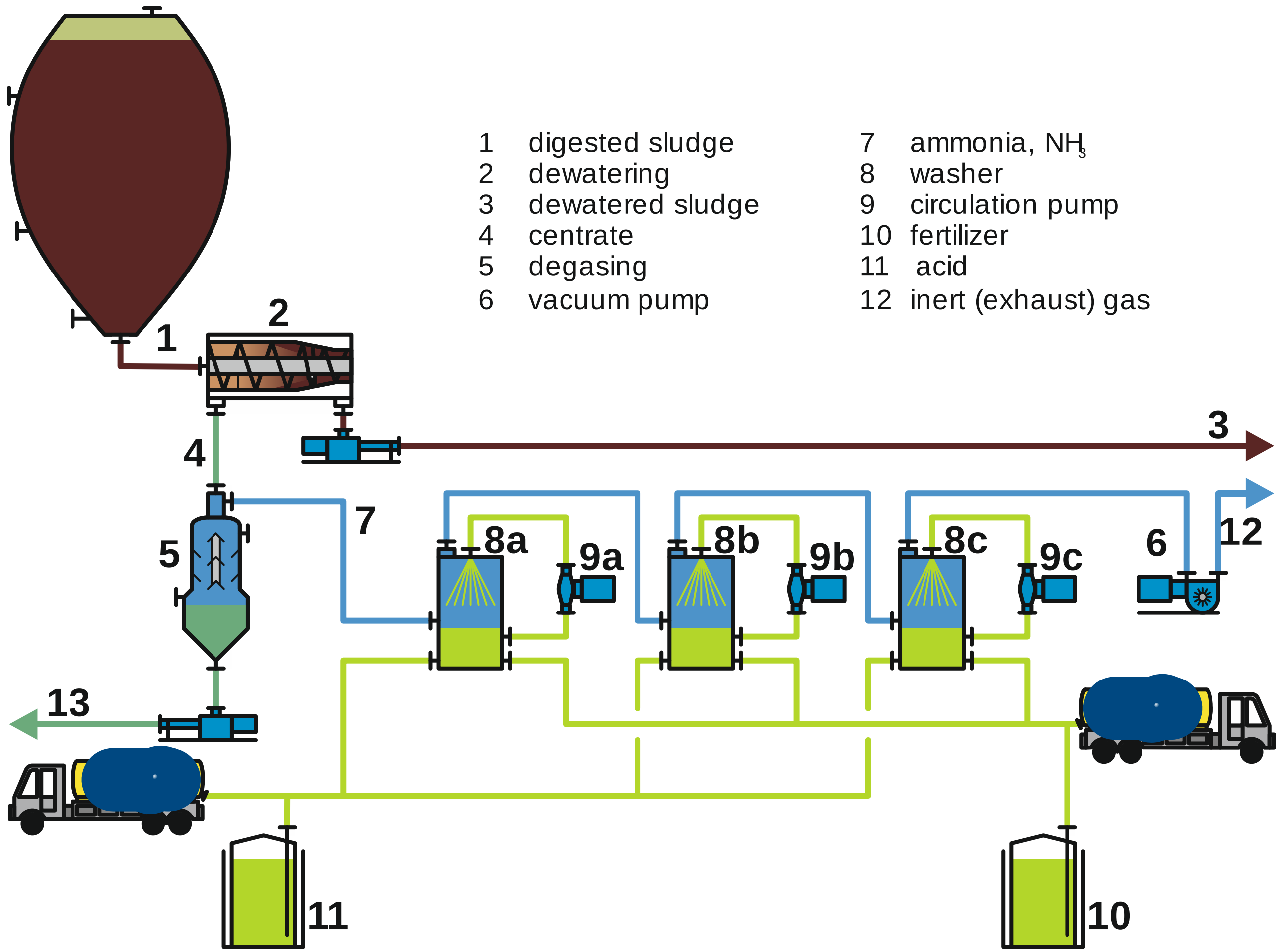
The PONDUS–N process



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The process, example for water of dewatering

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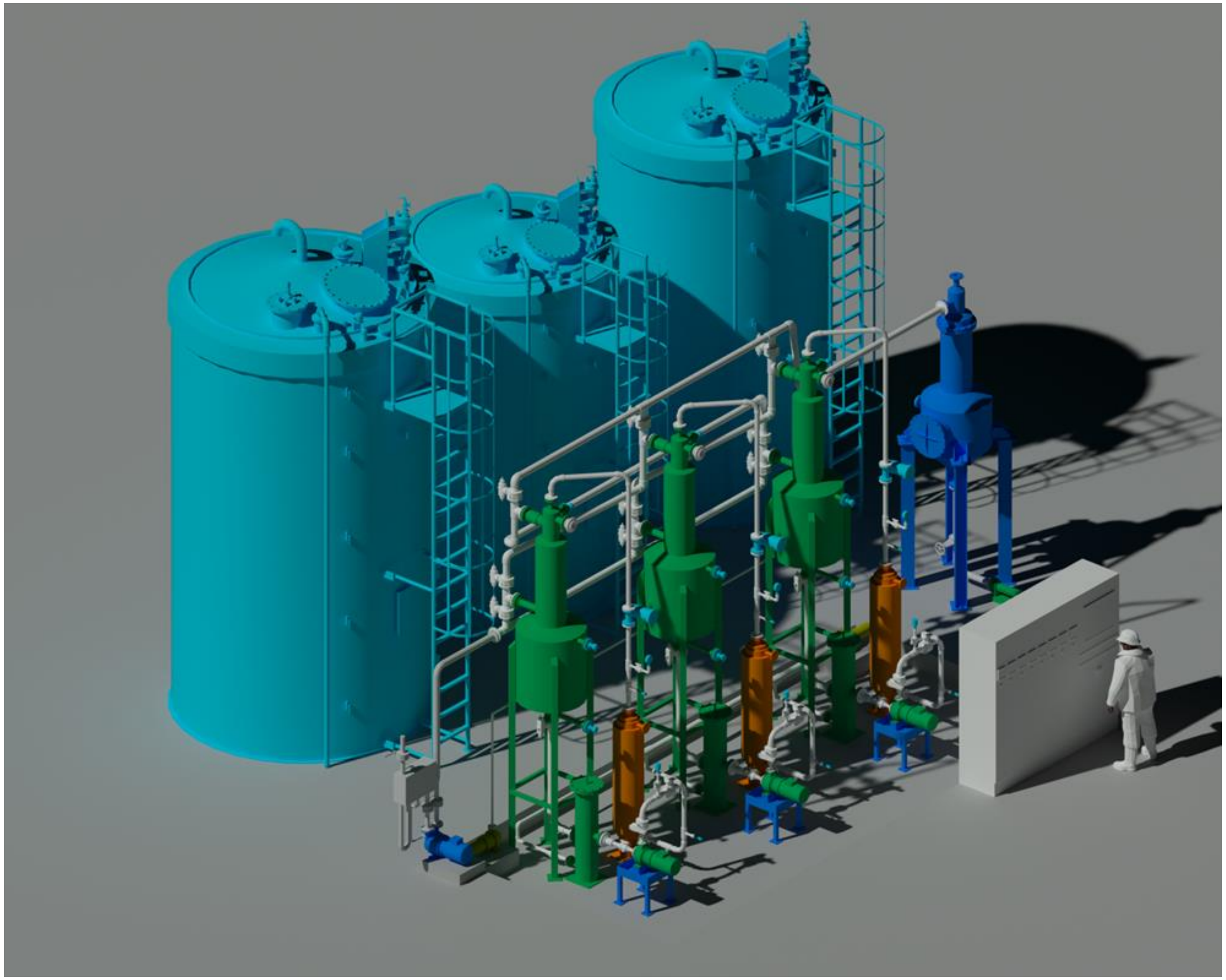

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Example for 300 T PE

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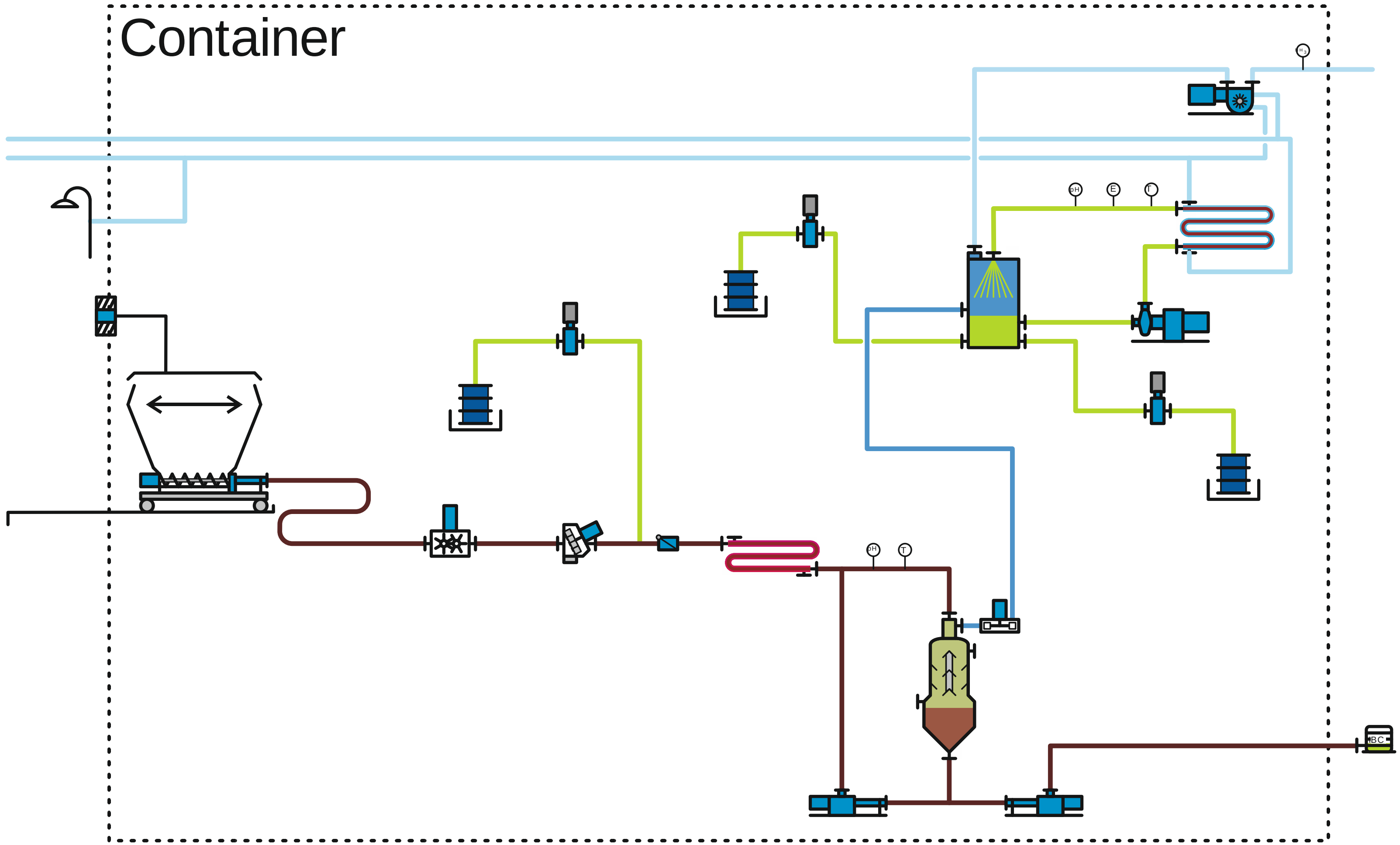

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Pilot plant for HORIZON 2020

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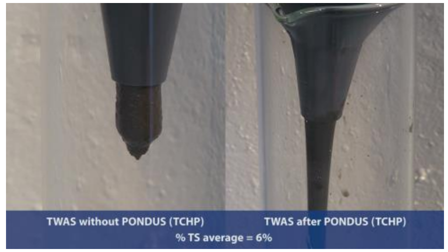
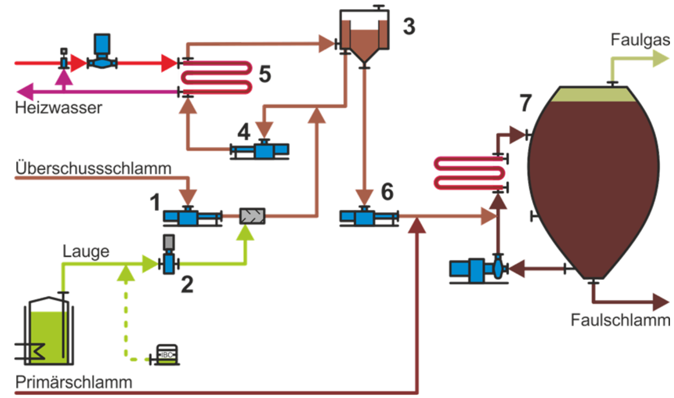
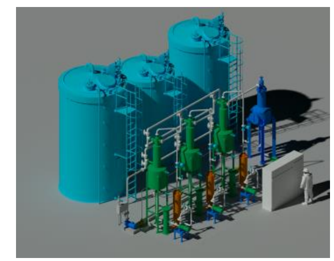
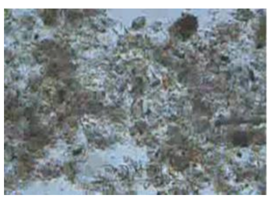
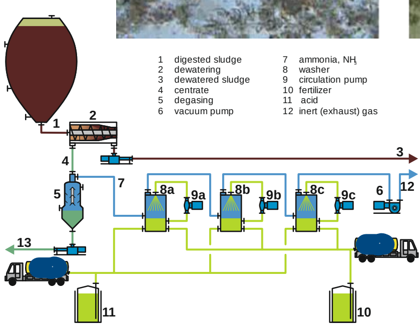


Thank you for your patience









Thermal-chemical hydrolysis and PONDUS-N

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