IWA Wastewater

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Thermal or thermo-alkaline hydrolysis for waste activated sludge? Comparison of pros and cons for a Berlin WWTP

CHRISTIAN REMY, VAHID TOUTIAN, CHRISTIAN LODERER
BERLIN CENTRE OF COMPETENCE FOR WATER

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POZNAN UNIVERSITY OF TECHNOLOGY
CO-ORGANISER

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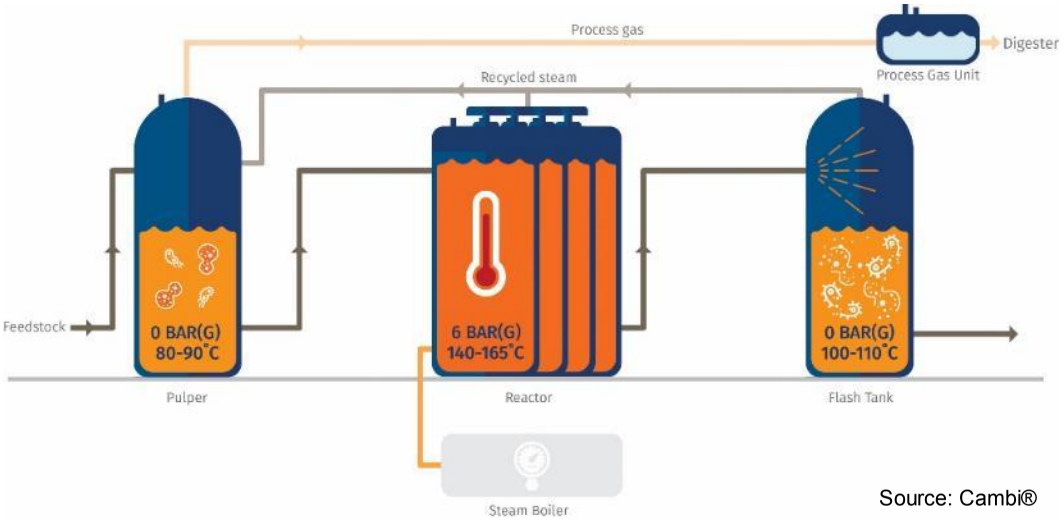
WASTE ACTIVATED SLUDGE – THE PROBLEM

- Problem: waste activated sludge (WAS) is poorly degradable in anaerobic digestion (< 40% reduction of volatile solids)
- Low biogas yield + low dewaterability → high costs for sludge disposal and energy
- Solution: pre-treatment of WAS before digestion to enhance biological degradability
- Different processes available:
  - Thermal
  - Chemical
  - Mechanical
  - Biological

SOLUTION: THERMAL OR THERMO-ALKALINE HYDROLYSIS?

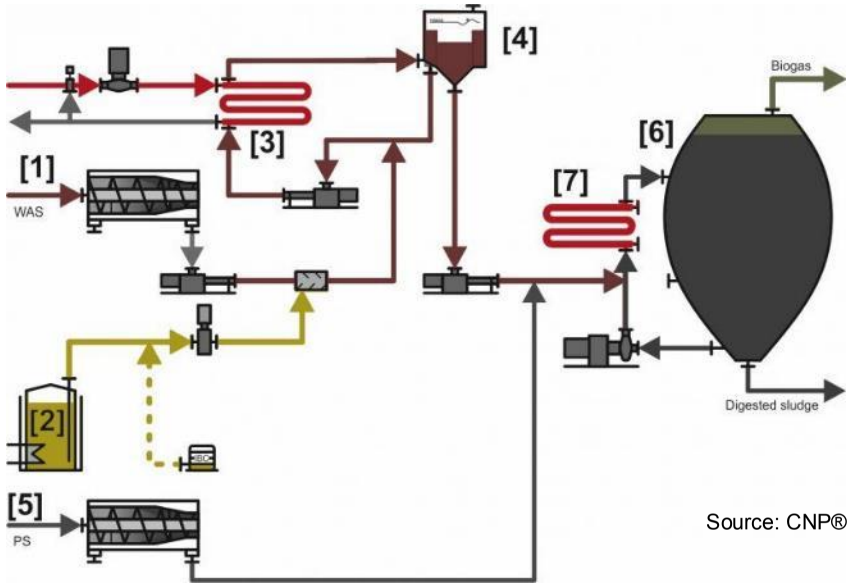
THERMO-PRESSURE HYDROLYSIS (THP)



Source: Cambi®

- T = 165°C + p = 6 bar
- HRT = 30 min

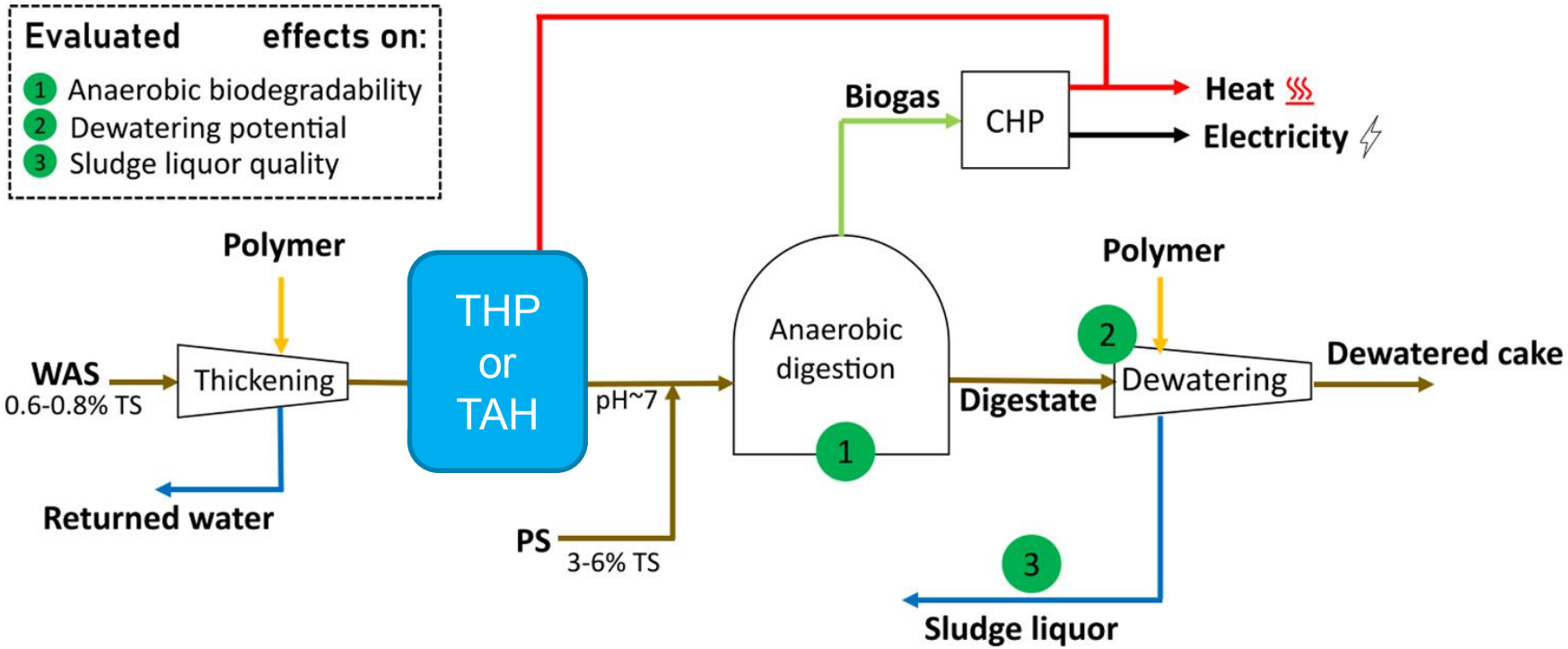
THERMO-ALKALINE HYDROLYSIS (TAH)



Source: CNP®

- T = 65°C + NaOH (pH = 10)
- HRT = 120 min

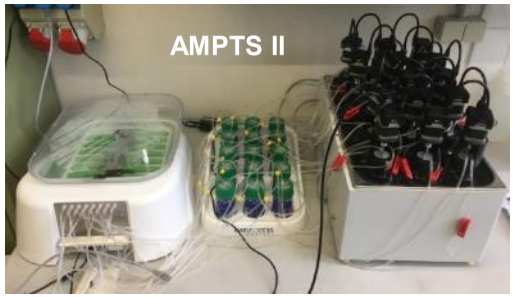
MPORTANT FACTORS FOR COMPARISON



NH_4, refractory COD

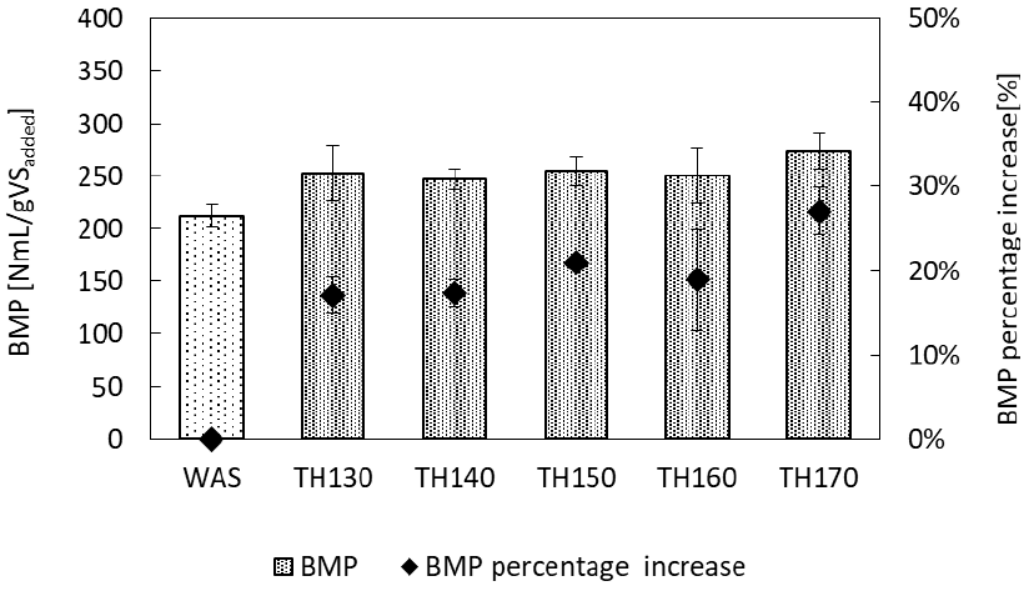
AB AND PILOT TESTING FOR A BERLIN WWTP (1.6 MIO PE)

Factor	THP	TAH	Method
Biogas yield	130-170°C	60-90°C	Biomethane potential tests
		65°C	Pilot digestors (12 months)
Dewatering	130-170°C	65°C	Lab centrifuge
Liquor: refractory COD	130-170°C	65°C	Zahn-Wellens-Test



IOGAS YIELD

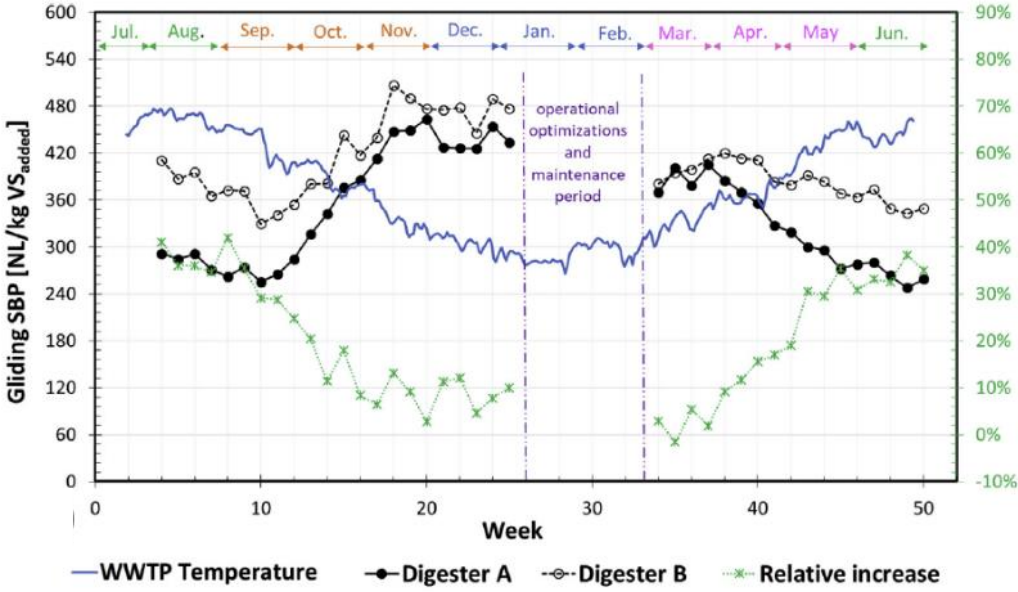
THERMO-PRESSURE HYDROLYSIS



- WAS only (lab)
- Increase: +17 to +27%

Toutian et al., Water Research 171 (2020)

THERMO-ALKALINE HYDROLYSIS

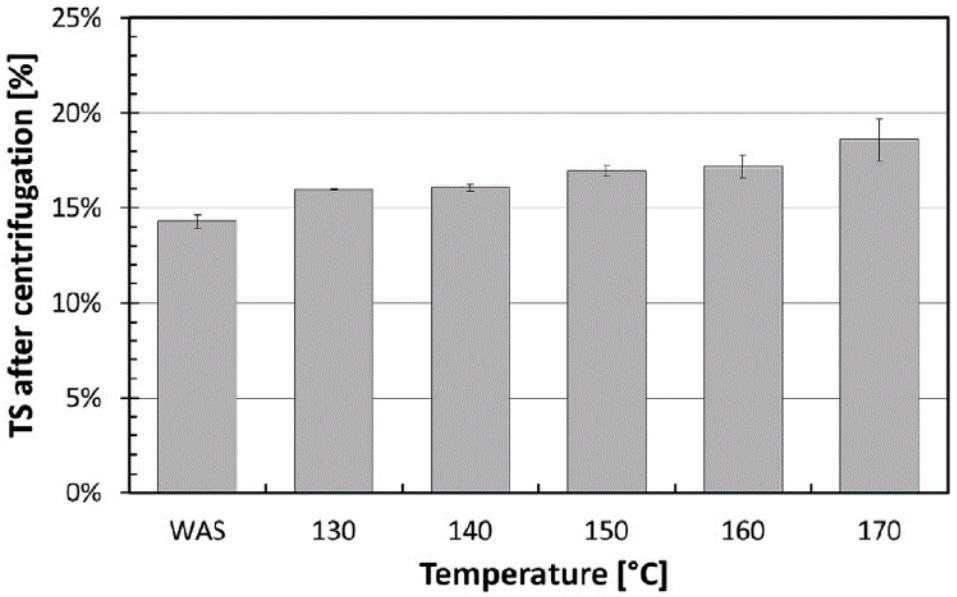


- PS + WAS (pilot)
- Increase: +20% (annual mean, seasonal e

Toutian et al., Water Research 182 (2020)

EWATERING

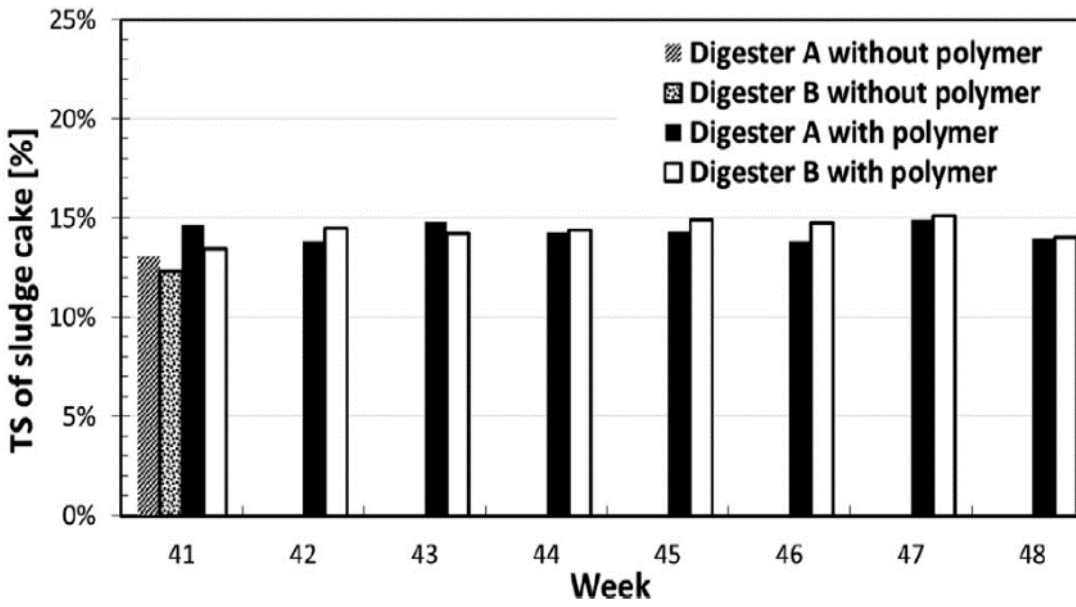
THERMO-PRESSURE HYDROLYSIS



- WAS only (lab)
- Increase: +2 to +4%

Toutian et al., Water Research 171 (2020)

THERMO-ALKALINE HYDROLYSIS

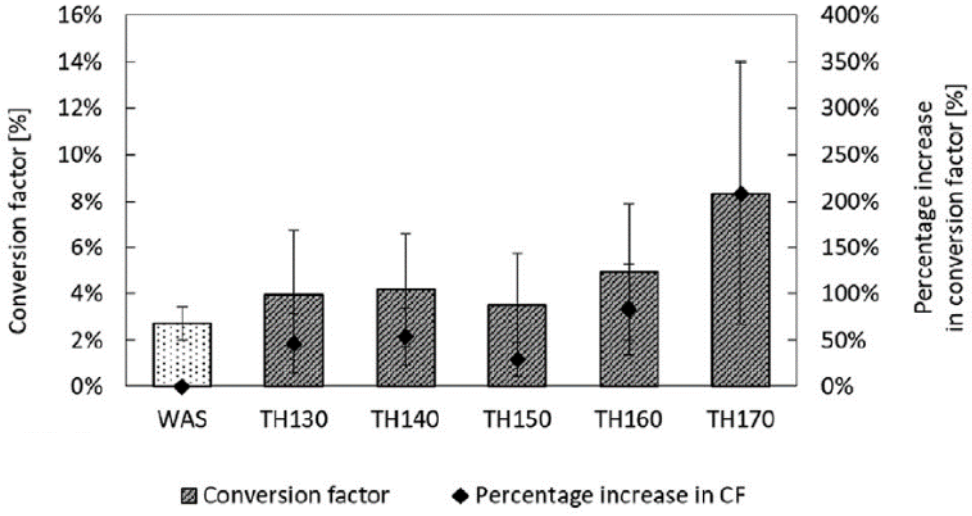


- PS + WAS (pilot)
- No effect

Toutian et al., Water Research 182 (2020)

EFRACTORY COD IN LIQUOR

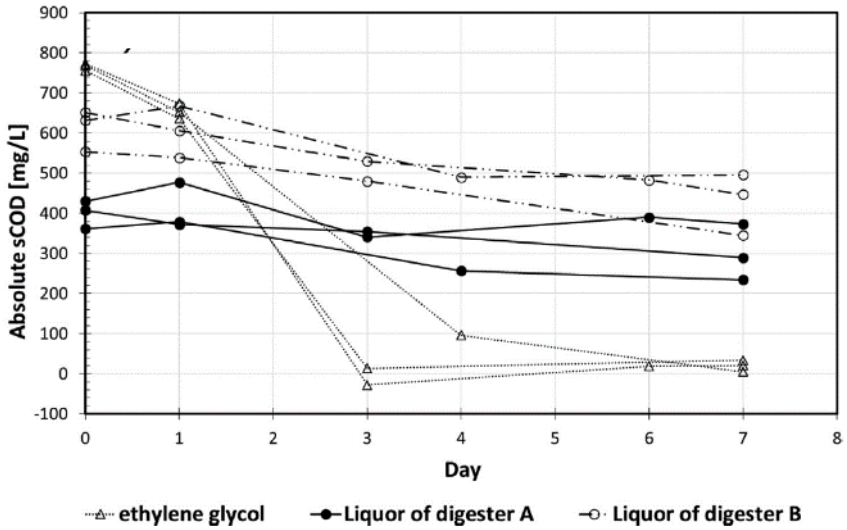
THERMO-PRESSURE HYDROLYSIS



- Increase: +50 to +200% (>160°C)
- Translates to + 2-11 mg/L COD in WWTP effluent

Toutian et al., Water Research 171 (2020)

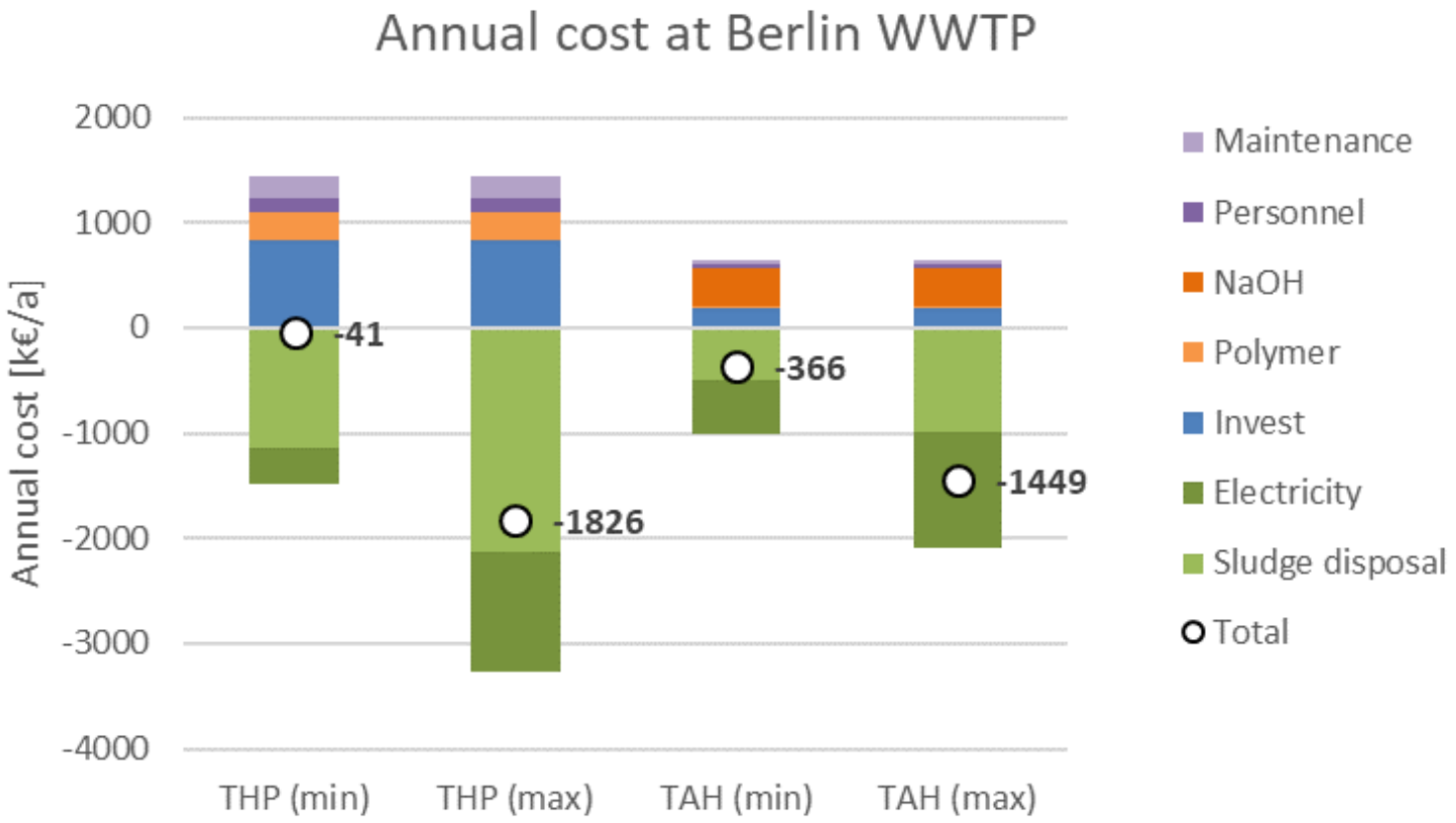
THERMO-ALKALINE HYDROLYSIS



- Increase: +30% (mean)
- Translates to + 1 mg/L COD in WWTP effluent

Toutian et al., Water Research 182 (2020)

OTAL COST COMPARISON (1,6 MIO PE)



Not included: digestor capacity increase, impact of lower viscosity, …

Interest rate: 3%
Amortization period
Maintenance: 3% o
Sludge disposal: 8
Electricity: 200 €/M
NaOH (50%): 320
Polymer: 3 €/kg a.

ONCLUSIONS FOR BERLIN WWTP

- THP: high biogas yield + positive impact on dewatering, BUT prohibitive risk of increasing refractory COD
- TAH: medium biogas yield + no impact on dewatering, only low risk of refractory COD
- Annual cost balance is comparable
- For this WWTP, TAH seems more favorable = less risky for WWTP effluent targets, but still a good effect
- THP and TAH have to be compared based on individual WWTP situation and goals!

CKNOWLEDGEMENTS

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