INTENSIFICATION OF ANAEROBIC SEWAGE SLUDGE FERMENTATION IN THE WASTEWATER TREATMENT PLANT „GDAŃSK-WSCHÓD"

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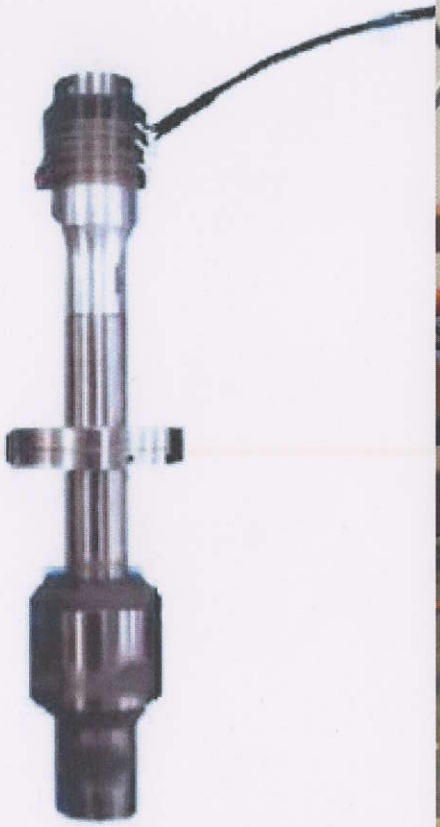
Department of Chemical Technology
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SCOPE OF PRESENTATION

- Test system of anaerobic digestion
  - [redacted]
  - [redacted]
  - VI stage of investigation (fermentation with US desintegration)
- Laboratory tests
- Dewatering
- Results of experiments
- Summary

Ultrasonic reactor system KS1000/2000 SONOTRONIC Nagel Co.





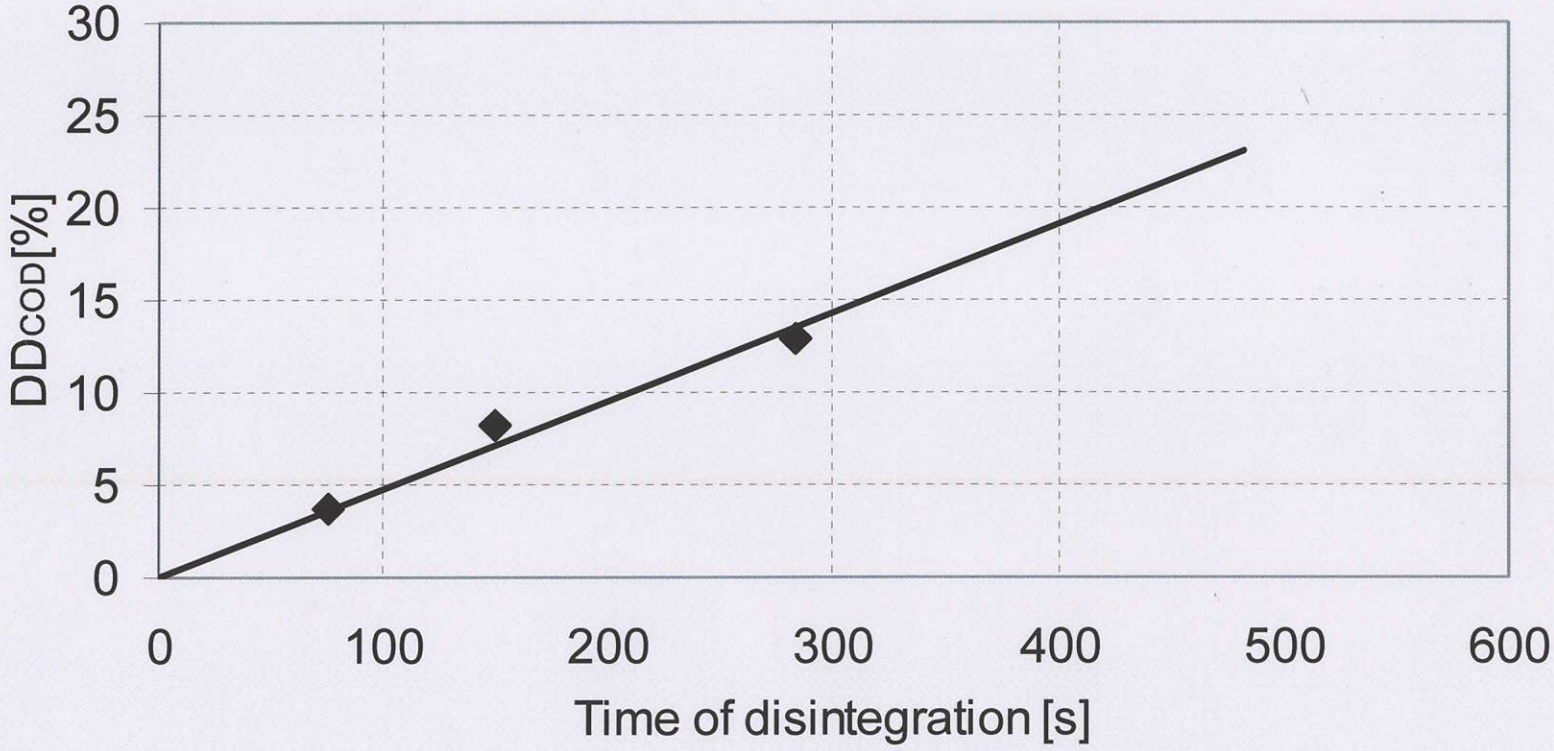


Degree of Disintegration DD_{COD}

- Centrifugation 10 - 30 min, 10.000 - 40.000 g
- Membrane filtration (0.45 µm)
- COD-measurement (by cuvette test)
- Reference Disintegration 22 hours at 20°C with 0.5 molar NaOH

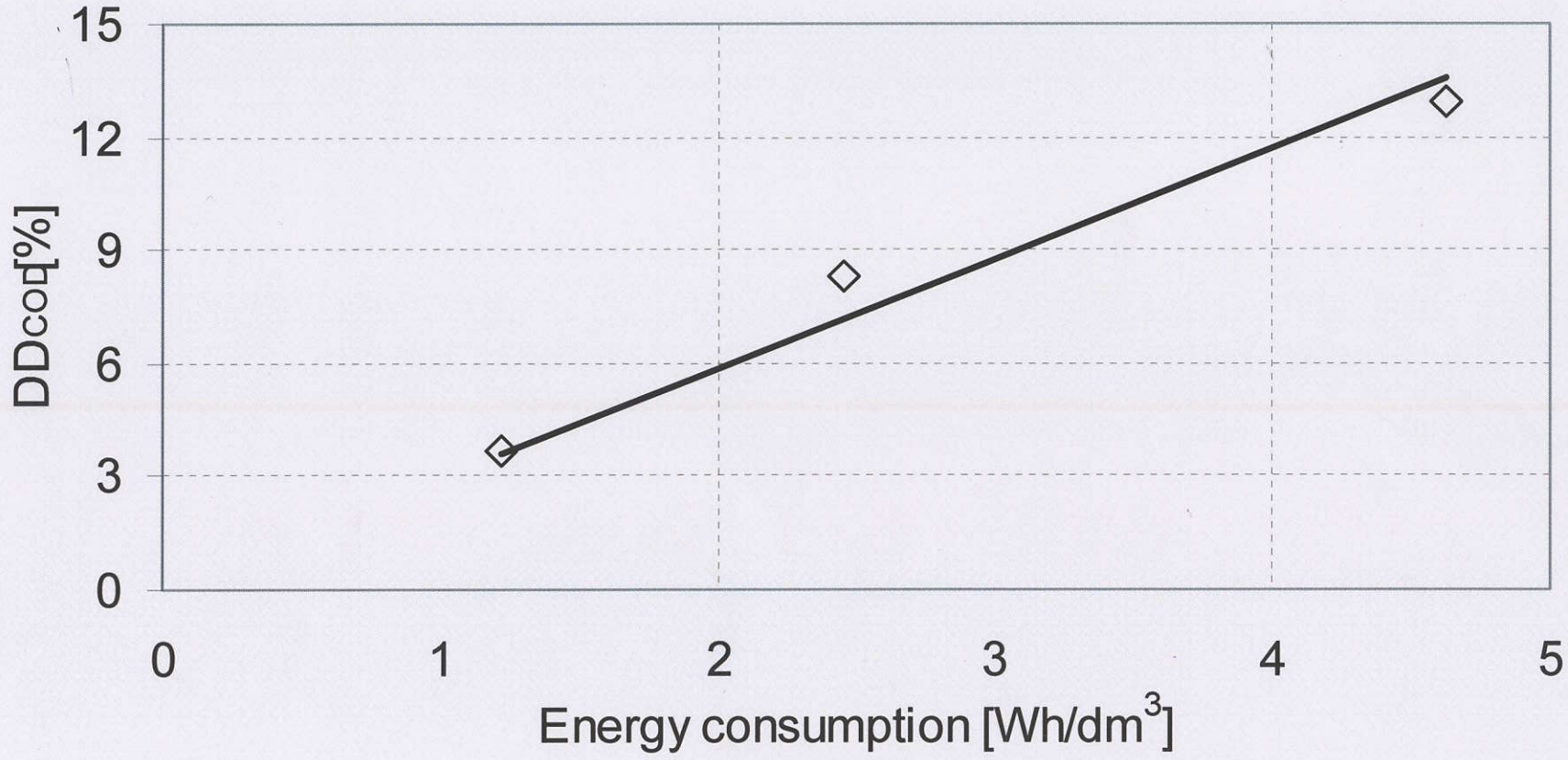
$$DD_{COD} = \frac{ChZT_{US} - ChZT_{R}}{ChZT_{NaOH} - ChZT_{R}} \cdot 100\%$$

Degree of disintegration DD_{COD} vas. time of disintegration

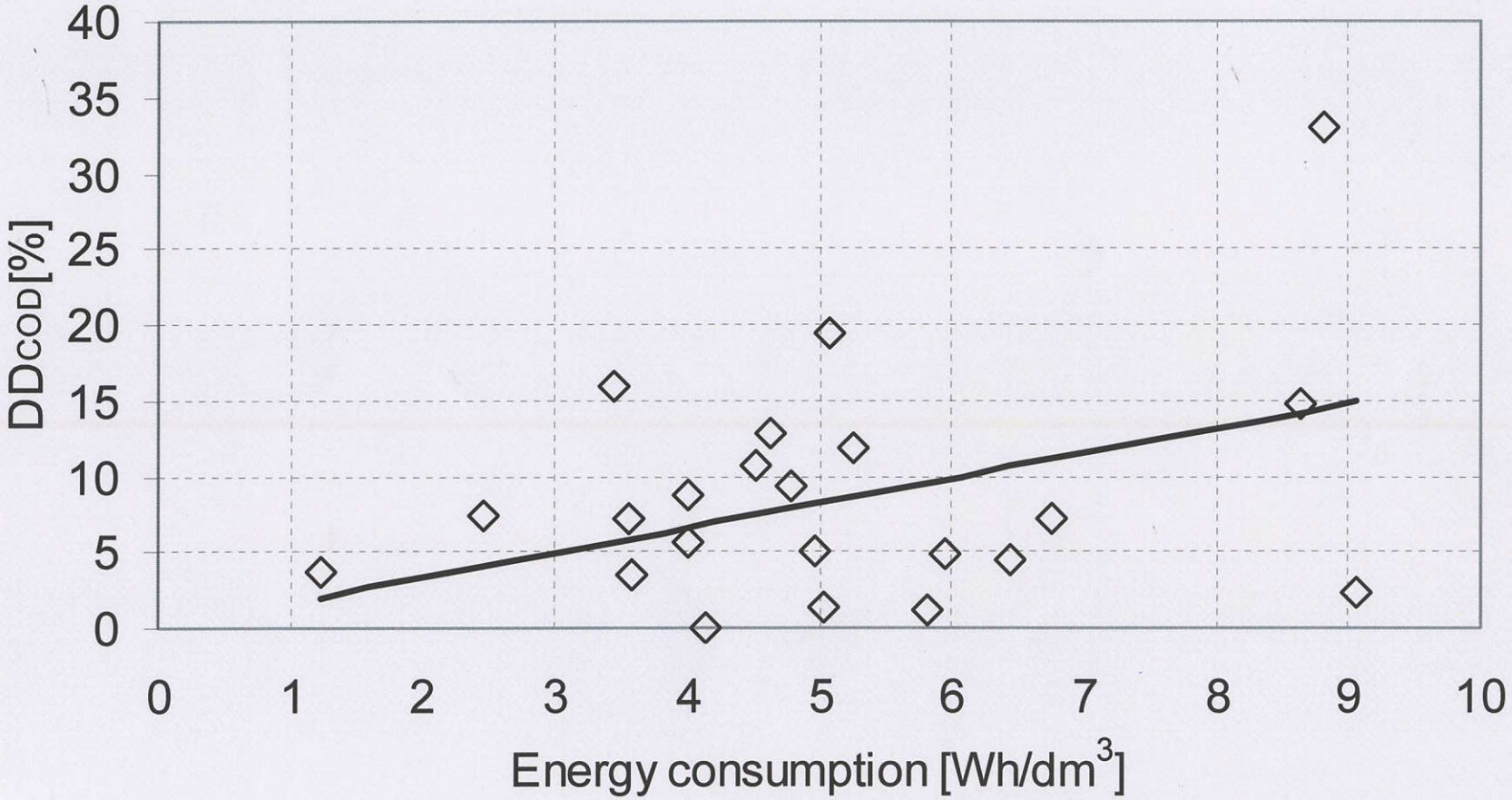


$$DD_{COD} = 0,0478\tau$$

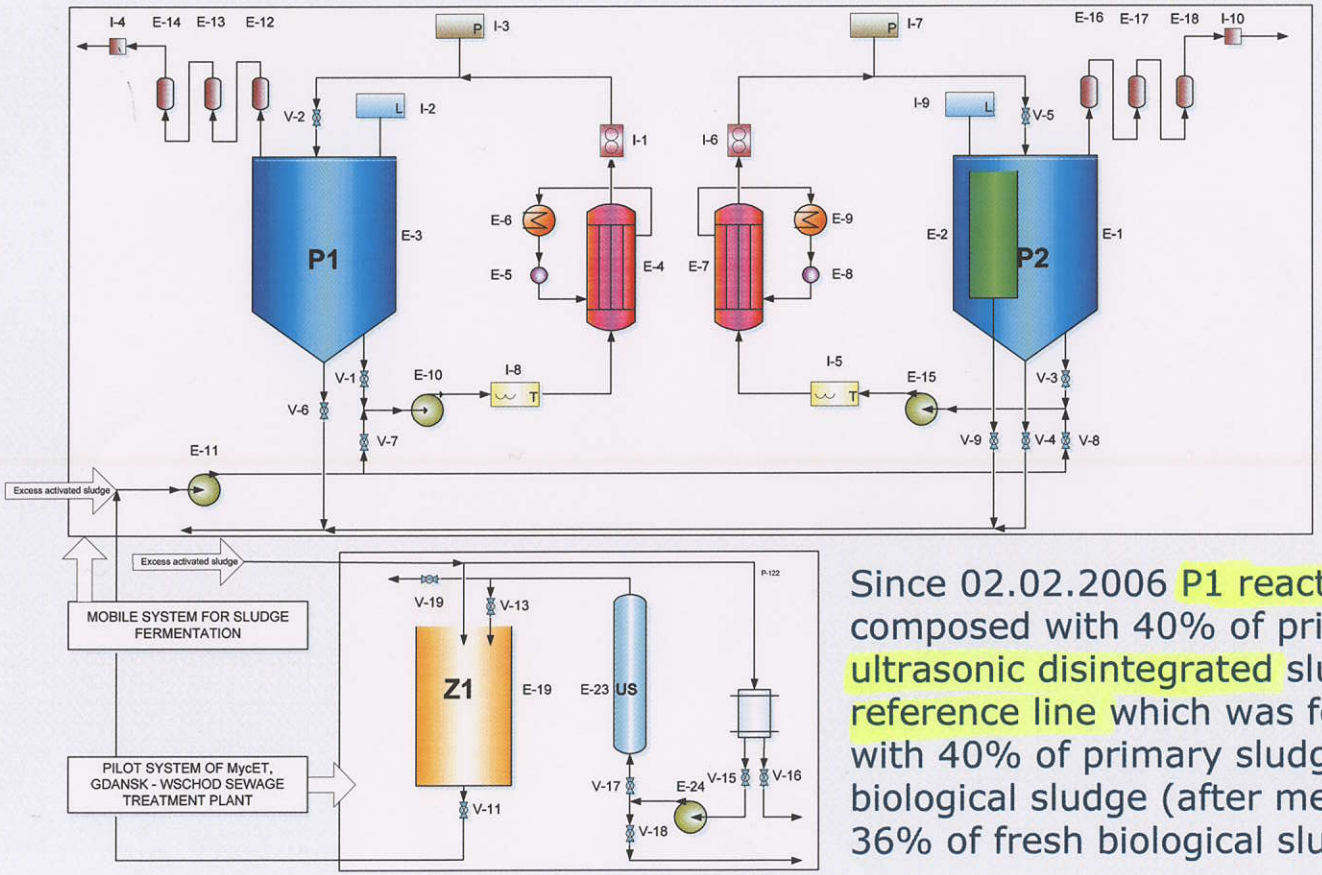
Energy consumption



Degree of disintegration DD_{COD} in all experiments



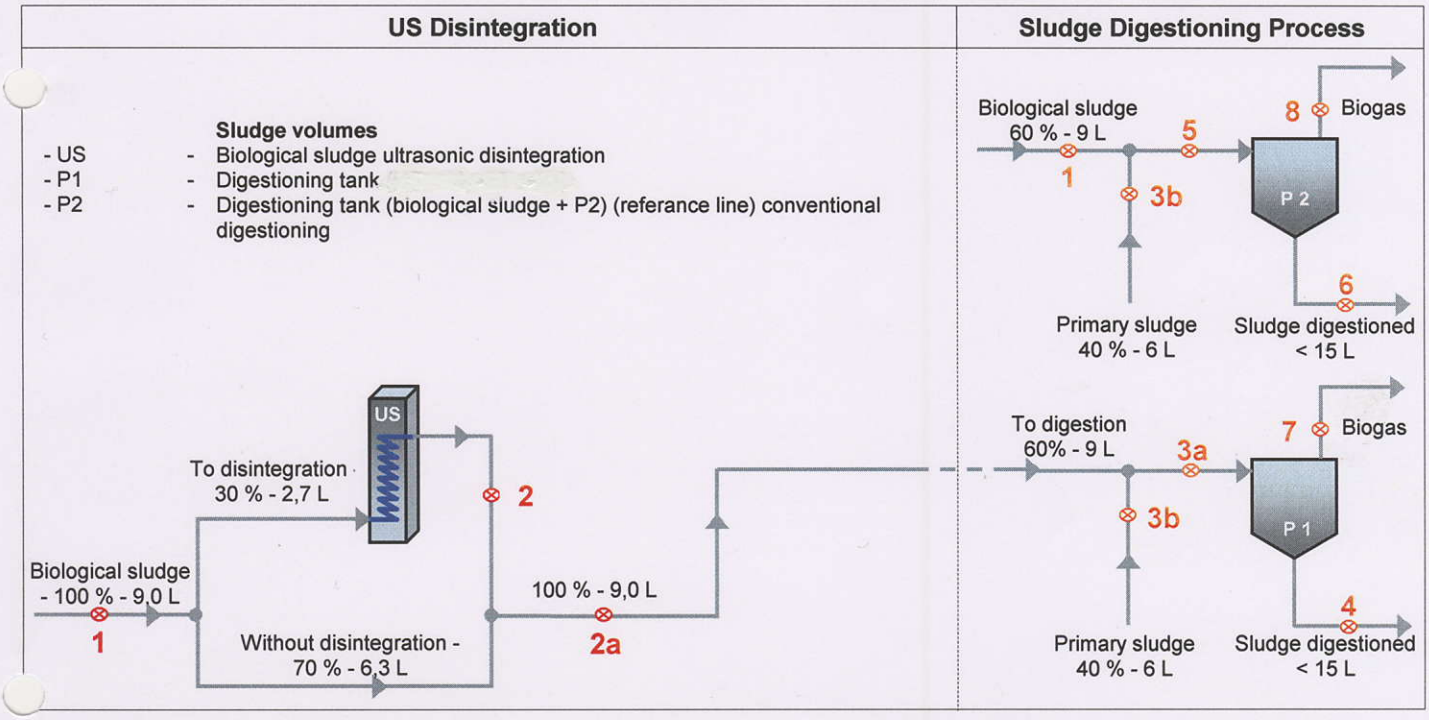
Test system for fermentation with US desintegration (VI stage of investigation)



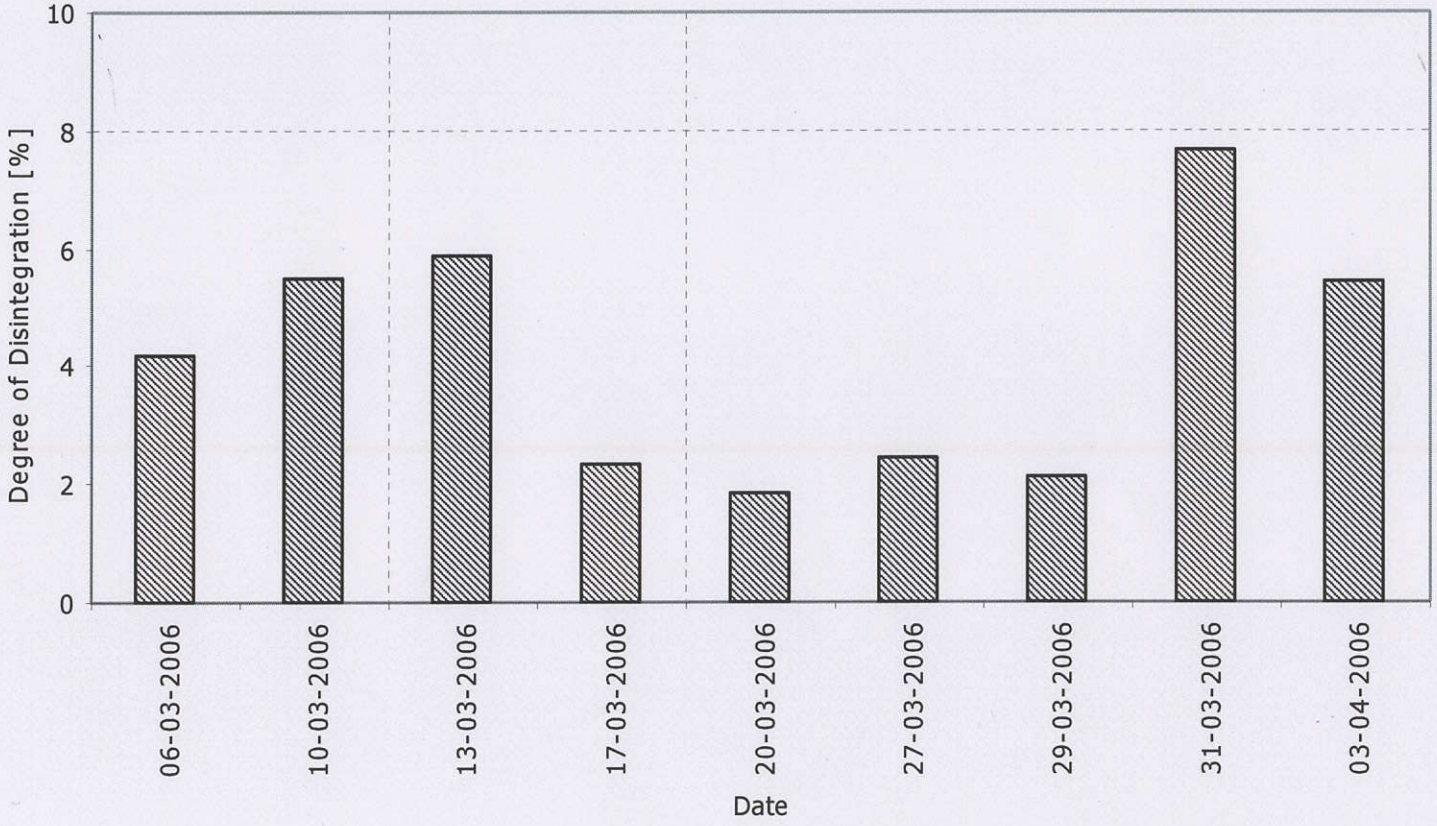
Started at 2.02.2006
Finished at 6.04.2006

P1 - digester
feed:

Since 02.02.2006 P1 reactor was fed with biomass composed with 40% of primary sludge and 60% of ultrasonic disintegrated sludge. P2 reactor was a reference line which was fed with biomass composed with 40% of primary sludge, 24% of concentrated biological sludge (after mechanical compression) and 36% of fresh biological sludge.


US Disintegration
Sludge Digestioning Process
Sludge volumes
- US - Biological sludge ultrasonic disintegration
- P1 - Digestioning tank
- P2 - Digestioning tank (biological sludge + P2) (referance line) conventional digestioning
Biological sludge
60 % - 9 L
1
5
8
Biogas
3b
P 2
6
Primary sludge
40 % - 6 L
Sludge digestioned
< 15 L
US
To disintegration
30 % - 2,7 L
2
Biological sludge
- 100 % - 9,0 L
1
100 % - 9,0 L
2a
Without disintegration -
70 % - 6,3 L
To digestion
60% - 9 L
3a
7
Biogas
3b
P 1
4
Primary sludge
40 % - 6 L
Sludge digestioned
< 15 L

Degree of disintegration



Average degree of disintegration was 4.2%

Summary

Properties	IV		V		VI	
	P1	P2	P1	P2	P1	P2
Biogas production	[redacted]	[redacted]	[redacted]	[redacted]	230.8	193.4
	[redacted]		[redacted]		32,4%	
Temperature [°C]	[redacted]	[redacted]	[redacted]	[redacted]	34.8	34.7
Recirculation [1/day]	[redacted]	[redacted]	[redacted]	[redacted]	230	249
Efficiency of bioreactor	[redacted]	[redacted]	[redacted]	[redacted]	0.769	0.644
Efficiency of fermentation process [%]	[redacted]	[redacted]	[redacted]	[redacted]	39.6	36.3