



## Start!

Good AD research starts with good techniques. This is AD 101, a workshop for researchers fresh in the field of anaerobic digestion although also more advanced researchers will benefit from the tips and tricks that are offered by experts in the field. We learn about the basic techniques, e.g., running BMP and SMA tests, but will also learn you to assess the activity of the anaerobic digestion process through more advanced techniques, including looking into the microbial communities via diverse approaches. Apart from *common* anaerobic digestion feed streams, also more complex feeds are tackled.

- Key Organiser: KU Leuven, Ilse Smets, Raf Dewil and Lise Appels
- Location: Ghent
- Cost: 300 EURO including all meals
- The program below is subject to change!

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### Thursday 20 June

12:00	Lunch	
13:00 – 13:30	<b>Registration and introduction</b>	
	<b>Batch assays: set-up and monitoring</b>	
13:30 – 14:15	The basics of <b>Biomethane Potential (BMP)</b> batch tests	Christof Holliger
14:30 – 15:00	<b>BMP</b> data processing and evaluation	Sasha Hafner
15:00 – 15:30	Predicting <b>BMP</b> from substrate composition	Sören Weinrich & Sasha Hafner
15:30 – 16:00	Coffee break	
16:00 – 16:45	<b>OBA exercise session</b>	Sasha Hafner
16:45 – 17:30	Extracting kinetic information from <b>BMP</b> tests	Sören Weinrich
17:30 – 18:30	Results of national and international inter-laboratory <b>BMP</b> studies	All
19:00	Dinner	

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### Friday 21 June

	<b>Batch assays (Ctd.)</b>	
9:00 – 9:45	Improving <b>BMP</b> measurement with gravimetric methods	Sasha Hafner
10:00 – 10:45	Transferability of <b>BMP</b> batch test results to continuous and full-scale processes	Sasha Hafner & Christof Holliger
	Coffee break	
10:45 – 11:15	Lab tour	
11:15 – 12:15		All
12:30 – 13:30	Lunch	
	<b>Not-biogas-based assessments</b>	
13:30 – 14:30	The basics of <b>Specific Methanogenic Activity (SMA)</b> tests	Miriam van Eekert
14:30 – 15:00	Quantifying <b>methanogenic activity</b> through cofactors F420/F430	Ilse Smets
15:00 – 15:30	Coffee Break	
15:30 – 16:00	Quantifying <b>hydrolysis</b>	Ilse Smets
16:00 – 17:30	<b>-omics</b> : who, what, where?	Jo De Vrieze

	19:00	Dinner	
<b>Saturday</b>	<b>22 June</b>		
		<b><u>Complexity of using waste streams</u></b>	
	9:00 – 10:30	<b>Substrate characterization:</b> what can we learn in terms of biodegradability and bio-accessibility?	Jean-Philippe Steyer
	10:30 – 11:00	Recalcitrant components	Lise Appels
	11:00- 12:00	High salinity waters	Cristina Gagliano
	12:00 – 12:15	Wrap-up of the workshop	All
	12:15 – 13:00	Lunch	
	13:00	Social activity in Ghent	
	17:00	Transfer to Delft	



## Predict-it!

Anaerobic digestion is a complex process involving numerous microorganisms that catalyse the step-wise conversion of organic matter to methane containing biogas.

Computational modelling of anaerobic digestion helps to understand the delicate balance between the different microorganisms in the process, but also allows for predicting biogas production rates and process pH-values as a function of the operational variables. The anaerobic digestion model no. 1 (ADM1) that has been developed approximately 15 years ago is widely applied for these purposes, but one may wonder if the complexity of ADM1 is adequate to fulfil this wide range of objectives.

On the first day of the workshop we will discuss the use of ADM1, recent add-ons (chemical speciation modelling, CFD modelling, sulphur cycle conversions), and specific dedicated (simplified) models. On the second day of the workshop we will focus on more detailed modelling metabolic pathways with thermodynamic constraints for novel anaerobic bioprocesses like (i) chain elongation processes for MCFA production, (ii) biohydrogen production, (iii) mixed culture fermentations for carboxylate production, and (iv) bioelectrochemical systems.

Group discussions on the first day of the workshop will focus on the future of ADM1, and the developments required. On the second day of the workshop participants will conduct exercises with a simple computational tool to get acquainted with thermodynamic state analysis and flux analysis of key metabolic process. On the third day state of the art research will be presented related to anaerobic digestion modelling.

- Key organiser: Delft University of Technology, Robbert Kleerebezem
- Location: Delft, The Netherlands

### Program of the workshop:

Thursday 20/06/2019		ADM1	
13:00 – 13:30		Registration	
13:30 – 14:00		Welcome and outline of the workshop	Robbert Kleerebezem
14:00 – 14:45		ADM1, state of the art	Damien Batstone
14:45 – 15:30		ADM1, application in science and practice	Jean-Philippe Steyer
15:30 – 16:00		Coffee break	
16:00 – 16:30		ADM1, the need for more simple models	Robbert Kleerebezem
16:30 - 17:00		ADM1, the need for more complex models	Jorge Rodriguez
17:00 – 18:00		Discussion on the future of ADM1	
19:00		Diner	
Friday 21/06/2019		Thermodynamics and Fluxes	
9:00 – 9:15		Introduction	Robbert Kleerebezem
9:15 – 10:00		Anaerobic carbohydrate fermentation	Rebecca Gonzalez
10:00 – 10:45		Anaerobic protein fermentation	Alberte Regueira Lopez
10:45 – 11:15		Break	
11:15 – 12:00		Pathways in chain elongation	Jorge Rodriguez
12:00 – 12:45		Extracellular electron transfer mediated parasitism	Roman Moscoviz
12:45 - 13:30		Lunch	
13:30 – 17:00		Exercises	
17:00 – 18:00		Discussion of results	

19:00

Diner

Saturday 22/06/2019

State of the art research

9:00 – 9:15

Introduction

Robbert Kleerebezem

9:15 – 10:00

In search for flux-force  
generalizations

Hadrien Delattre

10:00 – 10:45

Genome based models

Aljoscha Wahl

10:45 – 11:15

Break

11:15 – 12:00

Modeling chain elongation

Pieter Candry

12:00 – 12:45

Modeling Anaerobic Phototrophs

Daniel Puyol

12:45 - 14:00

Lunch

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## Magic!

Methane is a wonderful molecule, basically a small bag of carbon and energy. We can do much more with it than burn it, rather we should use it as a feedstock. We should not just think about the methane but also about all the other attractive “products” available in the biomass feedstock. In this workshop, we look at the emerging applications of methane, starting with learning the techniques of how biogas can be converted on site not only to power but also to biomethane. We learn about making more methane (power-to-gas), grid injection and then production of attractive new compounds such as feed and food protein, carbon monoxide... on site.

- Key Organiser: UGent, Korneel Rabaey
- Location: Ghent

Thursday 20 June		
12:00	Lunch	
13:00 – 18:00	Power to gas Electromethanogenesis Anaerobic digestion without biogas Exploiting novel metabolisms with extracellular electron flow Novel approaches for nitrogen extraction	Fabian Dewilde, OWS tbd Ramon Ganigue, UGent Amelia Rotaru Bruce Logan
19:00	Dinner	
Friday 21 June		
9:00 – 10:00	Biogas upgrading	Raul Munoz
10:15 – 11:00	Coupling biogas to the chemical industry	Korneel Rabaey
11:00 – 11:30	Reality: setting up a biomethane plant	tbd
11:30 – 12:30	Microbial protein production	Ilje Pikaar
12:30 – 13:30	Lunch	
13:30 – 16:00	A thinkers' session “Challenging AD to safeguard its future”	<i>Willy Verstraete</i> <i>Alfred Spormann</i> <i>Bruce Logan</i> <i>Korneel Rabaey</i>
19:00	Dinner	
Saturday 22 June		
9:00 – 12:00	Morning session: working out an exploratory case study for introducing a novel technology	Guidance by workshop team
13:00	Social activity in Ghent	
17:00		Transfer to Delft