



# 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

Thursday 20 June		
12:00	Lunch	
13:00 – 18:00	<b>BMP test</b> – the basics: Do's and don'ts learned from 2 ring tests <b>Lab tour</b>	Sasha Hafner Christof Holliger (tbc)
19:00	Dinner	
Friday 21 June		
9:00 – 12:00	<b>BMP results</b> – and now? (how to quantify, how to report)	Sasha Hafner
	SMA test	Miriam van Eekert
12:30 – 13:30	Lunch	
13:30 – 17:00	<b>Not-biogas-based measurements</b> <b>VFAs</b>  cofactors F420/F430 hydrolysis/microscopy -omics	Jean-Philippe Steyer  Ilse Smets Jo De Vrieze
19:00	Dinner	
Saturday 22 June		
9:00 – 12:00	<b>Complex waste streams</b> Recalcitrant components Lipids High salinity waters	Lise Appels To be confirmed To be confirmed
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: Wageningen, The Netherlands

### Program of the workshop:

Thursday 20/06/2019		
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		
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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New applications are arising around AD, such as chain elongation, fertilizer production, bioelectrochemical systems, biomethane... and AD technology as such is constantly evolving. To really change the world we need highly skilled and talented entrepreneurs.

Would you like to become an entrepreneur? Are you wondering what you could do after your PhD? Do you want to start-up an own company to implement the things you just discovered? If so, join this workshop!

You will be fostered in entrepreneurship for three days. Startlife ([www.start-life.nl](http://www.start-life.nl)) will support you to develop your entrepreneurial competences, to further stimulate your own business ideas. The topic of the workshop is 'closed resource cycles in a one million city'. You will be inspired by experienced entrepreneurs and scientists who have bridged the gap from science to application. We will engage with spin-off companies, as well as established companies who talk about their technology and discuss the hurdles of bringing their technology to fruition.

- Key-organisers: Wageningen University & Research, Annemiek ter Heijne, David Strik, Gitte Schober
- Location: Wageningen

<b>Thursday 20 June</b>		
12:00	Lunch	
13:00 – 18:00	Meet and greet Presentation case for the workshop Decentral Sanitation	Brendo Meulman (DESAH BV) StartLife
	Entrepreneurial skills Start case study	In groups
19:00	Dinner and social activity	
<b>Friday 21 June</b>		
9:00 – 10:00	Inspiring Presentation	Tbc
10:15 – 11:00	Infrastructure and planning challenge	StartLife
11:00 – 12:30	Entrepreneurial toolset	StartLife
12:30 – 13:30	Lunch	
13:30 – 16:00	Afternoon session: Development of prototype design	In groups
19:00	Dinner and finetuning of design	
<b>Saturday 22 June</b>		
9:00 – 11:00	Visualizing designs with artist impression	Invited artist
11:00-13:00	Presentations and feedback	StartLife and experts
13:00	Transfer to Delft	



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

<b>Thursday 20 June</b>		
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	
<b>Friday 21 June</b>		
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	
<b>Saturday 22 June</b>		
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