Biogas production: Determination of the methane production potential in anaerobic digestion processes.

The YIELDMASTER -System to measure the biological methane potential (BMP).

BlueSens gas sensor GmbH

Nowadays it is very important to use optimized processes to make a biogas plant profitable. The production of biogas is a strongly grown market in the last 20 years. In the beginning biogas was produced from manure to get rid of the “waste” in an intelligent way. Today biogas is a very important energy source that depends mainly on two factors -cost of substrate and effectivity of the gas production.

The price for the substrate and the methane potential is influenced by the weather what means good or bad harvest. Today the second- and third generation of biofuels is becoming more and more important to guarantee a sustainable production. Especially these second- and third generation substrates are not easy to use effectively.

To ensure that the biogas production is very effective it is necessary to know the biological methane potential (BMP) of the input material. This could be determined with different system described in the VDI 4630.

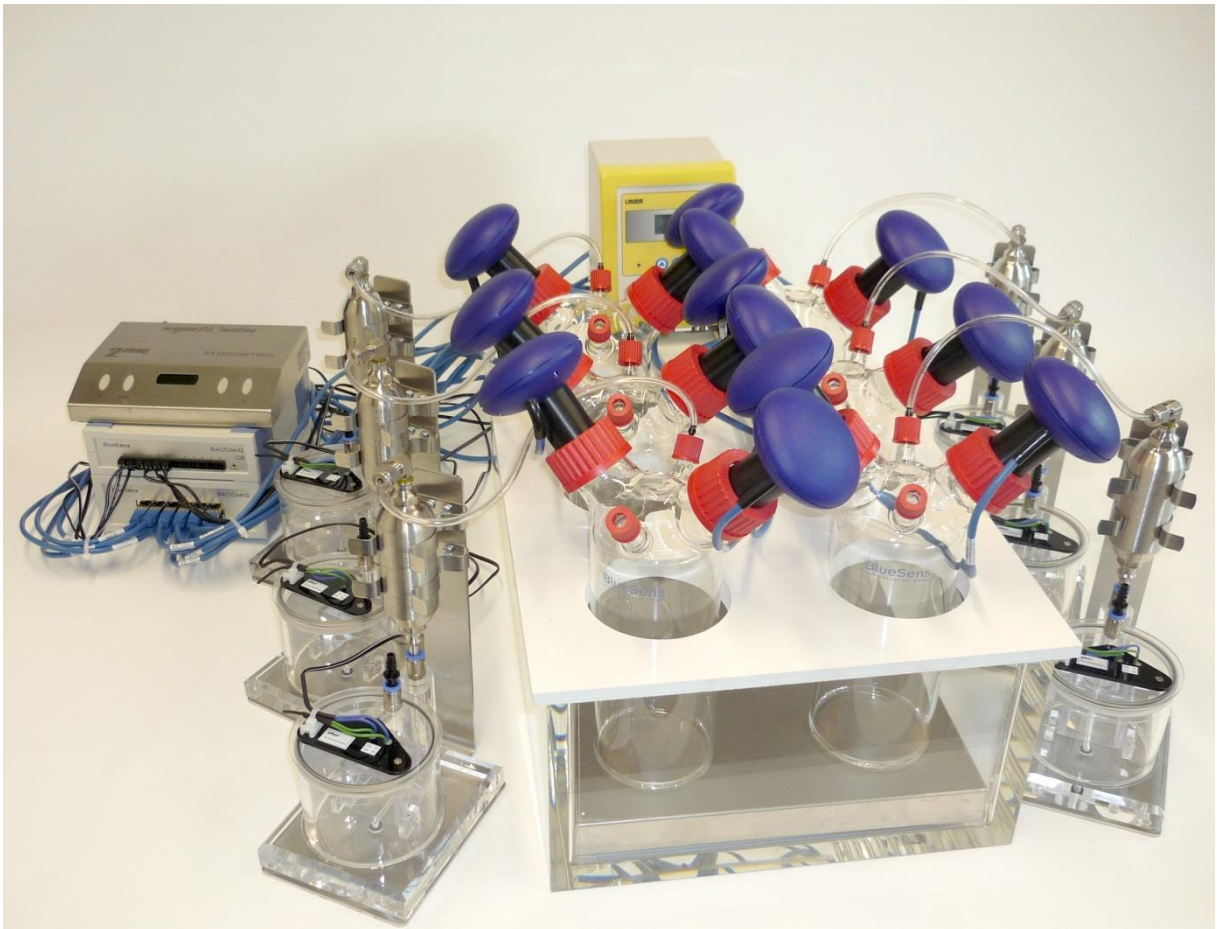

Fig. 1: Yieldmaster analysis system for the online monitoring of the produced gas volume and the gas quality. Yieldmaster contains glass vessels, CH4- and CO2 sensors, volume meter, data multiplexer and software. Stirrer, water bath and thermostat are available as an option.

This article outlines the comparison between an eudiometer based volume measurement with discontinuous gas quality control and an automated system for the simultaneous gas volume and quality measurement.

The following graph shows the produced volume from an experimental run with wheat straw, cellulose and biogas sludge as inoculum in a 1 Liter scale (fig. 2). It was performed as a triplet. The fermentation temperature was 40°C, laboratory was air conditioned at 20°C, amount of substrate $5g_{oDM}/l$, inoculum $10g_{oDM}/l$.

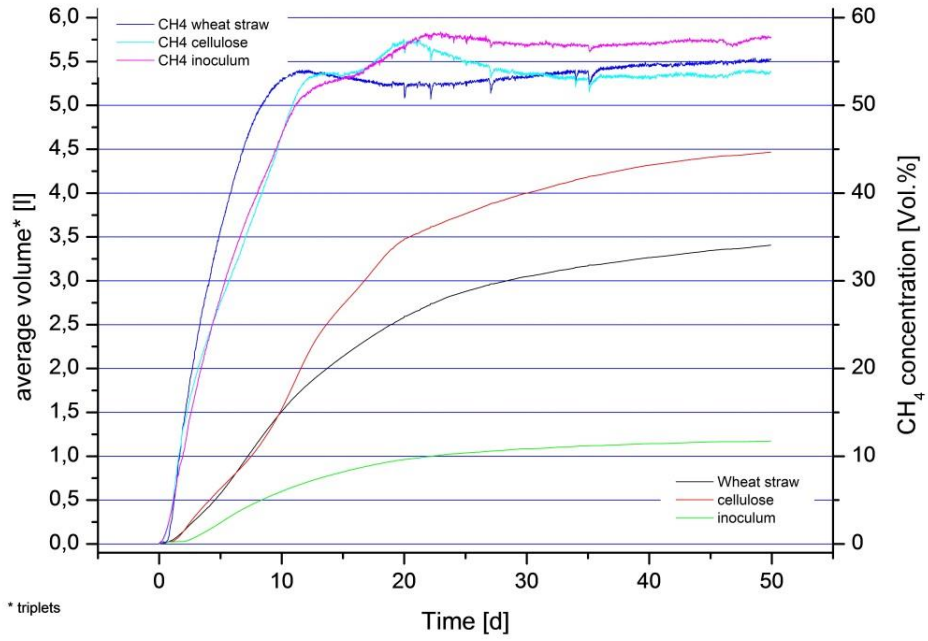

Fig. 2: Volume and CH_4 concentration over the time shown in one graph.

After the run the volume of the inoculum is subtracted from the volumina of Cellulose and wheat straw. It has been demonstrated that the eudiometer and the Yieldmaster, fit very well but the most important difference is that the Yieldmaster is working continuously for nearly 50 days without any disturbance or interaction by staff is needed.

methane yield [lN/kgoDM]	Cellulose		Wheat Straw	
	Eudiometer	Yieldmaster	Eudiometer	Yieldmaster
	316	287	206	218
	324	337	216	221
	335	352	236	230
Average	**325**	**325**	**219**	**223**

*Fig. 3:.Comparison between Eudiometer and Yieldmaster during a nearly 50 days run. **

As a conclusion the Yieldmaster system is well proven, easy to install and reliable for long term experiments. You can use this analysis system to determinate the BMP in the lab scale to optimize the effectiveness of your biogas production. It delivers kinetic data and as much data point as the user needs without any control at any time

*Eudiometer values from: Wetter, C.; Brügging, E., Kerkering, M.: Determination of the Biological Methane Potential with different Instruments, results from the eudiometer experiments. Fachhochschule Münster, Steinfurt 2013