BIOEXTRUSION
by LEHMANN®

Increased biogas yield

and decreased strirring energy thanks to bioextrusion

LMEngineering GmbH
Umwelttechnischer Anlagenbau

advantages

process of bioextrusion

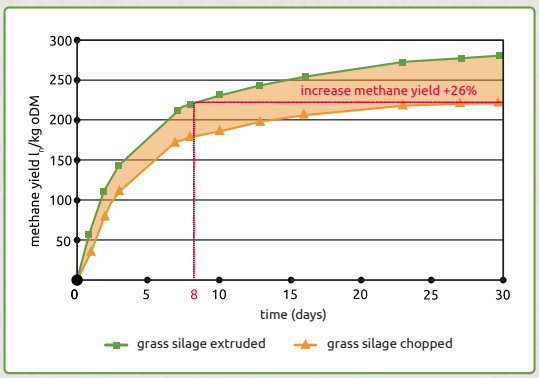
The process of bioextrusion in double-screw extruders has been developed in our company. It is based on hydrothermal desintegration and has proven it's worth for material and energetic usage of lignin containing substrates. The feedstock is chopped and desintegrated partly up into the cell structure by means of repeatedly pressure and tension release cycles as well as the increased temperature in the machine. The biogas yield increases due to the multiple increased surface.

stable manure before extrusion

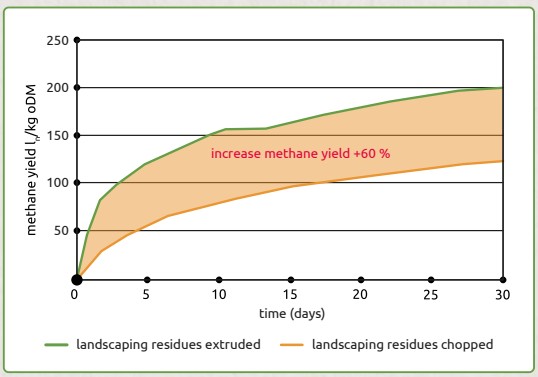
stable manure after extrusion

advantages

- suitable for feedstock which usually is difficult to use in biogas plants: solid manure, landscaping residues, maize straw, straw, grass, whole crop, bio waste
- reduction of floating layers
- good transportability in pipes and valves, good pumpability
- saving of stirring energy as the extruded material goes into the middle layer and spreads very well
- high homogeneity of the substrate (the extruder is an intensive mixer)
- improved availability of nutrients due to the desintegration of the lignin structure
- development of new bacterial strains corresponding to the availability of new food thanks to the desintegration
- faster desintegration of the biomass due to the larger surface, optimized environmental conditions and improved conditions for the reaction itself
- reduction of the retention time while the digestation rate is improved
- reduction of digestion chamber volume
- temperature drop between extruded material and digester is reduced



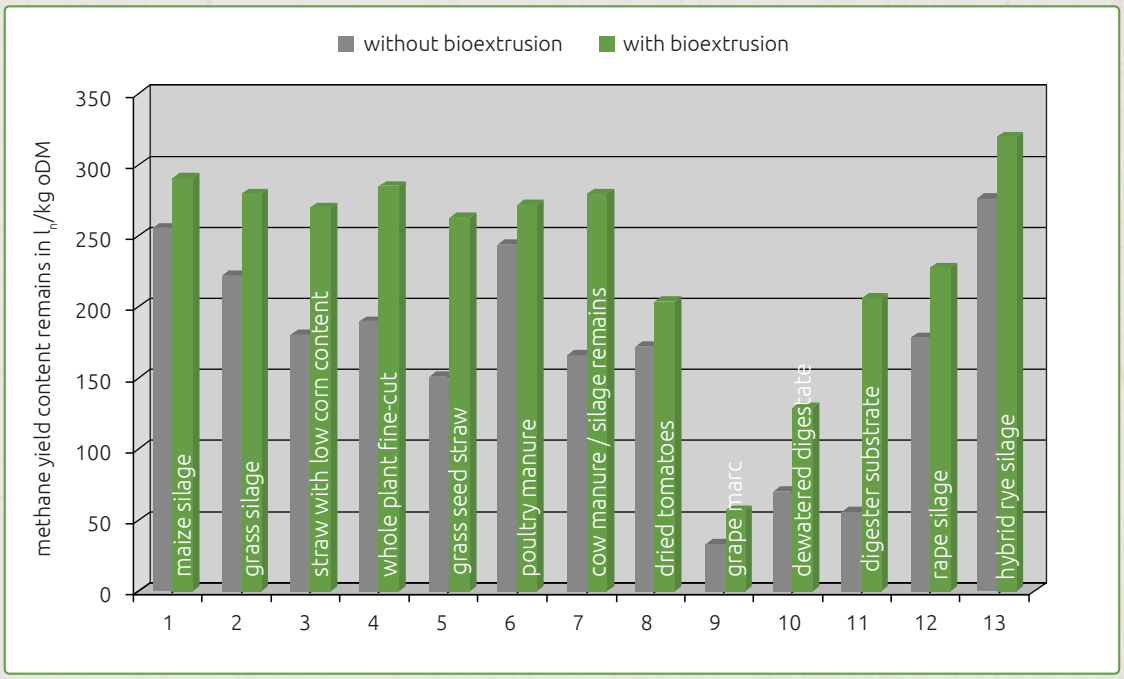
fermentation of grass silage



fermentation of landscaping residues

new potentials

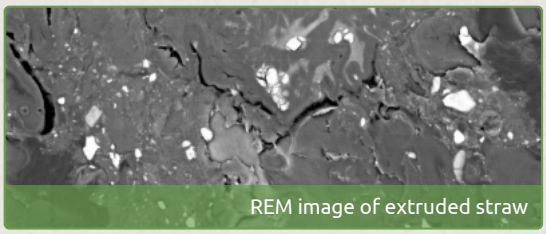
increase of methane production due to bioextrusion compared to chopped straw

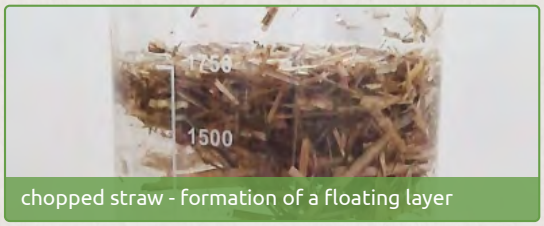


substrates	DM-content *	increased methane gas production rate *
straw	85 %	+35 %
hay	85 %	+42 %
solid cow manure	30 %	+36 %
rape straw	65 %	+32 %
gras silage	30 %	+24 %
maize silage	30 %	+14 %
miscanthus	80 %	+70 %
hybrid rye	65 %	+28 %

* values (averages) determined following the German directive VDI 4630, selection from several reports


REM image of untreated straw


REM image of extruded straw



chopped straw - formation of a floating layer

extruded straw - homogenous spreading

bioextrusion turns unused potentials into usable substrates

The sustainability of biogas production is primarily determined by price development of the substrates, exploitation of new ones and the improvement of the energetic utilisation ratio of the used materials. So far, substrates containing much lignocellulose or residual products like straw or landscaping material were reckoned as "not or only limited suitable for biogas production". Reasons are the high content of lignin and distinct pith structures with hollows and layers of fat.

crop straw

Germany has an annual production of around 30 million tons of crop straw. Depending on the chosen evaluation method, 8 to 13 millions thereof can be used sustainably for different energy recovery purposes. Straw belongs thus to the agricultural residual with the highes energy production potential. Compared to the thermal use, the use of straw for anaerobic fermentation processes with short transport ways offers numerous advantages. Nutriants and organic substances which are not converted into biogas are available as high quality digestate after the fermentation process and can be used for fertilization purposes.

rape straw

After bioextrusion, rape straw can be used in a biogas plants without problems and achieves great yields which legitimates the efforts for harvesting, storage and thermo-mechanical desintegration.

hybrid rye, ensiled

Test series have proven that the strawy substrate with corn is equal or even outreaches maize regarding biogas yield.

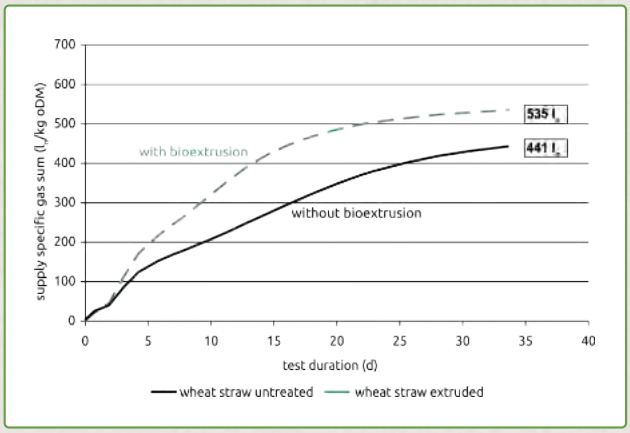
landscaping residue

Bioextrusion has proven its worth here as well. The bioextruder homogenises and desintegrates the substrate in a system together with a doser and a separation of extraneous materials. After that the material can be delivered to the fermenter. The process is suitable for both dry and wet fermentation plants.

woody bush and tree cut

The use seems to be well possible in biogas plants according to gas productivity analysis with bioextrusion.

further possible substrates are e.g. maize straw, miscanthus, manure



untreated straw

extruded straw

extruder model range

* measurements in brackets incl. hopper, length without additional module

model	type of drive e-motor	measurements* (L x W x H)	weight
lab extruder	3 kW	960 x 456 x 1000 mm	0,25 t
MSZ B 22e	2 x 11 kW	2595 × 915 × 970 (1270) mm	1,2 t
MSZ B 44e	2 x 22 kW	3850 × 1090 × 925 (1260) mm	3,1 t
MSZ B 60e	2 x 30 kW	3915 × 1155 × 925 (1260) mm	3,5 t
MSZ B 74e	2 x 37 kW	4105 × 1210 × 970 (1310) mm	4,1 t
MSZ B 90e	2 x 45 kW	4265 × 1250 × 970 (1310) mm	4,5 t
MSZ B 110e	2 x 55 kW	4690 × 1385 × 970 (1310) mm	5,5 t

throughput performances

* througput depends on material and dry matter content

throughput performances (average values)	maize and grass silage	greenwaste, solidmanure	wilted grass silage	straw	mixture (incl. straw)
% DM	ca. 30	ca. 30	25	50 - 60	30 - 35
MSZ B 44e	1,5 - 3,2 t/h	1,4 - 3,2 t/h	1,8 - 3,2 t/h	0,5 - 0,8 t/h	2,2 - 3,4 t/h
MSZ B 60e	2,0 - 3,5 t/h	1,8 - 4,0 t/h	2,5 - 3,5 t/h	0,6 - 1,0 t/h	2,5 - 3,5 t/h
MSZ B 74e	4,5 - 7,0 t/h	3,5 - 6,5 t/h	3,5 - 6,0 t/h	1,2 - 3,0 t/h	3,0 - 6,5 t/h
MSZ B 90e	4,9 - 7,8 t/h	4,0 - 7,5 t/h	4,0 - 7,3 t/h	2,0 - 3,4 t/h	4,0 - 6,0 t/h
MSZ B 110e	5,2 - 8,5 t/h	4,5 - 8,0 t/h	4,5 - 8,0 t/h	1,6 - 4,0 t/h	4,5 - 8,0 t/h
energy consumption Ø	6,0 - 14,0 kWh/t	2,5 - 12,5 kWh/t	5,0 - 12,5 kWh/t	30 - 45 kWh/t	8,0 - 18,0 kWh/t

MSZ-container with desintegration technology for biogas plants

A further development of Lehmann is a modularly designed container to upgrade of biogas plants. It also can be used for new plants or where structural modifications are not possible or difficult to realise. The advantage of this technology is the increase of biogas productivity and the possibility of feeding diverse materials into the biogas plant by means of bioextrusion. Bioextruders of variable size can be installed into the isolated container. The extruder is fed by a conveyor belt including mandatory metal detection. All metals are discharged inductively via a bypass. An additional unit for the separation of stones can be integrated where necessary. Following this the material falls through a fall shaft into the extruder. The defibrated material is ejected on the front site of the container via a stainless steel tube. The further transport can be carried out by a conveyor belt, a screw or a pump. There is a crane installted in the container to faciliate the necessary maintenance work. All components are controled via a central control unit.

about us

The technology of bioextrusion opens up numerous new possibilities for the most diverse biogenic substances. LMEngineering is working together with Lehmann-UMT GmbH to further develop the technology and thus to open up new potentials. In the company's own test facility, the bioextruders are put through their paces and the processing of a wide variety of materials is tested.

In addition to the bioextruders, LMEngineering's portfolio also includes the necessary feeding technology such as feeders, conveyor belts and screws, compacting and comminution technology as well as laboratory equipment in the field of biogas.

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