

Results from testing Seko mixer unit and Twin Screw Press for treatment of freshly harvested grass at Aarhus University's biogas plant, Foulum 20/9-2018
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Purpose of the test

- To measure dry matter content in the grass fiber fraction after modification of Twin Screw Press
- To test Seko shredder and mixer for pretreatment and loading of Twin Press
- To examine if the fiber fraction is more homogenous pressed than experienced during the test in June

Test method

The grass was cut in the field in the morning on the day for testing. Cutting was done with the Maksigrass machine, which means that no fine-chopping was done during harvest. The grass was a mixture of clover and rye grass and harvested when it was relatively young.

The harvested grass was loaded into the Seko mixer unit. After 10 minutes of mixing in batch 1 and 5 minutes of testing in batch 2 feeding from Seko mixer unit to Twin Screw Press started.



Figure 1. Left photo: Mixing of freshly cut grass in Seko mixer unit. Right photo: Feeding of Twin Screw Press from Seko mixer unit.

Results from measuring dry matter content

The first batch test lasted 25 minutes and a rough mass balance is presented in table 1 and the analysis results are presented in table 2. The second batch test lasted 35 minutes and results are presented in table 3 and 4.

Table 1. Amounts of grass treated and resulting amounts of liquid fraction and grass fiber fraction in batch 1.

Rough mass balance, Batch 1 (25 minutes)	Tons treated and produced	Capacity (tons /hour)	Distribution of input on output-fractions
Grass treated in Twin Screw	1.09	2.62	100%
Liquid fraction from Twin Screw	0.65	1.56	60%
Fiber fraction from Twin Screw	0.44	1.06	40%

It is seen in table 2 that the input grass was relatively wet. The dry matter content (TS) in the grass fiber output fraction was about 37%.

Table 2. Results from analyzing input grass and the two output fractions in batch 1.

Fractions – Batch 1	Dry matter, TS (%)	Total-N (kg/ton)	Ammonium-N (kg/ton)
Input grass	14.4%	5.48	0.22
Liquid from Twin Screw	4.3%	1.96	0.25
Fiber from Twin Screw	36.8%	11.72	0.34

Table 3. Amounts of grass treated and resulting amounts of liquid fraction and grass fiber fraction in batch 2.

Rough mass balance, Batch 2 (35 minutes)	Tons treated and produced	Capacity (tons /hour)	Distribution of input on output-fractions
Grass treated in Twin Screw	1.75	3.00	100%
Liquid fraction from Twin Screw	1.00	1.71	57%
Fiber fraction from Twin Screw	0.75	1.29	43%

Table 4. Results from analyzing input grass and the two output fractions in batch 2.

Fractions - Batch 2	Dry matter, TS (%)	Total-N (kg/ton)	Ammonium-N (kg/ton)
Input grass	16.0%	5.12	0.29
Liquid from Twin Screw	4.2%	1.81	0.19
Fiber from Twin Screw	32.2%	9.14	0.24

The dry matter content of the output fiber fraction in batch 2 was lower than in batch 1. This is probably because the feeding from Seko to Twin Press in batch 2 was not optimal. Due to technical problems it was not possible to achieve a continuous, stable flow of mixed grass into the Twin Press and that might have influenced the pressing. In addition, it might influence the dry matter content of the output fiber fraction that shredding and mixing was done in longer time in batch 1 than in batch 2.

For comparison the results from a previous test of Twin Screw Press in June 2018 are presented in table 5. It is seen that the input grass had a dry matter content, that was almost double as high as in the batch tests undertaken the 20/9-2018. It is also seen that in the June-test the dry matter content was more than 41 %.

Table 5. Dry matter content of input grass and output fractions from a test of Twin Screw Press in Foulum 6/6-2018.

Fractions - June 2018	Dry matter, TS (%)
Input grass	30.95
Liquid from Twin Screw	12.16
Fiber from Twin Screw	41.13

Observation of the visual character of the grass fiber fraction

The grass fiber fraction seemed to be more homogenous pressed during the two batch tests 20/9-2018 compared to the batch tests undertaken in June 2018. The grass fiber had a moss like character and apparently no intact elements of leaves or stalks had passed the Twin Screw Press. A photo of the fiber fraction after treatment in Twin Screw Press on the 20/9-2018 is shown in figure 2.



Figure 2. Left: Grass fiber fraction after treatment in Twin Screw Press. Right: Fresh grass after treatment in Seko mixer.

Energy consumption of Twin Screw Press

Measurement of the electricity consumption was not planned to be part of the test. However, during the two batch tests the Twin Screw Press was running with a current of 20-22 Ampere. This figure was read on the controlling panel of the Twin Screw Press.

Other observations

The Seko mixer unit was effective to shred and mix the freshly harvested grass before feeding it into the Twin Screw Press. In batch 1 the grass was treated 10 minutes before feeding of Twin Screw Press started. In batch 2 grass was treated only 5 minutes before feeding of Twin Screw Press started.

Since the Seko mixer unit is not completely waterproof some grass juice was lost on the ground and not collected in the tank.