Test report for PURROT®

Document information

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1. Introduction

This test report summarises the results from a test of the PURROT®-module. The test is planned and undertaken with the purpose to use the results for the verification of the technology under the EU ETV Pilot Programme as described in the EU ETV General Verification Protocol (European Commission, 2014). The report is made in accordance with the AgroTech Test Centre Quality Manual.

1.1 Name of technology

The PURROT®-module is developed for separation of organic dry matter from a liquid waste stream like e.g. digested biomass from biogas plant or slurry from intensive livestock production, which is defined as a waste product according to the EU Waste Directive. The purpose of the separation is to promote a more sustainable use of the components in this kind of liquid wastes. Through the separation of a waste into a solid and a liquid fraction the capability of producing renewable energy from the solid fraction is improved. At the same time the separation contributes to reducing the loss of the nutrients from field application of the waste.

Separation technologies for liquid wastes are already on the market, but the PURROT®-module is different from the existing products for its particular construction with five different separation principles integrated into a single module. This combination is made to provide PURROT® with a more stable and effective operational approach when working with difficult media as slurry or digested biomass.

1.2 Name and contact of proposer

The proposer is the Danish company PurFil Aps, Sverigesvej 16, 8700 Horsens, Denmark. Contact person of the proposer is Anders Tange. E-mail: at@purfil.com. Telephone: +45 4015 8777.

1.3 Name of test responsible

The test is performed by AgroTech, Agro Food Park 15, DK-8200 Aarhus N, Denmark.
Test responsible is Amparo Gómez Cortina. Phone: +45 8743 8470. E-mail: aco@agrotech.dk.

1.4 Reference to test plan and specific verification protocol

The Test Plan for PURROT was prepared by Amparo Gómez Cortina in august 2014. The test plan and the test report were made to meet the requirements of the Specific verification protocol for PURROT® prepared by ETA-Danmark. ETA-Danmark is a Danish Verification Body accredited by DANAK to undertake verifications.

2. Test design

The test has taken place on two different sites with three different inputs material. The three different input substrates are sow slurry (site 1), cow slurry (site 2) and digested biomass from Foulum Biogas plant (site 2). The biogas plant is mainly built for research and testing activities. However, in general the operation of the biogas plant is similar to a commercial plant of same size and the digested biomass from this plant is similar to a commercial plant based on manure and plant residues as the main substrates for biogas production. For the test of the three substrates a prototype version of PURROT was used.

Figure 1 illustrates the liquid waste flow and the location of the sample points and figure 2 is a photo of PURROT® module during the test at the biogas plant of Aarhus University.

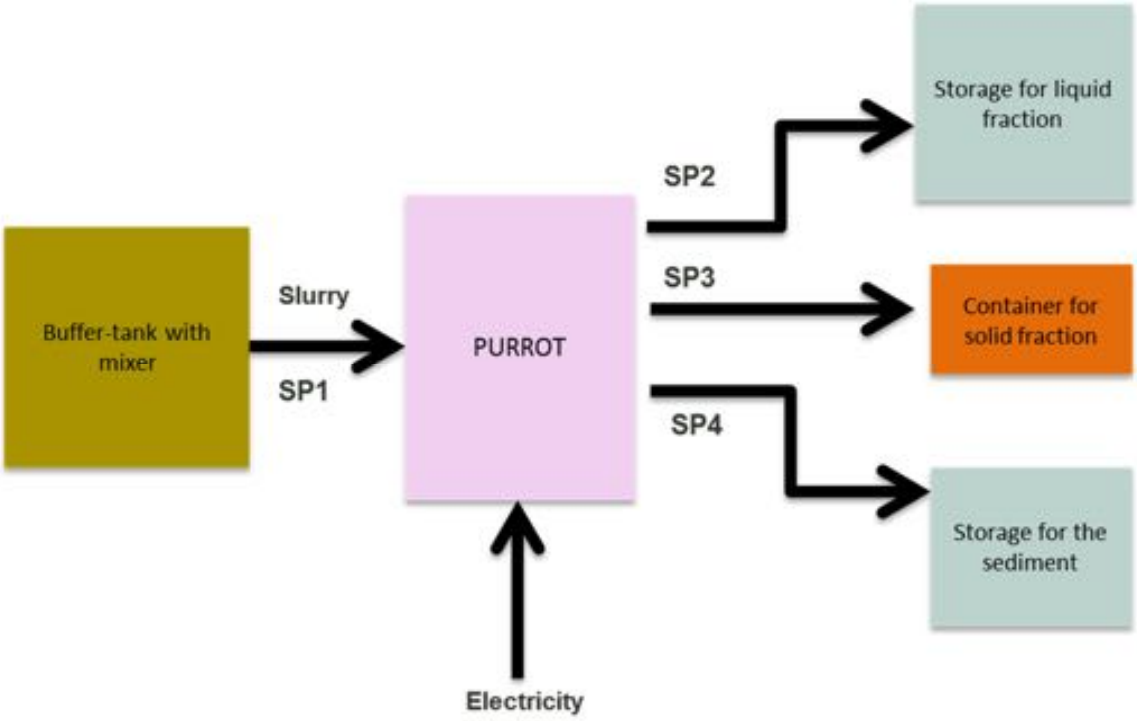

Figure 1. Simplified illustration of the PURROT® test set-up. The four sampling points are named as SP1, SP2, SP3 and SP4.

Figure 2. Photo of the PURROT® module during the test on site 2 (the biogas plant of Aarhus University). The solid output fraction is collected in the blue container to the left.

3. Test results

3.1 Test data summary

3.1.1 Separation efficiency

In this test separation efficiency is defined as the recovery factor of a given component for the solid fraction. In consequence, separation efficiency is a measure of the proportion of a given component in the input digested biomass or slurry that ends up in the solid fraction (expressed as a percent).

It is assumed in this test that no mass losses occur during the separation process. Consequently the input mass of each parameter should be equal to the mass of that same parameter leaving the PURROT® as part of the solid output or/and liquid output. In table 1 the separation efficiencies achieved during the test of PURROT® are presented.

Table 1. Separation efficiency of PURROT®.

Separation efficiency	**Sow slurry**	**Cow slurry**	**Digested biomass**
Percent (%) of the input substrate total phosphor is found in the dry matter fraction	33.3	23.5	46.4
Percent (%) of the input substrate total nitrogen is found in the dry matter fraction	9.5	18.8	21.9
Percent (%) of the input substrate volatile solids (VS) is found in the dry matter fraction	54.2	60.1	62.2
KWh electricity use per ton treated liquid waste	1.4	5.4	3.3

Separation efficiency is calculated based on the input flow measured by a flow meter installed on the PURROT®. The flow meter performance was tested by AgroTech and an uncertainty of 8% was found. All results are adjusted for this 8 % uncertainty on the input mass flow.

In table 2, 3 and 4 the effect of using the hydro cyclone for making both a sediment fraction and a solid fraction is illustrated.

Table 2. Separation efficiency of PURROT used for sow slurry with a total solids content of 2.9 – 3.2 %.

Parameter	**Share recovered in the solid fraction after separation with PURROT**	**Share recovered in the solid fraction and sediment fraction after separation with PURROT**
Weight	4 %	22 %
Total Phosphorous	33 %	58 %
Total Nitrogen	9 %	28 %
Total solids, TS	44 %	59 %
Volatile solids, VS	54 %	67 %

It is seen that the weight of the solid fraction constitutes 4 % of the input slurry. If the hydro cyclone is in operation the weight of the solid fraction together with the sediment fraction constitutes 22 % of the input slurry weight and 58 % of the phosphorous in the input slurry is recovered in the solid fraction and sediment fraction.

Table 3. Separation efficiency of PURROT used for cow slurry with a total solids content of 7.0 – 8.0 %.

Parameter	Share recovered in the solid fraction after separation with PURROT	Share recovered in the solid fraction and sediment fraction after separation with PURROT
Weight	12 %	24 %
Total Phosphorous	23 %	34 %
Total Nitrogen	19 %	32 %
Total solids, TS	54 %	62 %
Volatile solids, VS	60 %	68 %
Organic bound Nitrogen	29 %	44 %

In table 3 it is seen that 60 % of the volatile solids of the input slurry is recovered in the solid fraction after separation with PURROT. If the hydro cyclone is in operation 68 % of the input slurry´s volatile solids are recovered in the solid fraction together with the sediment fraction.

Table 4. Separation efficiency of PURROT used for digested biomass with total solids of 6.2–6.4 %.

Parameter	Share recovered in the solid fraction after separation with PURROT	Share recovered in the solid fraction and sediment fraction after separation with PURROT
Weight	10 %	20 %
Total Phosphorous	46 %	58 %
Total Nitrogen	22 %	31 %
Total solids, TS	56 %	60 %
Volatile solids, VS	62 %	66 %
Organic bound Nitrogen	33 %	51 %

In table 4 it is seen that 22 % of the total nitrogen in the digested biomass is recovered in the solid fraction after separation with PURROT. If the hydro cyclone is in operation 31 % of the total nitrogen in the digested biomass is recovered in the solid fraction together with the sediment fraction.

After implementation of the EU Nitrate Directive in Denmark a farm or a biogas plant need a certain amount of land to spread the produced manure or digested biomass. In Denmark the term "harmony area" is used to describe how much area is needed for a given production of manure. According to the general rules, 0.71 hectares are needed per 100 kg nitrogen present in pig slurry and digested biomass. For cow slurry, 0.59 hectares are required per 100 kg of nitrogen present in the manure.

In regions with intensive livestock production land for spreading manure is sometimes in high demand, which leads to increasing prices. However, separation of slurry is a way of reducing the harmony area needed for a certain livestock production. If the solid fraction is allocated for other purposes than fertilizing on the fields of the biogas plant/farm less land is required for spreading the digested biomass.

According to the Danish rules and the separation efficiency of PURROT used for separation of digested biomass it is possible to achieve around 35 % reduction in the land required for spreading the nitrogen of the biogas plant.

3.1.2 Content of solids in the different fraction after separation

Table 5, 6 and 7 presents the average content of total solids, ashes and volatile solids input slurry, liquid output fraction and solid output fraction respectively for the different type of slurry.

Table 5. Content of total solids, ashes and volatile solids for batches with sow slurry.

Fraction	Total solids (%)	Ash content* (%)	Volatile Solids (%)
Input slurry	3.07	0.91	2.16
Liquid output fraction	1.70	0.69	1.01
Solid output fraction	36.92	4.92	32.00
Sediment output fraction**	2.00	0.96	1.04

*Note: Values for ash content are calculated as the difference between total solids and volatile solids, not measured.

** The data sediments are only obtained from one batch

The average is based on 2 batches. The two different batches done with the sow slurry are made with two different flow rates to the PURROT separator.

Table 6. Content of total solids, ashes and volatile solid for batches with cattle slurry.

Fraction	Total solids (%)	Ash content* (%)	Volatile Solids (%)
Input slurry	7.63	5.74	1.22
Liquid output fraction	4.19	1.16	3.03
Solid output fraction	38.37	2.72	35.64
Sediment output fraction**	4.30	1.20	3.10

*Note: Values for ash content are calculated as the difference between total solids and volatile solids, not measured.

** The data sediments are only obtained from one batch

Table 7. Content of total solids, ashes and volatile solid for batches with digested biomass.

Fraction	Total solids (%)	Ash content* (%)	Volatile Solids (%)
Input slurry	6.3	1.24	5.06
Liquid output fraction	3.17	0.96	2.21
Solid output fraction	35.3	3.35	31.95
Sediment output fraction**	3.20	0.66	2.21

*Note: Values for ash content are calculated as the difference between total solids and volatile solids, not measured.

** The data sediments are only obtained from one batch

3.1.3 Nutrient concentration in the different fractions after separation

Table 8, 9 and 10 presents the average content of Total Nitrogen, Ammonium nitrogen, Total Phosphorous and total Potassium.

Table 8. Average concentration of nutrients for the batches with sow slurry.

Fraction	Total Nitrogen (Kg/ton)	Ammonium nitrogen (kg/ton)	Organic nitrogen* (kg/ton)	Total Phosphorous (kg/ton)	Total Potassium (kg/ton)
Input slurry	2.50	2.23	0.27	0.60	1.52
Liquid output fraction	2.60	2.18	0.42	0.36	1.54
Solid output fraction	7.18	3.00	4.18	5.40	1.47
Sediment output fraction**	3.28	2.35	0.93	0.80	1.49

**Organic nitrogen is not measured at a laboratory but is calculated as the difference between total nitrogen and ammonium nitrogen.*

*** The data on sediments are only obtained from one batch only.*

Table 9. Average concentration of nutrients for the batches with cow slurry.

Fraction	Total Nitrogen (Kg/ton)	Ammonium nitrogen (kg/ton)	Organic nitrogen* (kg/ton)	Total Phosphorous (kg/ton)	Total Potassium (kg/ton)
Input slurry	3.06	1.67	1.39	0.62	3.57
Liquid output fraction	2.67	1.66	1.00	0.51	3.46
Solid output fraction	4.77	1.65	3.11	1.23	2.95
Sediment output fraction**	2.87	1.72	1.15	0.52	3.12

**Organic nitrogen is not measure at a laboratory, is calculated as the difference between total nitrogen and ammonium nitrogen.*

*** The data on sediments are only obtained from one batch only.*

Table 10. Average concentration of nutrients for the batches with digested biomass.

Fraction	Total Nitrogen (Kg/ton)	Ammonium nitrogen (kg/ton)	Organic nitrogen* (kg/ton)	Total Phosphorous (kg/ton)	Total Potassium (kg/ton)
Input slurry	2.33	1.52	0.81	0.62	2.43
Liquid output fraction	1.96	1.40	0.56	0.35	2.42
Solid output fraction	4.84	2.09	2.75	2.85	2.64
Sediment output fraction**	2.21	1.46	0.76	0.38	2.47

**Organic nitrogen is not measure at a laboratory, is calculated as the difference between total nitrogen and ammonium nitrogen.*
*** The data on sediments are only obtained from one batch only.*

3.1.4 Treatment capacity and electricity consumption

Table 11 presents the capacity of the PURROT-module for the different substrates and the electricity consumption per ton of treated biomass.

Table 11. Feed capacity and electricity consumption.

Matrix	Capacity (tons of input biomass treated per hour)	Electricity consumption (kWh/ton treated biomass)
Sow slurry	2.28	1.23
Cow slurry	0.64	5.36
Digested biomass	0.91	3.30

3.1.5 Calorific value

The calorific value of the solid fraction is measured in this test. The purpose is to obtain a measure of the energy potential of the solid fraction. The potential energy depends on the dry matter and the ash content of the solid fraction. The calorific value is relevant if there is no option for disposing manure and burning the solid fraction can produce energy.

The values measured in the laboratory are the gross calorific value and the net calorific value. The gross calorific value is the highest calorific value as this value includes the heat of vaporization of the water. In addition, the net calorific value is analysed because this parameter is used in Europe for classification of fuels. This value is the gross calorific value subtracted the heat of water vaporization. For the sow substrate was only analysed the gross calorific value and the net calorific value was calculated (see appendix 2).

Table 12. Gross and net calorific value.

Biomass	Dry matter of the fibre fraction (%)	Calorific value	
		Gross calorific value (MJ/kg dry matter)	Net calorific value (MJ/ kg dry matter)
Sow slurry	36.92	16.17	15.52
Cow slurry	38.33	18.48	18.06
Digested biomass	35.38	17.81	17.88

3.2 Test performance observation

The test at the site started on September 2014 with achievement of the first batch out of 8 batches included in the test and was finished with batch number 8 on January 2015. The table below presents dates for all 8 batches and the duration of each batch.

Table 13. Basic data from each of the 8 batch tests performed.

Batch number	Date	Length of batch (hours: minutes)	Amount of treated slurry (litres)	Amount of solid fraction (kg)	Amount of liquid fraction (kg)	Amount of sediment fraction (kg)

1 sow	01-09-2014	03:00	6256	180	6076	-
2 sow	15-09-2014	03:00	6864	320	5364	1180
average		03:00	6560	250	5720	-
1 cow	17-12-2014	03:00	2041	177	1864	-
2 cow	18-12-2014	03:00	1935	232	1703	-
3 cow	18-12-2014	03:00	1803	255	1364	184
average		03:00	1926	221	1644	-
1 digested biomass	14-01-2015	03:00	2690	259	2431	-
2 digested biomass	15-01-2015	03:00	2798	270	2345	183
3 digested biomass	15-01-2015	03:00	2759	324	2119	316
average		03:00	2749	284	2298	-

3.3 Test quality assurance summary, incl. audit results

Weight calibration
The fibre fraction is weighted by a certified weighing bridge at the sow site (site 1). The weighing bridge measures only in a range of 20 kg. That is why the weight was checked again with AgroTechs certified weight.

On site 2 the fibre fraction was measured by a wagon that had incorporated a weight. The wagon was tested with AgroTechs certified weight giving no variation.

Figure 3. Left photo: Wagon used to weigh solid output fraction. Right photo: AgroTech´s certified weight.

The flowmeter used under the test was made by Siemens and it was calibrated 6 months before starting the test. The flowmeter was tested by AgroTech during the test at it performed 8% below what showed the display data. This correction was taken into account for the calculation of the mass balances.

Figure 4. Flowmeter used under the test.

There was included one batch for every type of substrate with a sedimentation fraction. In this batch, the fibre fraction is separated at the end of the rotary filter as in the other batches. The new at this batch is that part of the liquid output is recirculated to the cyclone, where the

particles with size between 5 to 100 microns are separated and the rest output returned to the PURROT inlet.

Under one of the test days one expert from ETA-Danmark visited the test site and audited the test practices. The audit report is included in appendix 4.

3.4 Amendments to and deviations from test plan

The separation module was moved from one site to another during the test. This delayed the test activities. It was also the reason why there are only completed two batches at site 1, with sow slurry.

4. References

Cortina, A.G. (2014): Test Plan for PURROT. 20th of August 2014.

European Commission (2014): EU Environmental Technology Verification pilot programme. General Verification Protocol (GVP). Version 1.1 - July 7th, 2014.

International Standardization Organisation (2008): EN ISO 9001. Quality management systems - Requirements. 15.11.2008.

Frandsen, T.Q. (2014): Specific verification protocol PURROT®.

Appendix 1 - Terms and definitions

Term	Definition	Comments
Accreditation	Meaning as assigned to it by Regulation (EC) No 765/2008	EC No 765/2008 is on setting out the requirements for accreditation and market surveillance relating to the marketing of products
Additional parameter	Other effects that will be described but are considered secondary	None
Amendment	A change to a specific verification protocol or a test plan done before the verification or test step is performed	None
Analytical laboratory	Independent analytical laboratory used to analyse test samples	The test centre may use an analytical laboratory as subcontractor
Application	The use of a technology specified with respect to matrix, purpose (target and effect) and limitations	The application must be defined with a precision that allows the user of a technology verification to judge whether his needs are comparable to the verification conditions
DANETV	Danish centre for verification of environmental technologies	None
Deviation	A change to a specific verification protocol or a test plan done during the verification or test step performance	None
Environmental technologies	Environmental technologies are all technologies whose use is less environmentally harmful than relevant alternatives	The term technology covers a variety of products, processes, systems and services
Evaluation	Evaluation of test data for a technology for performance and data quality	None
General verification protocol (GVP)	Description of the principles and general procedure to be followed by the ETV pilot programme when verifying an individual environmental technology.	None
Innovative environmental technologies	Environmental technologies presenting a novelty in terms of design, raw materials involved, production process, use, recyclability or final disposal, when compared with relevant alternatives.	None

Term	Definition	Comments
Matrix	The type of material that the technology is intended for	Matrices could be soil, drinking water, ground water, degreasing bath, exhaust gas condensate etc.
Method	Action described by e.g. generic document that provides rules, guidelines or characteristics for tests or analysis	An in-house method may be used in the absence of a standard, if prepared in compliance with the format and contents required for standards, see e.g. [4]
Operational parameter	Measurable parameters that define the application and the verification and test conditions.	Operational parameters could be temperature, production capacity, concentrations of non-target compounds in matrix etc.
(Initial) performance claim	Proposer claimed technical specifications of technology. Shall state the conditions of use under which the claim is applicable and mention any relevant assumption made.	The proposer claims shall be included in the ETV proposal. The initial claims can be developed as part of the quick scan.
Performance parameters (revised performance claims)	A set of quantified technical specifications representative of the technical performance and potential environmental impacts of a technology in a specified application and under specified conditions of testing or use (operational parameters).	The performance parameters must be established considering the application(s) of the technology, the requirements of society (legislative regulations), customers (needs) and proposer initial performance claims.
Potential environmental impacts	Estimated environmental effects or pressure on the environment, resulting directly or indirectly from the use of a technology under specified conditions of testing or use.	None
Procedure	Detailed description of the use of a standard or a method within one body	The procedure specifies implementing a standard or a method in terms of e.g.: equipment used.
Product	Ready to market or prototype stage product/technology, process, system or service based upon an environmental technology.	In the EU ETV GVP [1] the term "technology" is used instead of the term "product".
Proposer	Any legal entity or natural person, which can be the technology manufacturer or an authorised representative of the technology manufacturer. If the technology manufactures concerned agree, the proposer can be another stakeholder undertaking a specific	Can be vendor or producer

Term	Definition	Comments
	verification programme involving several technologies.	
Purpose	The measurable property that is affected by the technology and how it is affected.	The purpose could be reduction of nitrate concentration, separation of volatile organic compounds, reduction of energy use (MW/kg) etc.
Ready to market technology	Technology available on the market or at least available at a stage where no substantial change affecting performance will be implemented before introducing the technology on the market (e.g. full-scale or pilot scale with direct and clear scale-up instructions).	None
Specific verification protocol	Protocol describing the specific verification of a technology as developed applying the principles and procedures of the EU GVP and this quality manual.	None
Standard	Generic document established by consensus and approved by a recognised standardization body that provides rules, guidelines or characteristics for tests or analysis	None
Test body	Unit that that plans and performs test	None
Verification body	Unit that plans and performs the verification	None
Test/testing	Determination of the performance of a technology for measurements / parameters defined for the application.	None
Test performance audit	Quantitative evaluation of a measurement system as used in a specific test.	E.g. evaluation of laboratory control data for relevant period (precision under repeatability conditions, trueness), evaluation of data from laboratory participation in proficiency test and control of calibration of online measurement devises.
Test system audit	Qualitative on-site evaluation of test, sampling and/or measurement systems associated with a specific test.	E.g. evaluation of the testing done against the requirements of the specific verification protocol, the test plan and the quality manual of the test body.

Term	Definition	Comments
Test system control	Control of the test system as used in a specific test.	E.g. test of stock solutions, evaluation of stability of operational and/or on-line analytical equipment, test of blanks and reference technology tests.
Vendor	The party delivering the technology to the customer. In the EU ETV GVP and in this quality manual referred to as proposer.	Can be the producer.
Verification	Provision of objective evidence that the technical design of a given environmental technology ensures the fulfilment of a given performance claim in a specified application, taking any measurement uncertainty and relevant assumptions into consideration.	None

Appendix 2 - Test data report

The data presented in this appendix 2 are the raw data obtained from the laboratories, Agrolab for the substrate analyses and The Danish Technological Institute for the calorific values.

Table A1. Sow slurry. Batch 1.

		Parameter (enhed)											
Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammoniumkvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
10249 ACO 2699	Slurry 1	3,20	96,8	22,6	2,3	2,27	0,62	1,43	1,6	1,93	0,03	2,26	71%
10249 ACO 2700	Slurry 2	3,30	96,7	23,2	2,3	2,26	0,65	1,49	1,6	1,93	0,04	2,32	70%
10249 ACO 2701	Slurry 3	3,20	96,8	22,8	2,36	2,25	0,66	1,51	1,61	1,94	0,11	2,28	71%
Beregnet middelværdi rågylle		*3,23*	*96,77*	*22,87*	*2,32*	*2,26*	*0,64*	*1,48*	*1,60*	*1,93*	*0,06*	*2,29*	*71%*
10249 ACO 2702	Liquid output 1	1,80	98,2	11,1	2,24	2,24	0,4	0,91	1,58	1,9	0	1,11	62%
10249 ACO 2703	Liquid output 2	1,80	98,2	11,1	2,44	2,23	0,4	0,93	1,58	1,9	0,21	1,11	62%
10249 ACO 2704	Liquid output 3	1,80	98,2	11,1	2,24	2,22	0,41	0,93	1,61	1,94	0,02	1,11	62%
Beregnet middelværdi filtrat		*1,80*	*98,20*	*11,1*	*2,31*	*2,23*	*0,40*	*0,92*	*1,59*	*1,91*	*0,08*	*1,11*	*62%*
10249 ACO 2705	Solid output 1	42,60	57,4	365	7,5	3	6,01	13,8	1,56	1,88	4,5	36,5	86%
10249 ACO 2706	Solid output 2	42,60	57,4	363	7,95	2,95	7,41	17	1,52	1,83	5	36,3	85%
10249 ACO 2707	Solid output 3	42,80	57,2	374	8,15	3,25	6,59	15,1	1,58	1,91	4,9	37,4	87%
Beregnet middelværdi fiber		*42,67*	*57,33*	*367,33*	*7,87*	*3,07*	*6,67*	*15,30*	*1,55*	*1,87*	*4,80*	*36,73*	*86%*
10249 ACO 27008	Ekstra rågylle-input	3,20	96,8	22,6	2,96	2,31	0,71	1,63	1,82	2,2	0,65	2,26	71%

Table A2. Sow slurry. Batch 2.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammonium kvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
15-09-2014	10249 ACO 2709	Slurry 1	2,90	97,10	20,3	2,88	2,23	0,5588	1,27	1,4276	1,72	0,65	2,03	70,00%
15-09-2014	10249 ACO 2710	Slurry 2	2,90	97,1	20,3	2,74	2,21	0,5544	1,26	1,4442	1,74	0,53	2,03	70,00%
15-09-2014	10249 ACO 2711	Slurry 3	2,90	97,1	20,3	2,61	2,19	0,5588	1,27	1,4442	1,74	0,42	2,03	70,00%
	Beregnet middelværdi rågylle		*2,90*	*97,1*	*20,3*	*2,675*	*2,2*	*0,5566*	*1,265*	*1,4442*	*1,74*	*0,475*	*2,03*	*70,00%*
15-09-2014	10249 ACO 2712	Liquid output 1	1,60	98,4	9,22	2,82	2,14	0,308	0,7	1,4774	1,78	0,68	0,922	57,63%
15-09-2014	10249 ACO 2713	Liquid output 2	1,60	98,4	9,13	2,96	2,11	0,308	0,7	1,4774	1,78	0,85	0,913	57,06%
15-09-2014	10249 ACO 2714	Liquid output 3	1,60	98,4	8,86	2,91	2,14	0,308	0,7	1,4857	1,79	0,77	0,886	55,38%
	Beregnet middelværdi filtrat		*1,60*	*98,40*	*9,07*	*2,90*	*2,13*	*0,31*	*0,70*	*1,48*	*1,78*	*0,77*	*0,91*	*56,69%*
15-09-2014	10249 ACO 2715	Solid output 1	30,90	69,1	273	6,35	2,85	3,9688	9,02	1,3778	1,66	3,5	27,3	88,35%
15-09-2014	10249 ACO 2716	Solid output 2	31,20	68,8	270	6,2	2,95	4,202	9,55	1,411	1,7	3,25	27	86,54%
15-09-2014	10249 ACO 2717	Solid output 3	31,40	68,6	275	6,95	3	4,2284	9,61	1,3612	1,64	3,95	27,5	87,58%
	Beregnet middelværdi fiber		*31,17*	*68,83*	*272,67*	*6,50*	*2,93*	*4,13*	*9,39*	*1,38*	*1,67*	3,57	27,27	87,49%
15-09-2014	10249 ACO 2718	Ekstra rågylle-input	3,00	97	21,8	2,63	2,27	0,5764	1,31	1,4691	1,77	0,36	2,18	72,67%
15-09-2014	10249 ACO 2719	Sedimenter	*2,00*	*98*	*10,4*	*3,28*	*2,35*	*0,8008*	*1,82*	*1,494*	*1,8*	*0,93*	1,04	52,00%

Table A3. Cow substrate. Batch 1.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammoniumkvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
17-12-2014	10249 ACO 2962	Slurry 1	7,00	93	57,9	3,16	1,65	0,6204	1,41	4,5	3,75	1,51	5,79	83%
17-12-2014	10249 ACO 2963	Slurry 2	6,30	93,7	51,2	3,07	1,66	0,5984	1,36	4,476	3,73	1,41	5,12	81%
17-12-2014	10249 ACO 2964	Slurry 3	7,60	92,4	63,2	3,22	1,62	0,6292	1,43	4,524	3,77	1,6	6,32	83%
17-12-2014	*Beregnet middelværdi rågylle*		*6,97*	*93,03*	*57,43*	*3,15*	*1,64*	*0,62*	*1,40*	*4,50*	*3,75*	*1,51*	*5,74*	*0,82*
17-12-2014	10249 ACO 2965	Liquid output 1	4,10	95,9	29,8	2,7	1,64	0,5192	1,18	4,332	3,61	1,06	2,98	73%
17-12-2014	10249 ACO 2966	Liquid output 2	4,10	95,9	29,6	2,66	1,63	0,5104	1,16	4,272	3,56	1,03	2,96	72%
17-12-2014	10249 ACO	Liquid output 3	4,10	95,9	30	2,66	1,62	0,5104	1,16	4,32	3,6	1,04	3	73%
17-12-2014	*Beregnet middelværdi filtrat*		*4,10*	*95,90*	*29,80*	*2,67*	*1,63*	*0,51*	*1,17*	*4,31*	*3,59*	*1,04*	*2,98*	*0,73*
17-12-2014	10249 ACO 2968	Solid output 1	40,30	59,7	372	4,62	1,74	1,4872	3,38	3,744	3,12	2,88	37,2	92%
17-12-2014	10249 ACO 2969	Solid output 2	37,90	62,1	349	5,1	1,68	1,2144	2,76	3,732	3,11	3,42	34,9	92%
17-12-2014	10249 ACO 2970	Solid output 3	41,10	58,9	382	5,22	1,74	1,3464	3,06	3,696	3,08	3,48	38,2	93%
17-12-2014	*Beregnet middelværdi fiber*		*39,77*	*60,23*	*367,67*	*4,98*	*1,72*	*1,35*	*3,07*	*3,72*	*3,10*	*3,26*	*36,77*	*0,92*

Table A4. Cow substrate. Batch 2.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammonium kvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
18-12-2014	10249 ACO 2991	Slurry 1	8,00	92,00	66,5	3,17	1,67	0,6248	1,42	3,0627	3,69	1,5	6,65	83,13%
18-12-2014	10249 ACO 2992	Slurry 2	7,90	92,1	66,5	3,07	1,66	0,638	1,45	3,154	3,8	1,41	6,65	84,18%
18-12-2014	10249 ACO 2993	Slurry 3	8,00	92	66,4	2,97	1,65	0,638	1,45	3,1208	3,76	1,32	6,64	83,00%
18-12-2014	*Beregnet middelværdi rågylle*		*7,97*	*92,03*	*66,47*	*3,07*	*1,66*	*0,63*	*1,44*	*3,11*	*3,75*	*1,41*	*6,65*	*0,83*
18-12-2014	10249 ACO 2994	Liquid output 1	4,20	95,9	30,2	2,66	1,61	0,506	1,15	2,9714	3,58	1,05	3,02	71,90%
18-12-2014	10249 ACO 2995	Liquid output 2	4,20	95,8	30,4	2,68	1,63	0,5104	1,16	2,9797	3,59	1,05	3,04	72,38%
18-12-2014	10249 ACO 2996	Liquid output 3	4,10	95,9	29,9	2,88	1,67	0,5104	1,16	3,0876	3,72	1,21	2,99	72,93%
18-12-2014	*Beregnet middelværdi filtrat*		*4,17*	*95,87*	*30,17*	*2,74*	*1,64*	*0,51*	*1,16*	*3,01*	*3,63*	*1,10*	*3,02*	*0,72*
18-12-2014	10249 ACO 2997	Solid output 1	40,80	59,2	381	4,86	1,56	1,2452	2,83	2,5066	3,02	3,3	38,1	93,38%
18-12-2014	10249 ACO 2998	Solid output 2	41,30	58,7	386	5,22	1,68	1,2276	2,79	2,4817	2,99	3,54	38,6	93,46%
18-12-2014	10249 ACO 2999	Solid output 3	40,60	59,4	378	4,8	1,62	1,254	2,85	2,5232	3,04	3,18	37,8	93,10%
18-12-2014	*Beregnet middelværdi fiber*		*40,90*	*59,10*	*381,67*	*4,96*	*1,62*	*1,24*	*2,82*	*2,50*	*3,02*	*3,34*	*38,17*	*0,93*

Table A5. Cow substrate. Batch 3.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammonium kvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
18-12-2014	10249 ACO 3006	Slurry 1	8,00	92,00	66,4	3,04	1,7	0,616	1,4	3,1291	3,77	1,34	6,64	83,00%
18-12-2014	10249 ACO 3007	Slurry 2	8,00	92	66	2,92	1,71	0,6292	1,43	3,1291	3,77	1,21	6,6	82,50%
18-12-2014	10249 ACO 3008	Slurry 3	7,90	92,1	65,6	2,91	1,7	0,6028	1,37	3,0295	3,65	1,21	6,56	83,04%
	Beregnet middelværdi rågylle		*7,97*	*92,03*	*66,00*	*2,96*	*1,70*	*0,62*	*1,40*	*3,10*	*3,73*	*1,25*	*6,60*	*0,83*
18-12-2014	10249 ACO 3012	Liquid output 1	4,30	95,7	30,9	2,56	1,7	0,5192	1,18	3,0544	3,68	0,86	3,09	71,86%
18-12-2014	10249 ACO 3013	Liquid output 2	4,30	95,7	30,8	2,63	1,74	0,5148	1,17	3,0295	3,65	0,89	3,08	71,63%
18-12-2014	10249 ACO 3014	Liquid output 3	4,30	95,7	30,7	2,56	1,72	0,528	1,2	3,0793	3,71	0,84	3,07	71,40%
	Beregnet middelværdi filtrat		*4,30*	*95,70*	*30,80*	*2,58*	*1,72*	*0,52*	*1,18*	*3,05*	*3,68*	*0,86*	*3,08*	*0,72*
18-12-2014	10249 ACO 3009	Solid output 1	34,10	65,9	317	4,38	1,56	1,0912	2,48	2,6311	3,17	2,82	31,7	92,96%
18-12-2014	10249 ACO 3010	Solid output 2	34,70	65,3	322	4,38	1,68	1,0824	2,46	2,5813	3,11	2,7	32,2	92,80%
18-12-2014	10249 ACO 3011	Solid output 3	34,50	65,5	321	4,32	1,62	1,078	2,45	2,6145	3,15	2,7	32,1	93,04%
	Beregnet middelværdi fiber		*34,43*	*65,57*	*320,00*	*4,36*	*1,62*	*1,08*	*2,46*	*2,61*	*3,14*	*2,74*	*32,00*	*0,93*
18-12-2014	10249 ACO 3003	sedimenter 1	4,30	95,7	30,9	2,94	1,73	0,5104	1,16	3,0876	3,72	1,21	3,09	71,86%
18-12-2014	10249 ACO 3004	sedimenter 2	4,30	95,7	31	2,86	1,72	0,5324	1,21	3,1789	3,83	1,14	3,1	72,09%
18-12-2014	10249 ACO 3005	sedimenter 3	4,30	95,7	31,1	2,8	1,71	0,5148	1,17	3,1042	3,74	1,09	3,11	72,33%
	10249 ACO	Sedimenter	*4,30*	*95,70*	*31,00*	*2,87*	*1,72*	*0,52*	*1,18*	*3,12*	*3,76*	*1,15*	*3,10*	*0,72*

Table A6. Digested biomass. Batch 1.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammoniumkvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
14-01-2015	10249 ACO 3091	Slurry 1	6,10	93,9	49,1	2,31	1,49	0,5676	1,29	2,407	2,9	0,82	4,91	80%
14-01-2015	10249 ACO 3092	Slurry 2	6,20	93,8	50,2	2,28	1,49	0,5764	1,31	2,3987	2,89	0,79	5,02	81%
14-01-2015	10249 ACO	Slurry 3												
14-01-2015	*Beregnet middelværdi rågylle*		*6,15*	*93,85*	*49,65*	*2,30*	*1,49*	*0,57*	*1,30*	*2,40*	*2,90*	*0,81*	*4,97*	*0,81*
14-01-2015	10249 ACO 3094	Liquid output 1	3,20	96,8	22,3	2,03	1,38	0,3432	0,78	2,3738	2,86	0,65	2,23	70%
14-01-2015	10249 ACO 3095	Liquid output 2	3,20	96,8	22,1	2,17	1,43	0,3784	0,86	2,6062	3,14	0,74	2,21	69%
14-01-2015	10249 ACO	Liquid output 3												
14-01-2015	*Beregnet middelværdi filtrat*		*3,20*	*96,80*	*22,20*	*2,10*	*1,41*	*0,36*	*0,82*	*2,49*	*3,00*	*0,70*	*2,22*	*0,69*
14-01-2015	10249 ACO 3097	Solid output 1	37,90	62,1	347	4,98	2,16	2,5344	5,76	2,5398	3,06	2,82	34,7	92%
14-01-2015	10249 ACO 3098	Solid output 2	38,10	61,9	347	5,34	2,16	2,6004	5,91	2,573	3,1	3,18	34,7	91%
14-01-2015	10249 ACO	Solid output 3												
14-01-2015	*Beregnet middelværdi fiber*		*38,00*	*62,00*	*347,00*	*5,16*	*2,16*	*2,57*	*5,84*	*2,56*	*3,08*	*3,00*	*34,70*	*0,91*

Table A7. Digested biomass. Batch 2.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammonium kvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
14-01-2015	10249 ACO 3103	Slurry 1	6,40	93,6	51,3	2,48	1,54	0,638	1,45	2,4983	3,01	0,94	5,13	80%
14-01-2015	10249 ACO 3104	Slurry 2	6,30	93,7	50,9	2,38	1,53	0,6424	1,46	2,4734	2,98	0,85	5,09	81%
	Beregnet middelværdi rågylle		*6,35*	*93,65*	*51,10*	*2,43*	*1,54*	*0,64*	*1,46*	*2,49*	*3,00*	*0,90*	*5,11*	*0,80*
14-01-2015	10249 ACO 3106	Liquid output 1	3,20	96,8	22,2	2	1,41	0,352	0,8	2,3904	2,88	0,59	2,22	69%
14-01-2015	10249 ACO 3107	Liquid output 2	3,20	96,8	22,2	1,8	1,44	0,3476	0,79	2,4153	2,91	0,36	2,22	69%
	Beregnet middelværdi filtrat		*3,20*	*96,80*	*22,20*	*1,90*	*1,43*	*0,35*	*0,80*	*2,40*	*2,90*	*0,48*	*2,22*	*0,69*
14-01-2015	10249 ACO 3109	Solid output 1	38,90	61,1	352	4,92	2,16	3,2164	7,31	2,7307	3,29	2,76	35,2	90%
14-01-2015	10249 ACO 3110	Solid output 2	38,60	61,4	351	4,74	2,22	3,1944	7,26	2,7141	3,27	2,52	35,1	91%
	Beregnet middelværdi fiber		*38,75*	*61,25*	*351,50*	*4,83*	*2,19*	*3,21*	*7,29*	*2,72*	*3,28*	*2,64*	*35,15*	*0,91*
14-01-2015	10249 ACO 3112	sedimenter	3,2	96,8	22,3	2,29	1,47	0,3828	0,87	2,4734	2,98	0,82	2,23	0,696875
14-01-2015	10249 ACO 3113	sedimenter	3,2	96,8	22,3	2,18	1,45	0,3872	0,88	2,4651	2,97	0,73	2,23	0,696875
	Beregnet middelværdi fiber		3,2	96,8	22,3	2,235	1,46	0,385	0,875	2,46925	2,975	0,775	2,23	0,696875

Table A8. Digested biomass. Batch 3.

			Parameter (enhed)											
Dato	Prøvemærkning	Prøvetype	Tørstof, TS (%)	Vandindhold (%)	Glødetab, org. Substans (kg/ton)	Kvælstof tot., N (kg/ton)	Ammonium kvælstof, NH4-N (kg/ton)	Phosphor, P (kg/ton)	Phosphat tot., P2O5 (kg/ton)	Kalium, K (kg/ton)	Kalium tot., K2O (kg/ton)	Organisk N (kg/ton)	Org. Tørstof, VS (%)	VS/TS (%)
15-01-2015	10249 ACO 3115	Slurry 1	6,40	93,70	50,7	2,26	1,55	0,66	1,5	2,4485	2,95	0,71	5,07	79%
15-01-2015	10249 ACO 3116	Slurry 2	6,40	93,6	51,2	2,28	1,52	0,6292	1,43	2,3655	2,85	0,76	5,12	80%
	Beregnet middelværdi rågylle		*6,40*	*93,65*	*50,95*	*2,27*	*1,54*	*0,64*	*1,47*	*2,41*	*2,90*	*0,74*	*5,10*	*0,80*
15-01-2015	10249 ACO 3118	Liquid output 1	3,10	96,9	21,8	1,82	1,36	0,3388	0,77	2,3406	2,82	0,46	2,18	70%
15-01-2015	10249 ACO 3119	Liquid output 2	3,10	96,9	21,9	1,96	1,38	0,3432	0,78	2,3738	2,86	0,58	2,19	71%
	Beregnet middelværdi filtrat		*3,10*	*96,90*	*21,85*	*1,89*	*1,37*	*0,34*	*0,78*	*2,36*	*2,84*	*0,52*	*2,19*	*0,70*
15-01-2015	10249 ACO 3121	Solid output 1	29,40	70,6	261	4,5	1,98	2,8072	6,38	2,6394	3,18	2,52	26,1	89%
15-01-2015	10249 ACO 3122	Solid output 2	28,90	71,1	259	4,56	1,86	2,772	6,3	2,6643	3,21	2,7	25,9	90%
	Beregnet middelværdi fiber		*29,15*	*70,85*	*260,00*	*4,53*	*1,92*	*2,79*	*6,34*	*2,65*	*3,20*	*2,61*	*26,00*	*0,89*
15-01-2015	10249 ACO 3124	sedimenter 1	3,20	96,8	21,9	2,16	1,46	0,3652	0,83	2,3821	2,87	0,7	2,19	68%
15-01-2015	10249 ACO 3125	sedimenter 2	3,20	96,8	21,9	2,21	1,44	0,3828	0,87	2,5481	3,07	0,77	2,19	68%
			3,20	*96,80*	*21,90*	*2,19*	*1,45*	*0,37*	*0,85*	*2,47*	*2,97*	*0,74*	*2,19*	*0,68*

Table A9. Calorific values.

Date	Sample	Water content (105^{0}C) %	Gross calorific value (J/g dry matter)	Net calorific value (J/g dry matter)
17-12-2014	SPE 10579 5000 (Cow-batch 1)	59,5 ± 0,3	18770 ± 50	17530 ± 50
17-12-2014	SPE 10579 5001 (cow batch 1)	61,0 ± 03	18800 ±40	17530 ± 40
18-12-2014	SPE 10579 5003 (cow batch 2)	59,3 ± 0,3	18890 ± 40	17610 ± 40
18-12-2014	SPE 10579 5004 (cow batch 2)	59,1 ± 0,1	18930 ± 50	17650 ± 50
18-12-2014	SPE 10579 5006 (cow batch 3)	65,9 ± 0,5	19030 ± 50	17790 ± 50
18-12-2014	SPE 10579 5007 (cow batch 3)	65,8 ± 0,4	18990 ± 50	17730 ± 50
14-01-2015	SPE 10579 3249 (biomass batch 1)	61,9 ± 0,2	18800 ± 50	17520 ± 50
14-01-2015	SPE 10579 3250 (biomass batch 1)	62,0 ± 0,5	18740 ± 40	17510 ± 40
14-01-2015	SPE 10579 3251 (biomass batch 2)	61,5 ± 0,6	18590 ± 40	17350 ± 40
14-01-2015	SPE 10579 3252 (biomass batch 2)	61,1 ± 0,5	18440 ± 50	17190 ± 50
15-01-2015	SPE 10579 3253 (biomass batch 3)	70,2 ± 0,1	17900 ± 30	16720 ± 30
15-01-2015	SPE 10579 3254 (biomass batch 3)	71,0 ± 0,5	18010 ± 50	16760 ± 50

The analyses were performed by the Danish Technological Institute. The method used for analysis of the calorific samples is DS/CEN/TS 14918.

Table A10. Calorific values.

Date	Sample	Gross calorific value (kJ/kg dry matter)	Net calorific value (kJ/kg dry matter)*
16-09-2014	29920-2715	16390	15738,52
16-09-2014	29920-2715	15890	15238,52
16-09-2014	29920-2717	16220	15568,52

The analyses were performed by Agrolab. The method used for analysis of the calorific samples is DS/CEN/TS 14918.

*It is calculated from the Gross calorific value

(NCV (net calorific value) = HCV – X[H] · 8,9 kg H2O/kg H · 2,44 MJ/kg H2O

Where X is parameter content [kg/kg])

Appendix 3 - Amendment and deviation reports for test

See section 3.4 Amendments to and deviations from test plan.

Appendix 4 - Audit report

ETA Danmark Test System Audit Report

Project no.:011987-07	Date of audit: 2015.01.14
Testing project: Purrot	Site: The biogas plant of Foulum Research Centre, Borrehøjvej 43, DK-8830 Tjele, Denmark
Test system audit – Materials, waste and resources	
Present during audit Auditor: Peter Fritzel Other: Sune Petersen and Amparo Gómez Cortina, AgroTech Anders Tange and Karsten Jensen, PurFil Aps	
Checklist *Conformity with test plan:* **Test method in general** Section 2: Test set up is as described in test plan. Test plan dated 2014.08.20. **Operation of treatment unit:** Section: 2.2.1: The digested biomass used in this test is taken from a pretank which is mixed constantly during the batch test. Mass flow meter and electricity meter is **Operation conditions, and measurements for monitoring them** Section 2.2.5: A check list covering the measuring session is present. **On-line measurements and sampling for performance parameters** Section 2.2.5: A table is mentioning the batch measuring session **Data logging and retrieval** Section 2.2.6: Registrations are done by test staff during the batch test. **Sampling and sample storage** Section 2.2.5: Samples are taken from the input and the output. They are cooled by using ice and sent away for analysis. **Documentation of laboratory operations and sampling** 3.1. Samples are analysed by Institute Koldingen GmbH, see appendix 1. **Other issues identified by auditor:** The solid fraction produced during the batch is weighed by using a weighing device of the biogas plant. A control of this weighing device is done by using a calibrated weighing device of AgroTech. The calibration scheme was presented for auditor. In excel-file "Udstyrsliste_Agrotech" row 291 showed that last control date was performed 2014.08.12. **Non-conformities noted by auditor** None	
Auditor's conclusions There is a good correlation between the test plan and execution of measurements. The experiments are performed in a secure manner.	
Date: 2015.02.27 Signature: Peter Fritzel	

Appendix 1 to audit report

DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

Institut Koldingen GmbH
Breslauer Straße 60, 31157 Sarstedt

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

ausgewählte physikalische, physikalisch-chemische und chemische Untersuchungen von Grundwasser und Oberflächenwasser;
physikalische, physikalisch-chemische und chemische Untersuchungen von landwirtschaftlichen Nutzböden, Böden nach AbfKlärV, Böden, Altlasten und Abfall, gärtnerisch genutzten Böden und Kultursubstraten;
Untersuchung von Böden gemäß BEK (dänische Verordnung über Qualitätsanforderungen an Umweltmessungen);
Untersuchung von Bodeneluaten;
physikalische, physikalisch-chemische und chemische Untersuchungen von Klärschlamm und organische Düngemittel, Kompost und Bioabfall, Abfall und Stoffe zur Verwertung;
Untersuchung von Abfalleluaten;
Probenahmen von, landwirtschaftlichen Nutzböden, Böden nach AbfKlärV, gärtnerisch genutzten Böden und Kultursubstraten Schlämmen, Sedimenten Klärschlamm sowie Abfall und Stoffen zur Verwertung;
Fachmodule Boden und Altlasten sowie Abfall

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 06.10.2014 mit der Akkreditierungsnummer D-PL-14047-01 und ist gültig bis 21.05.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 41 Seiten.

Registrierungsnummer der Urkunde: **D-PL-14047-01-00**

Im Auftrag

Andrea Valbuena
Abteilungsleiterin

Berlin, 06.10.2014

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Appendix 5 – Additional photos of the PURROT® module