

# VERA VERIFICATION STATEMENT

## VERIFICATION OF ENVIRONMENTAL TECHNOLOGIES FOR AGRICULTURAL PRODUCTION

It is hereby stated that

**Technology: SyreN**

**Manufactured by: BioCover a/s**

has been tested according to the VERA test protocol for  
Gaseous Emissions from Land Applied Manure version 1, December 2010.

The following main results have been documented through the test:

**Verified environmental efficiency:**

Ammonia emission reduction efficiency at 49 % when applied on cattle slurry  
No effect on odour emission reduction efficiency

**Verified operational stability:**

The SyreN technology has demonstrated a satisfactory operational stability

October 2<sup>nd</sup> 2012



**VERA** 

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*Mr. Peter Engel, Head of the International VERA Secretariat*

### *Exemption of liability*

The VERA Secretariat does not endorse, certify or approve technologies. VERA verifications are based on an evaluation of the technology performance under specific, predetermined criteria and the appropriate quality assurance procedures.

VERA as a representative for the Danish EPA, the German Federal Ministry of Food, Agriculture and Consumer Protection and the Dutch Ministry of Infrastructure and Environment make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified.

The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Further the end user must be aware that the countries involved in VERA are having different legal requirements which will influence the status and use of this verification statement in each country.

## The VERA Organisation

VERA – Verification of Environmental Technologies for Agricultural Production – is an international organisation for test and verification of environmental technologies for agricultural production. VERA is established as a co-operation between the Danish Environmental Protection Agency, the Dutch Ministry of Infrastructure and Environment and the German Federal Ministry of Food, Agriculture and Consumer Protection.

The purpose of VERA is to enhance a well-functioning market for environmental technologies to increase the environmental protection of agricultural production by substantially accelerating the acceptance and use of improved and cost-effective environmental technologies.

VERA verifies the performance of technologies by carrying out tests according to pre-defined test protocols. A VERA Verification Statement secures validated documentation for the environmental efficiency and operational stability of the technology and is an important step in the introduction of the technology to the market. Based on information from the test reports, the VERA Verification Statement gives a general and short description of the technology, its principle of operation, and the main results and conclusions from the VERA test.

## Applicant Data

Technology type	Acidification of cattle slurry during land application of slurry
Applied for	Reduction of ammonia emissions during land application of slurry
Technology name	SyreN
Company	BioCover a/s
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Test institute	Aarhus University, Faculty of Agricultural Sciences Faculty in collaboration with AgroTech A/S (Institute for Agri Technology and Food Innovation).

## Technology Description

During land application of slurry, the SyreN technology continuously acidifies the slurry by mixing concentrated sulphuric acid with slurry. By lowering slurry pH, the potential for ammonia emission is significantly reduced compared to land application of untreated slurry. The SyreN technology was during this test applied to a standard trailing hose slurry application system with a distance between each hose of 30 centimetres. This type of standard trailing hose system was furthermore applied as the reference system.

During operation of the SyreN technology, the sulphuric acid is transported and stored in an approved container mounted in front of the tractor which is mounted with a liquid manure spreader. In this test the spreader was at the rear end equipped with a bar on which hoses were mounted, and the liquid manure was applied on the soil through the hoses trailing on the soil surface. The sulphuric acid is with the SyreN technology pumped through pipes from the acid container on the tractor to the outlet of the manure spreader where the liquid manure is mixed with the acid in a static mixer before the slurry is pumped into the device used to apply the acidified slurry on the soil. The system continuously controls the rate of acid being mixed with slurry by continuous online pH measurement of acidified slurry. The technology is applicable during seasons for slurry application.

The SyreN technology includes an online data handling system, which saves the values of the following variables: pH in the untreated slurry, pH in the acidified slurry and acid consumption per m<sup>3</sup> slurry. The data handling system continuously measures the amount/volume of spread slurry and the SyreN technology automatically and continuously adjusts the rate and the amount of acid added to the slurry according to the target slurry pH.

## Test Design

The SyreN technology was tested in June 2010 according to the instructions in the VERA Test Protocol for Measurement of Gaseous Emissions from Land Applied Manure (Version 1, December 2009). The environmental efficiency of SyreN was tested with a standard trailing hose slurry application system without the SyreN technology as the reference system. The SyreN system was tested in experiments where cattle slurry from a dairy cow production was applied to at forage grass field at Research Centre Foulum, near Viborg, Denmark. The soil type was sandy loam.

Ammonia emission was measured during field scale test in six 36\*36 m field plots. Acidified cattle slurry was applied to three plots and untreated slurry was applied to three plots. The experiment was carried out on two measuring days on 2<sup>nd</sup> of June and 15<sup>th</sup> of June 2010. The ammonia emissions were measured during 6 days following the application of slurry.

Odour was measured on four plots in the same fields where ammonia emission from 6 plots were measured. Odour was measured after application of acidified slurry on two plots and of untreated slurry to two plots. The plots were 12\*30 m and were situated 200 metres from the nearest ammonia plot. Odour concentration was measured 20 minutes after cattle slurry application. The experiment was carried out on two measuring days on 2<sup>nd</sup> of June and 15<sup>th</sup> of June 2010.

## Test Results

### *Environmental Efficiency*

Table 1 presents the ammonia emission reduction efficiency after application of SyreN technology on cattle slurry.

**Table 1:** Ammonia emission as affected by acidification of slurry with the SyreN technology. The emission from acid treated and untreated slurry is presented and the treatment effect is presented as the reduction in pct. of emission of ammonia from untreated cattle slurry (n=3). TAN = total ammonia nitrogen.

Treatment	Reference		SyreN	
	Dosage (TAN/ha)	NH <sub>3</sub> -N loss (kg/ha)	Dosage (TAN/ha)	NH <sub>3</sub> -N loss (kg/ha)
<b>June 2</b>	83.4	34.3	72.6	19.6
<b>June 15</b>	69	27.9	72.6 and 66.4 <sup>1</sup>	11.4 and 12.7 <sup>1</sup>
<b>Average</b>	76.2	31.1	70.5	14.6
<b>NH<sub>3</sub>-N loss (g NH<sub>3</sub>-N/applied kg TAN)</b>		408.1		207.1

<sup>1</sup> Two repetitions carried out in the same trial.

The ammonia emission was with application of the SyreN technology on cattle slurry on average reduced with 49 % compared to ammonia emissions from the untreated slurry.



Table 2 presents the effect of the SyreN treatment on the odour emission after application of acidified cattle slurry compared to odour from a plot amended with untreated slurry as reference.

**Table 2:** SyreN effect on odour emission reduction measured after two individual cattle slurry land applications (n=3). OUE = odour units.

<b>Odour</b>	<b>Reference odour concentration</b>	<b>SyreN odour concentration</b>	<b>Odour loss proportional to reference</b>
	(OUE m <sup>3</sup> [stdev.])		(%)
<b>June 2</b>	903 [225]	853 [131]	5
<b>June 15</b>	627 [90]	737 [202]	-18
<b>Average</b>	765	795	-6.5

The measurements of odour concentration indicated that the acidification of cattle slurry with the SyreN technology did not affect odour concentration significantly, i.e. the technology neither significantly increased nor decreased the odour load from application of slurry.

The pH of the acidified slurry was on average reduced to pH 6.4, varying between pH 6.1 and 6.5 during the experiment. This indicates that the SyreN technology efficiently controls pH to below the set values, which in this study was 6.4.

### *Operational Stability*

The test proved that the system had a satisfying operational stability after a few adjustment of the technology. SyreN is delivered with a complete user manual, which describes relevant directions for system operation, maintenance and security. The acid supply to the slurry is controlled by continuous pH measurement and the slurry-acid mixture has to reach below a fixed target pH prior to land application, which is set and controlled online. The actual acid consumption, therefore, depends on the initial slurry pH and will consequently vary between slurries.

The functionality and operational stability of the SyreN system can be controlled by relevant authorities by checking the online pH log file of the applied slurry.



### *Identified Side Effects*

None observed.

### *Additional Results*

None observed.

## **Additional Information**

Procedures for handling and transportation of concentrated acids are described in the user manual.

## **Test Organisation**

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## Validity and Terms of Use

### *Validity*

This VERA Verification Statement is only valid for the specific verified product/technology. There is no time limit for the validity of this VERA Verification Statement as long as the product/technology stays unmodified.

The International VERA Secretariat can, however, at any time invalidate the VERA Verification Statement if it is found to be misused or if significant modifications have been made to the product/technology that are estimated to have a negative effect on the environmental efficiency or operational stability. In regard to the latter the VERA Secretariat can require that a new VERA test should be performed.

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- This verification cannot be considered an endorsement, approval, authorization or warranty of any kind, and the performance parameters provided cannot be extended to other applications or to other technologies
- Morten Toft from BioCover a/s agrees not to use this VERA Verification Statement, the Test Report, or to refer to those for any other technology than the one specified in the statement.
- The VERA Verification Statement will be made available for public access at the VERA website: [www.veracert.eu](http://www.veracert.eu).
- All other information obtained or produced during the verification process is considered confidential and will not be made available for others than the part owning the intellectual property rights.



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