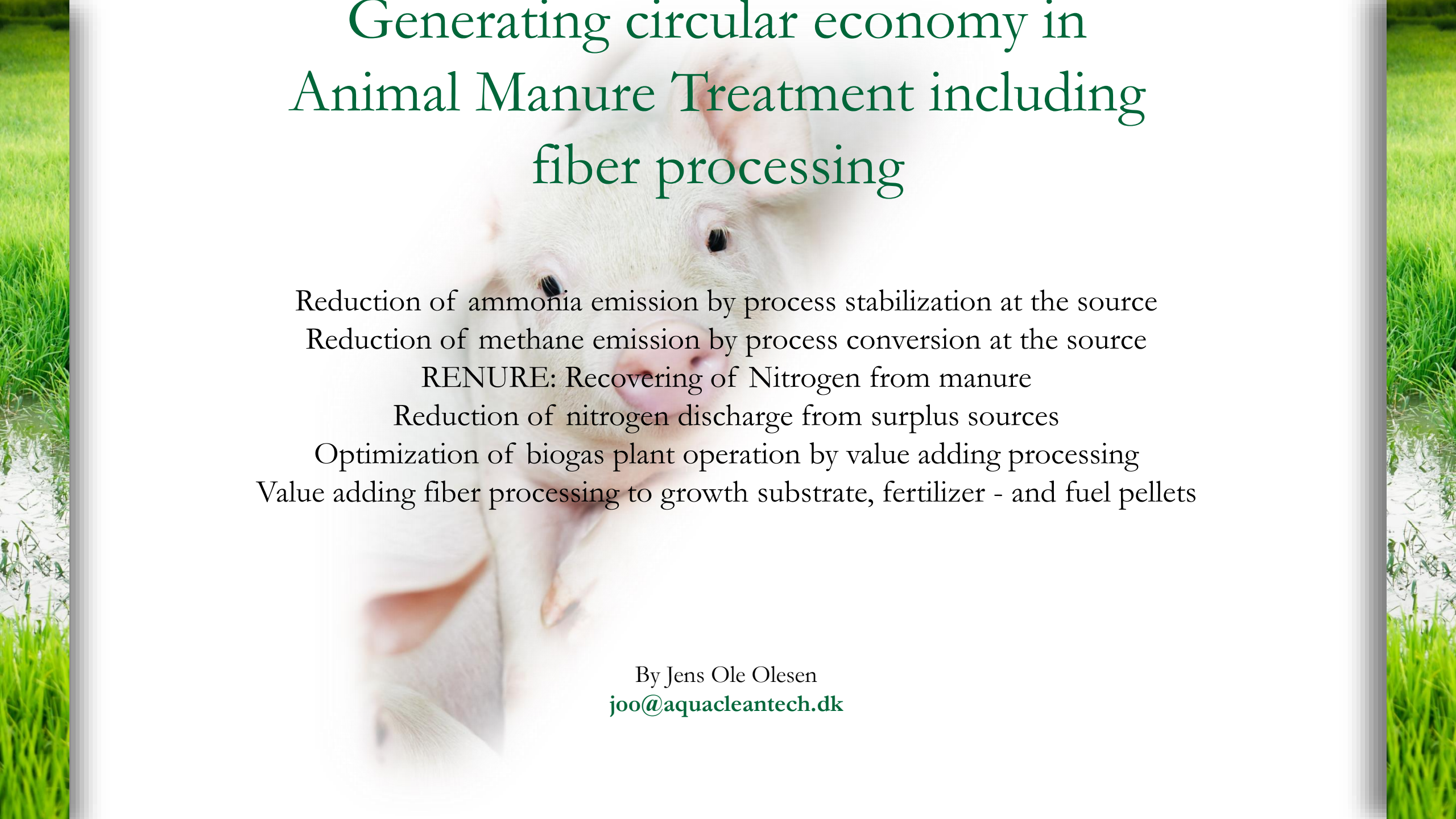
Generating circular economy in Animal Manure Treatment including fiber processing



Reduction of ammonia emission by process stabilization at the source
Reduction of methane emission by process conversion at the source
RENURE: Recovering of Nitrogen from manure
Reduction of nitrogen discharge from surplus sources
Optimization of biogas plant operation by value adding processing
Value adding fiber processing to growth substrate, fertilizer - and fuel pellets

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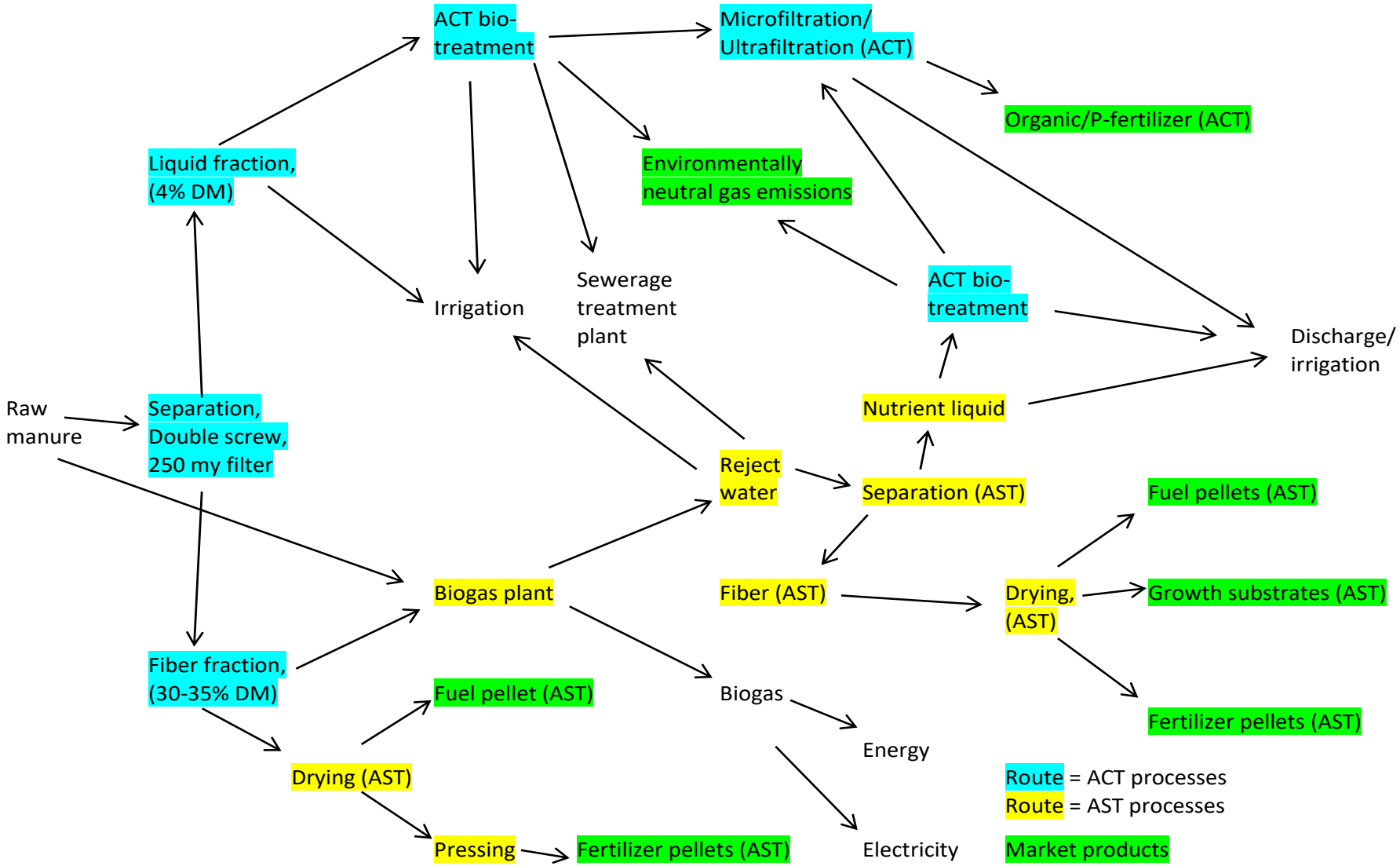
Manure processing routes overview by Aqua Cleantech, ACT, and Advanced Substrate technology, AST



1. Improving digestate for plant fertilization

National legislation requires that total solids (TS) content < 3,5% in digestate for field spreading. By the ACT nitrification process, NH4 will be transformed to NO3, and the process will reduce the TS content to approx. 2,0%.

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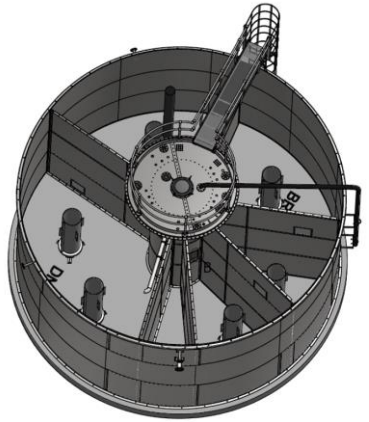
Environmental and economical benefits:

- Ammonia captured and stabilized at source
- All N-nutrient as NO3
- CH4 mineralized
- Fiber for value processing

Screw press

Screw press reject,	kg/ton	
TS	5,3%	53,1
VS of TS	60,8%	32,3
N_{tot}		4,58
NH_4^+		3,56
NO_3		0,00
P		0,70
K		6,43
S		0,54

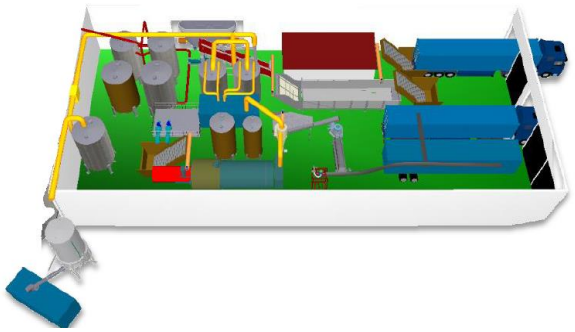


ACT nitrification

Centrifugal fine filtration

Fiber fraction,	kg/ton	
TS	32,0%	320,0
VS of TS	86,0%	275,2
N_{tot}		11,26
NH_4^+-N		2,56
NO_3-N		0,00
P		3,54
K		4,61
S		2,16

Value adding fiber processing



Fiber post-Ni,	kg/ton	
TS	30,0%	300,0
VS of TS	90,0%	270,0
N_{tot}		4,80
NO_3-N		2,63
NH_4^+-N		0,00
P		0,52
K		4,75
S		0,40

Reject post- Ni,	kg/ton	
TS	2,0%	20,0
VS of TS	40,0%	8,0
N_{tot}		4,74
NH_4^+-N		0,01
NO_3-N		3,68
P		0,72
K		6,65
S		0,56

2. Processing digestate for N-reduction

National legislation requires that total solids (TS) content < 3,5% in digestate for field spreading, and Nitrate Directive limits spreading of limited areas. ACT N-reduction limited the N-content to customized levels, and TS content to approx. 2,0%.

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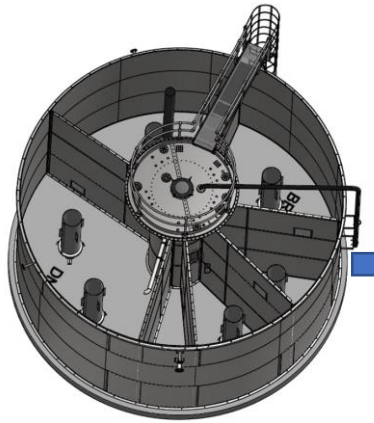
Environmental and economic benefits:

- Total-N reduced to farm demand or zero (all to N2)
- CH4 consumed as substrate for DN
- Fiber for value processing

Screw press

Screw press reject,		kg/ton
TS	5,3%	53,1
VS of TS	60,8%	32,3
N_{tot}		4,58
NH_4^+		3,56
NO_3		0,00
P		0,70
K		6,43
S		0,54

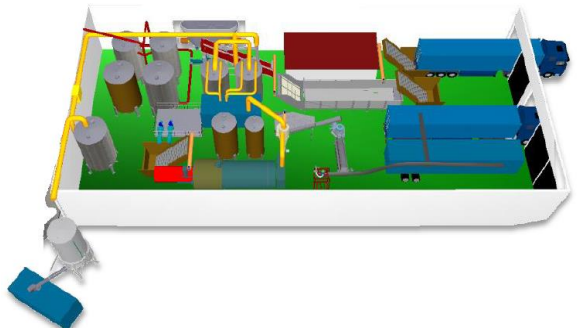


ACT N - reduction

Centrifugal fine filtration

Fiber fraction,		kg/ton
TS	32,0%	320,0
VS of TS	86,0%	275,2
N_{tot}		11,26
NH_4^+-N		2,56
NO_3-N		0,00
P		3,54
K		4,61
S		2,16

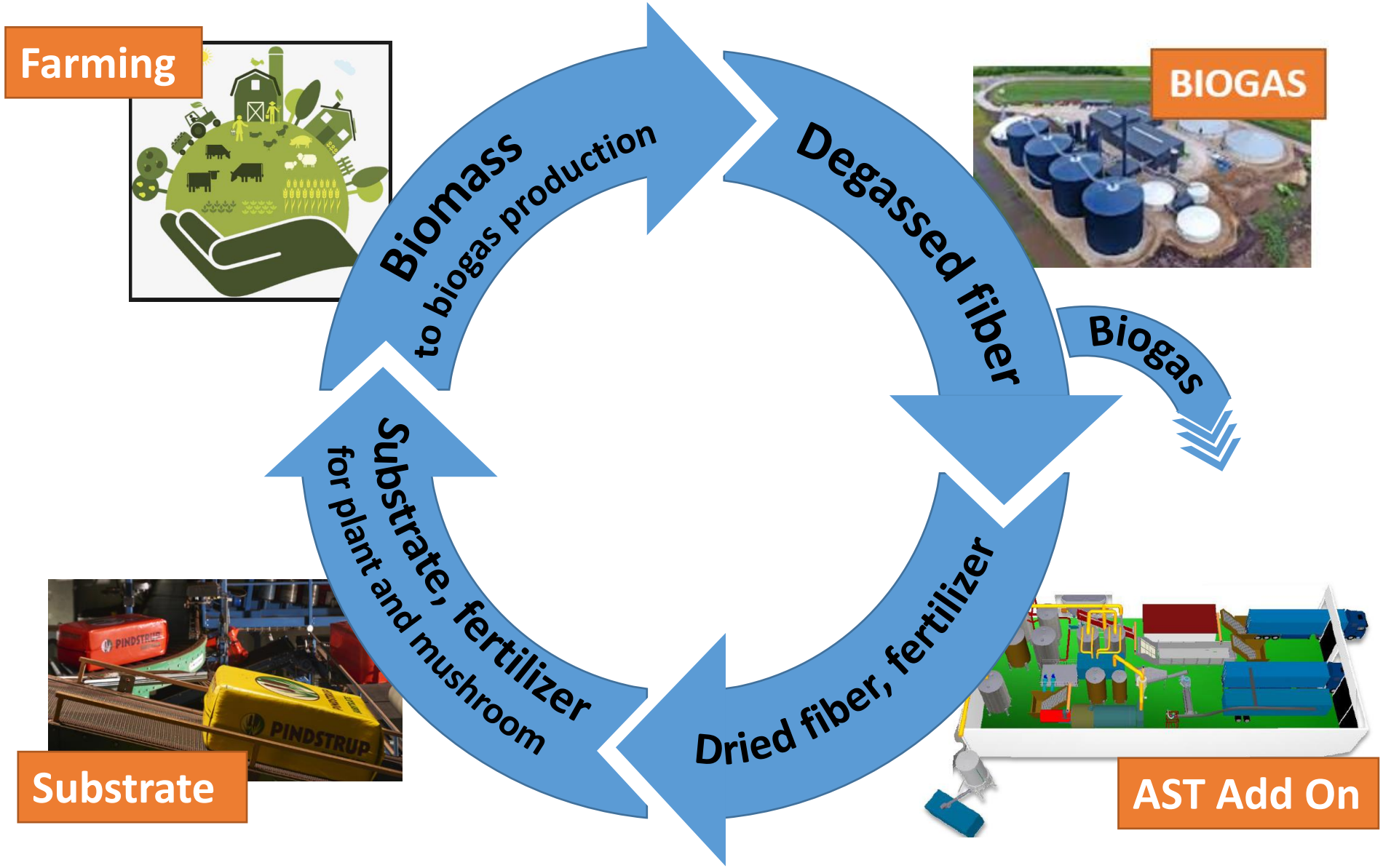
Value adding fiber processing



Fiber post N-reduc., kg/ton		
TS	30,0%	300,0
VS of TS	10,0%	30,0
N_{tot}		1,88
NO_3-N		0,00
NH_4^+-N		0,00
P		3,96
K		7,13
S		0,48

Reject post N-reduc., kg/ton		
TS	2,0%	20,0
VS of TS	10,0%	2,0
N_{tot}		0,13
NH_4^+-N		0,01
NO_3-N		0,01
P		0,01
K		3,21
S		0,50

Fiber processing for growth substrate or fertilizer/energy pellets



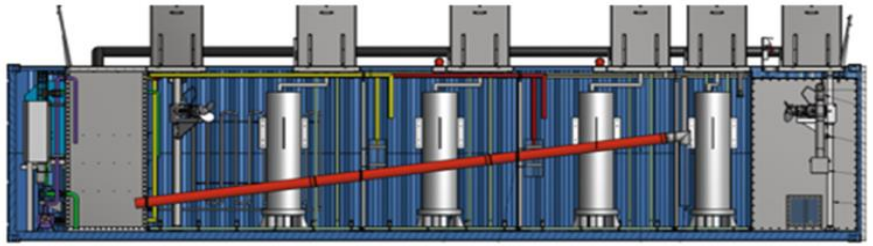
ETV validation

ETV
Verification Report

ETA DANMARK

Project No.: 011987-09 Date: 05-04-2019

Verification Report for AgroBioClean



Prepared by: Thorkild Q. Frandsen, Danish Technological Institute
Prepared for proposer: Assentoft Silo A/S
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Value from pig manure cleaning in optimal operation

Parameter	Container Inlet mg/l	Container outlet mg/l	Container reduction	0,8µ membran filter, mg/l	Reduction in filter	Reduction in total
NH_4-N	5.473	120	98%	7,9	93%	100%
NO_2-N	36	1,5	96%	0,2	87%	99%
NO_3-N	123	2,4	98%	2,4	0%	98%
In-organic N	5.631	124	98%	10,5	92%	100%
Total - N	7.428	891	88%	241	73%	97%
Organic N	1.796	766	57%	230	70%	87%
Total-P	1.815	508	72%	50	90%	97%
K+	4.503	1.628	64%	2.400	-47%	47%
Dry Matter	67.725	14.067	79%	5.975	58%	91%
COD	95.917	11.700	88%	1.173	90%	99%
TOC	28.315	3.750	87%	1.021	73%	96%
pH-value	7,8	8,3	-6%	8,2	1%	-5%

ADVANTAGES of ACT and AST technologies in European animal production

- Generation of circular economy in domestic animal production
- Reductions in greenhouse gas emission
- Reductions in ammonia emission
- Optimization of biogas plant operation
- Complete utilization of fiber products from agriculture
- Economical/environmental advantages by savings in transportation costs.
- Large scale production possible
- Animal production without farm land possible
- Reduction in smell impact
- Environmentally neutral disposal of excess waste water
- No waste products from animal production

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Thank you for your attention

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