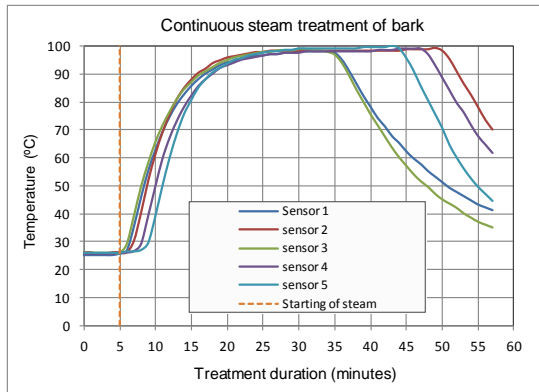


Coniferous bark heat treatment for the elimination of the pinewood nematode by Continuous hot steam system



TECHNICAL REQUIREMENTS



Brussels
SCPH 22-23 November 2012

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TECHNICAL REQUIREMENTS

- 1- Reception place
- 2 - Previous screening
- 3 - Equipment: heat source, heating and treatment chamber and sensors
- 4 - Automatic registration of temperatures
- 5 - System validation
- 6 -Treatment monitoring



TECHNICAL REQUIREMENTS - cont.

7- Final screening

8 - Storage and transport

9 - Hygiene measures



3 – Equipment: heat source, heating and treatment chamber and sensors

2 MODELS

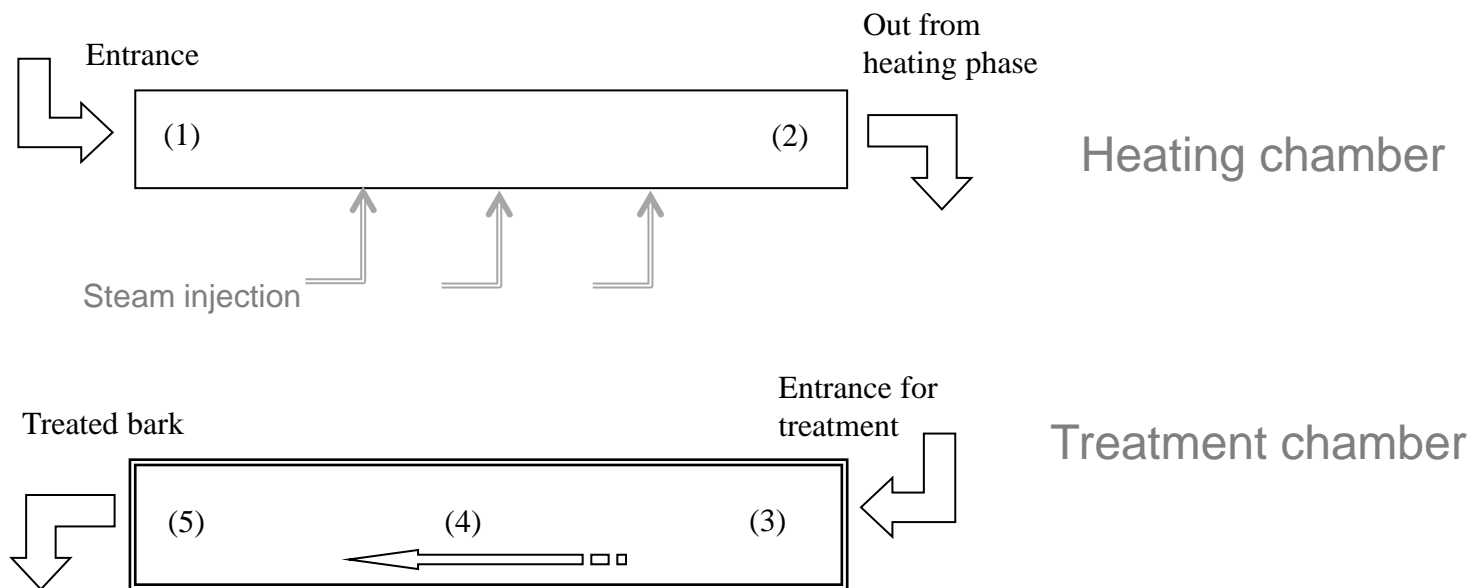


Courtesy: Alfarroxo

Courtesy: Leal&Soares

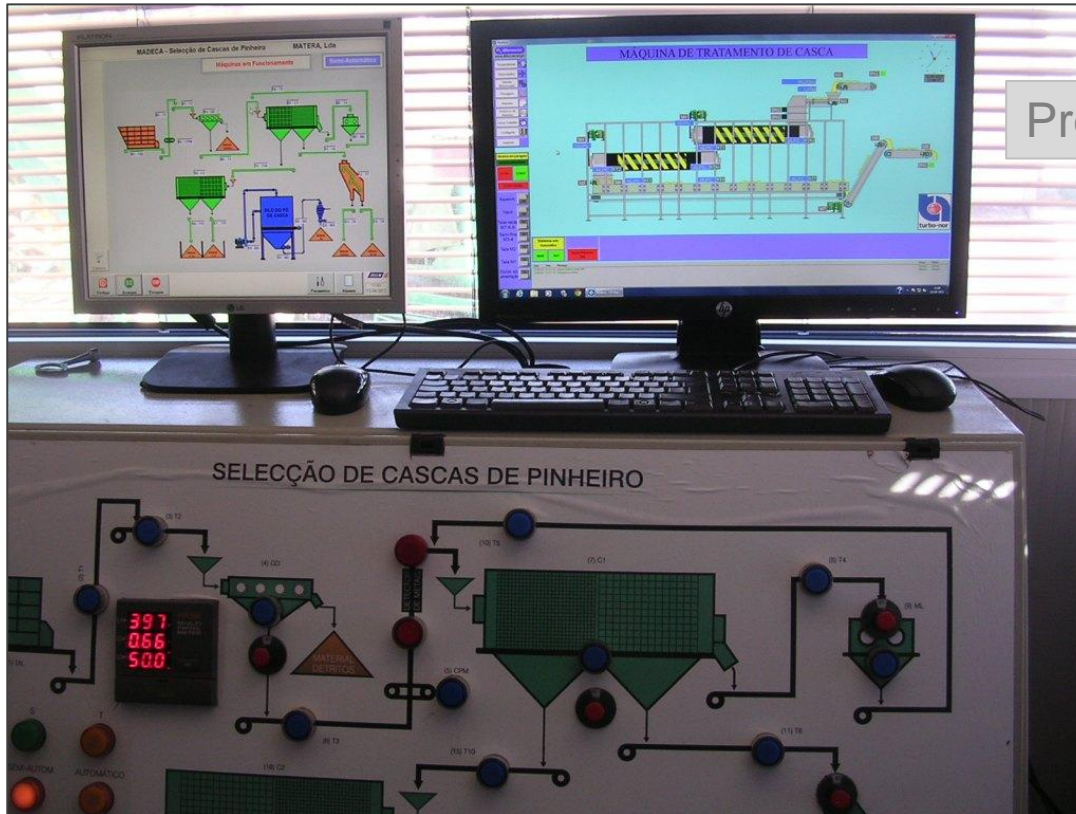


3 - Equipment: heat source, heating and treatment chamber and sensors





4 - Automatic registration of temperatures



Process control

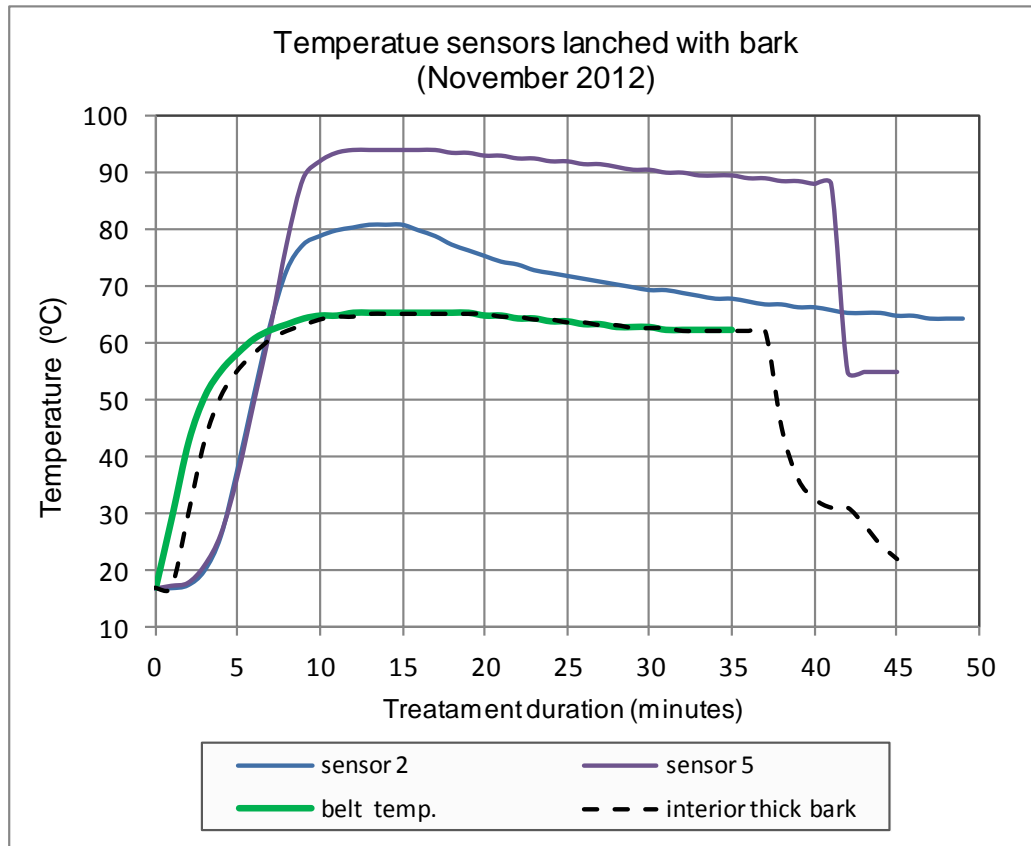
Registers

Date	Hour	Temperatures			Quantity
		T3	T4	T5	
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³
dd	hh:mm	T	T	T	m ³

... every 10 minutes ...

Courtesy: Madeca

5 - System validation – temperature evaluation



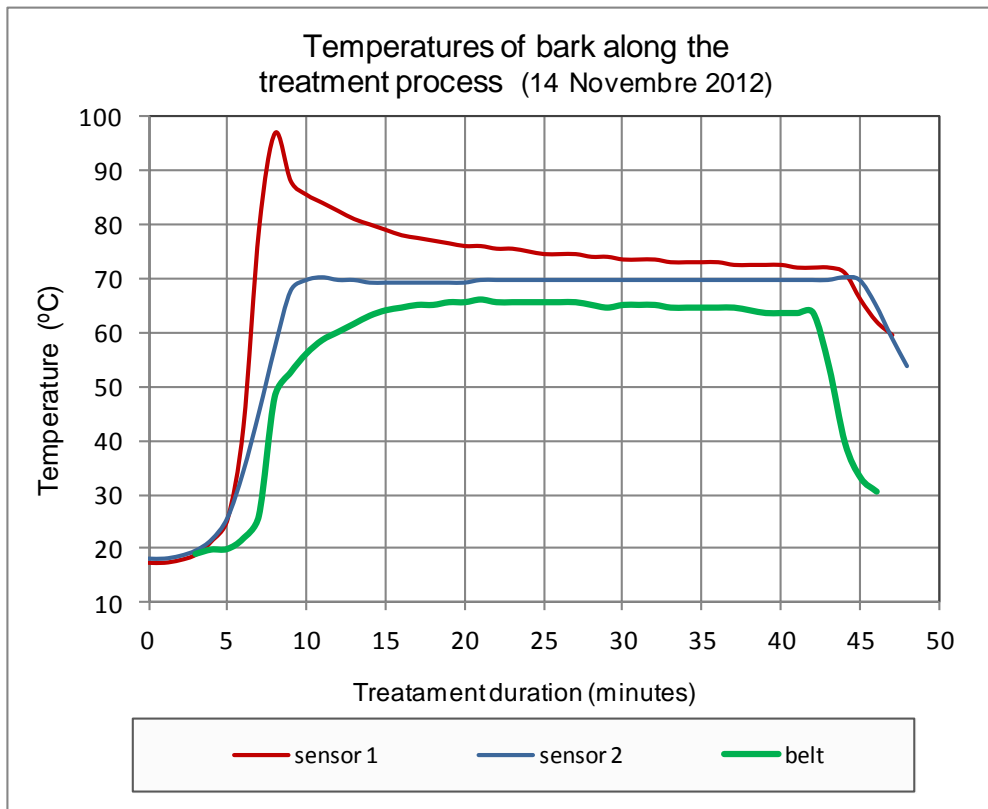
Note: enterprise A

Button sensor
inside thick bark



Inside bark	sensor 1	sensor 2	sensor 3	sensor 5
Time (min) ? 64 °C	31	41	34	33
Time (min) ? 60 °C	33	42	35	34
Temp. máx. (°C)	84.5	80.6	87.5	94.0

5 - System validation – temperature evaluation

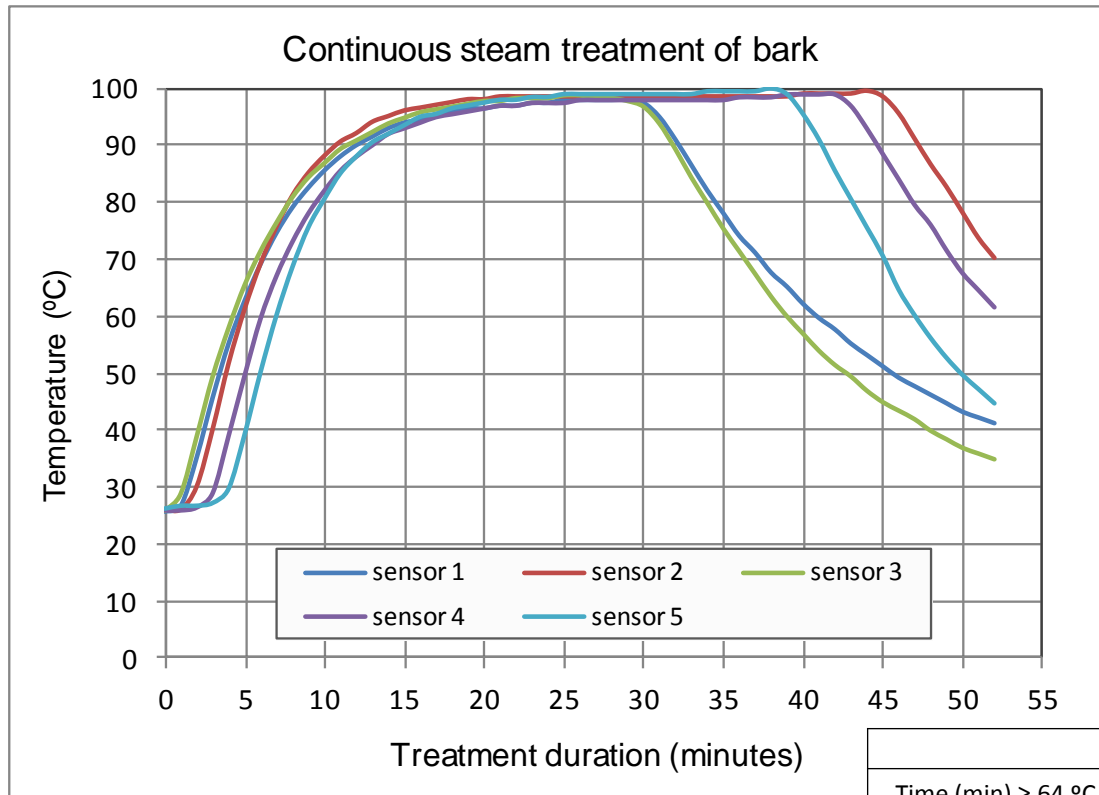


Note: enterprise M.

	sensor 1	sensor 2	Belt
Time (min) ≥ 64 °C	38	37	23
Time (min) ≥ 60 °C	39	37	30
Max. Temp. (°C)	97.0	70.2	66.0



5- System validation – temperature evaluation



Note: enterprise LS

	sensor 1	sensor 2	sensor 3	sensor 4	sensor 5
Time (min) \geq 64 °C	39	46	32	44	38
Time (min) \geq 60 °C	35	50	34	45	40
Max. temp. (°C)	98.0	99.5	98.9	98.9	100.0

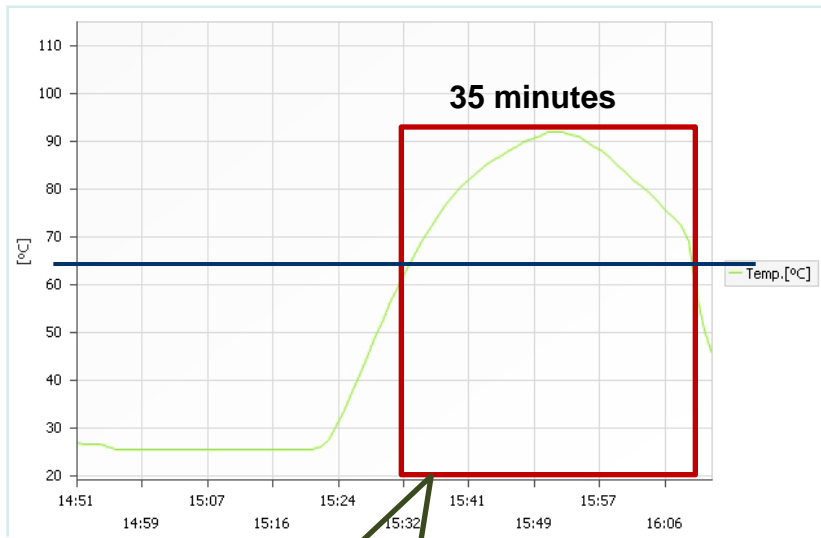
6 - System validation – biological evaluation

Continuous hot steam system – Thermal / biological validation



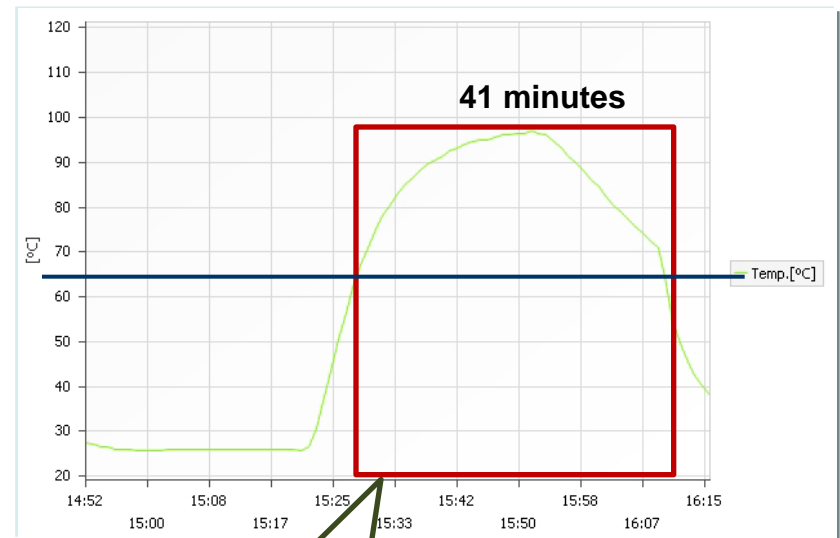
Temperature probes inserted inside bark and wood pieces in order to evaluate the temperature in the core during treatment.

Bark



Average Temperature
(30 min treatment)
75,6°C

Wood



Average Temperature
(30 min treatment)
78,6°C

Continuous hot steam system – Biological validation



9 bags containing wood chips and bark (700 g/bag)
One temperature button sensor inside one tennis ball per bag

***B. xylophilus* > 131 000**
(> 80% J_{III} dispersal juvenil stage– most tolerant stage)

Other nematodes including other *Bursaphelenchus* species > 3600

Continuous hot steam system – Biological validation

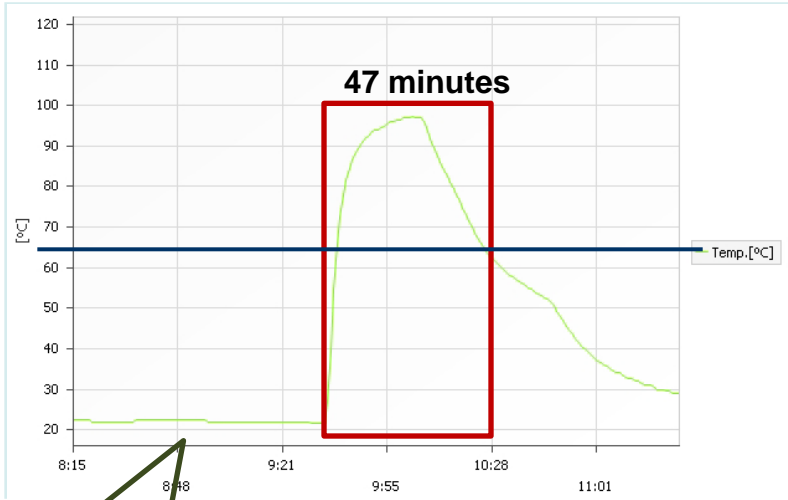


3 bags (4, 6 and 7) - nematode screening after treatment

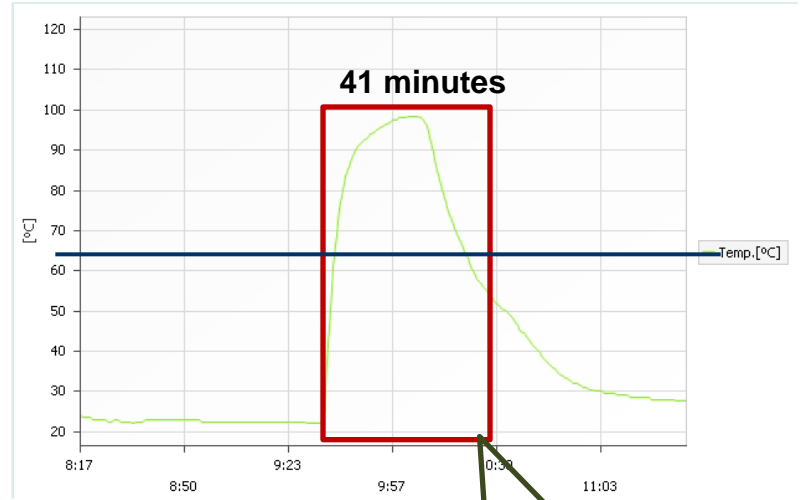
3 bags (2, 3 and 9) – nematode screening after incubation (15 days at 25°C)

Continuous hot steam system – Biological validation (Results)

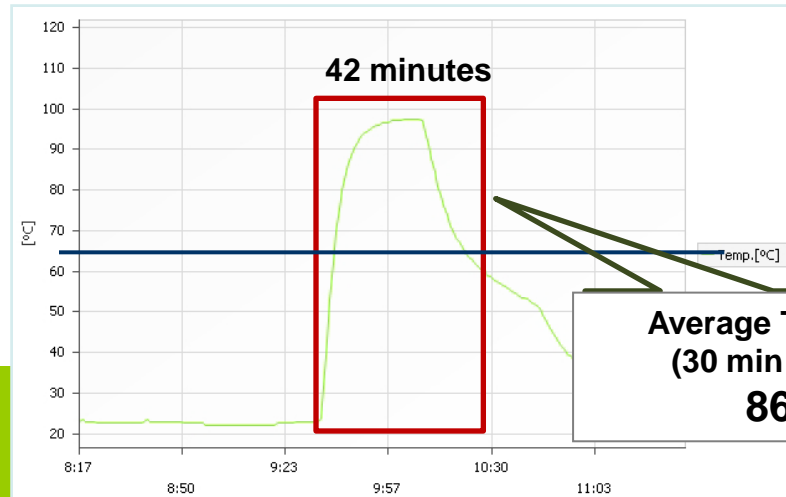
Probe 4



Probe 6



Probe 7



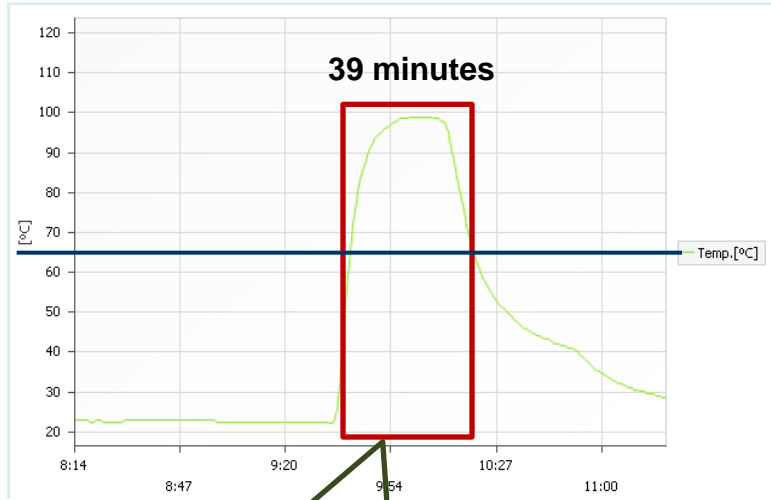
Average Temperature
(30 min treatment)
88,5°C

Average Temperature
(30 min treatment)
88,4°C

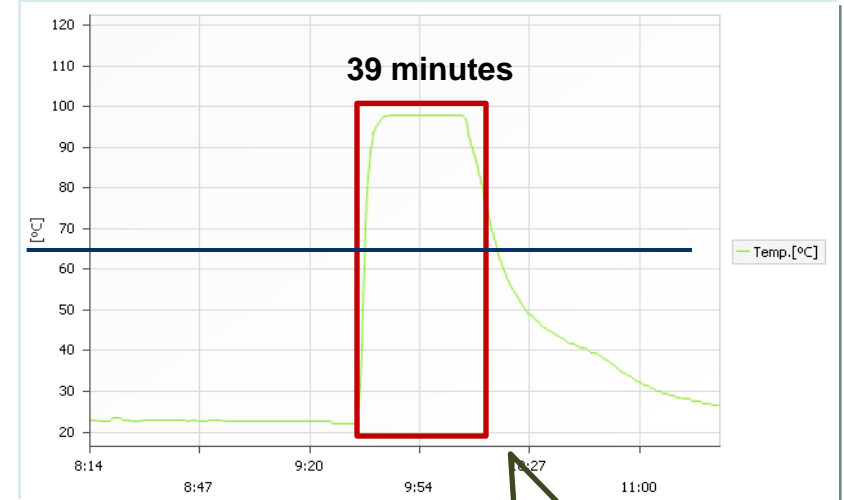
Average Temperature
(30 min treatment)
86,6°C

Continuous hot steam system – Biological validation (Results)

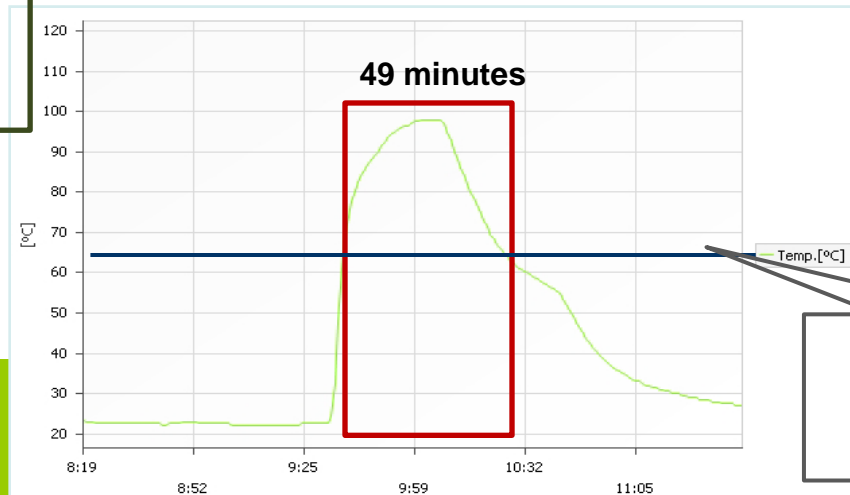
Probe 2



Probe 3



Probe 9



Average Temperature
(30 min treatment)
89,1°C

Average Temperature
(30 min treatment)
93,4°C

Average Temperature
(30 min treatment)
86,5°C

Continuous hot steam system – Biological validation (Results)

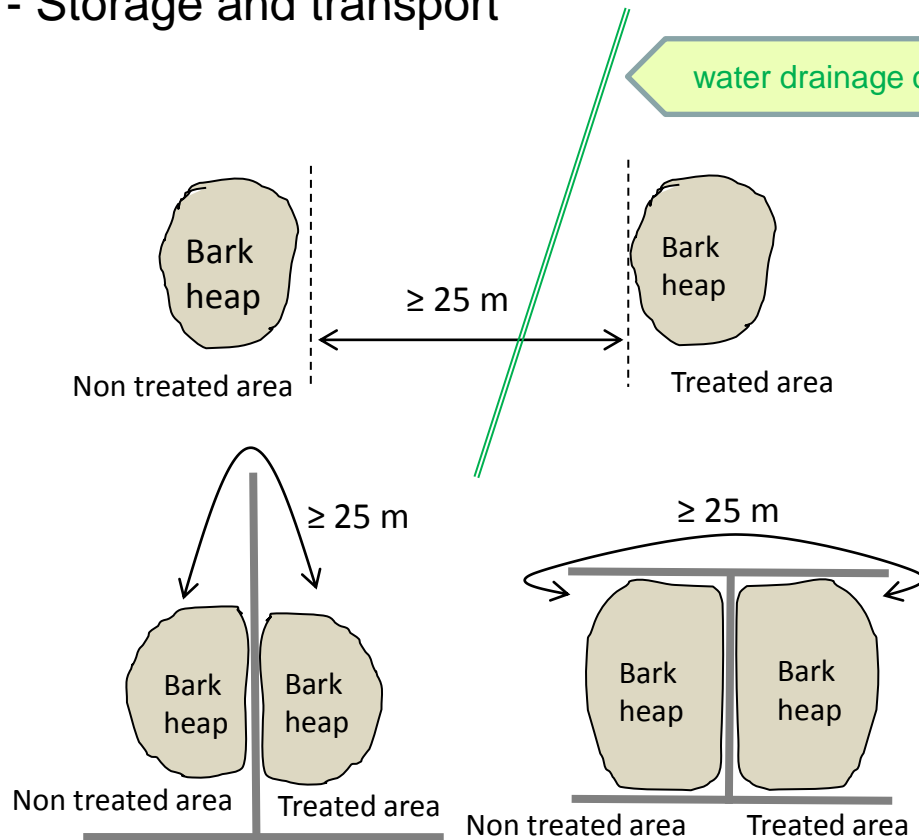
Bag	Nº nematodes (before treatment)	Nº nematodes (after treatment)	Bag	Nº nematodes (before treatment)	Nº nematodes (after treatment and incubation)
4	133 660 (131 000 PWN)	0	2	133 660 (131 000 PWN)	0
6	133 660 (131 000 PWN)	0	3	133 660 (131 000 PWN)	0
7	133 660 (131 000 PWN)	0	9	133 660 (131 000 PWN)	0

Results

Probit 9 efficacy (100% mortality of more than 100 000 test organisms)



8 - Storage and transport



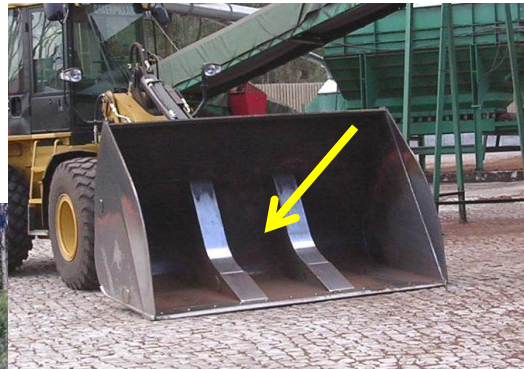
Keep safety distance
between clean and
dirty storage zones



9 - Hygiene measures



Courtesy: Madeca



Cleanliness and sterilization of all containers
Ex. Steam projection



Norma Portuguesa

prNP xxxx
2012



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PORTUGAL

MINISTÉRIO DA AGRICULTURA,
DO MAR, DO AMBIENTE
E DO ORDENAMENTO DO TERRITÓRIO

Casca e estilha de madeira de Resinosas Tratamento fitossanitário pelo calor para eliminação do nemátode da madeira do pinheiro (*Bursaphelenchus xylophilus*) e outros organismos prejudiciais

Écorce de bois et copeaux de Résineux
Traitement fitossanitaire à la chaleur pour l'élimination du nématode du p
(*Bursaphelenchus xylophilus*) et d'autres organismes nuisibles

Softwood bark and wood chips
Phytosanitary heat treatment for the elimination of the pinewood nemato
(*Bursaphelenchus xylophilus*) and other harmful organisms

ICS
79.040

HOMOLOGAÇÃO
Termo de Homologação n.º 28/2009, de 2009-02-

DESCRIPTORIOS

Nemátode; madeira; casca; madeira de resinosas; madeira de
pinheiro



Ministério da Agricultura,
Mar, Ambiente e
Ordenamento do Território

DGAV
Direção - Geral
de Alimentação
e Veterinária

Versão 1 (16/11/2012)

REQUISITOS TÉCNICOS PARA TRATAMENTO TÉRMICO DE CASCA ISOLADA DE CONÍFERAS POR VAPOR QUENTE ¹

- SISTEMA DE TRATAMENTO EM CONTÍNUO -

Introdução

Este procedimento define os requisitos técnicos para eliminação do nemátode da madeira do pinheiro (NMP) *Bursaphelenchus xylophilus* em casca isolada de coníferas através do tratamento pelo calor, assim como as condições de controlo do processo, o armazenamento do material tratado e do seu transporte após tratamento.

A casca deve ser submetida a uma temperatura mínima de 64°C em todo o volume de material a tratar e em toda a massa de cada cavaco de casca individualmente, durante pelo menos 30 min consecutivos, de forma a garantir a morte do NMP e outros organismos prejudiciais.

O sistema de tratamento térmico em contínuo consiste num conjunto de operações que têm por base a passagem forçada de vapor saturado a temperatura $\geq 100^{\circ}\text{C}$ através da casca. Neste sistema a casca movimenta-se continuamente ao longo de uma câmara isolada termicamente de forma a cumprir o tempo de permanência mínimo definido.

Para garantir que o tratamento térmico é devidamente aplicado e monitorizado, devem ser cumpridos os seguintes requisitos:



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Many thanks!



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FCTUC



Laboratório Nacional de Energia e Geologia, I. P.