

Fátima, 19th February 2013

# Artificial heat treatment of coniferous bark for the elimination of the pinewood nematode

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## Energy consumption

Energy needs:

1 m<sup>3</sup> of bark  $\Leftrightarrow$  30-40 kg of steam/hour,

16200 kcal/m<sup>3</sup> of bark

18,8 kW-h/m<sup>3</sup> of bark

## Bark characteristics

	Wet	Air dried	Oven dry
Apparent density (15-30)	240 kg/m <sup>3</sup>	183 kg/m <sup>3</sup>	177 kg/m <sup>3</sup>
Moisture	41 %	18 %	0 %
Volumetric shrinkage	---	7.2 %	16 %

**Artificial heat treatment**

**Industrial equipments**

**Temperature profiles**

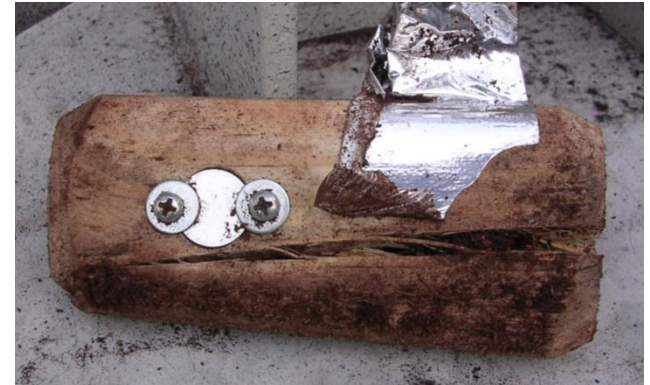
# ***Methods used to introduce and circulate temperature sensors inside treatment chamber***



Aluminium tape



Bark



Wood



Tennis balls



Ping-pong balls

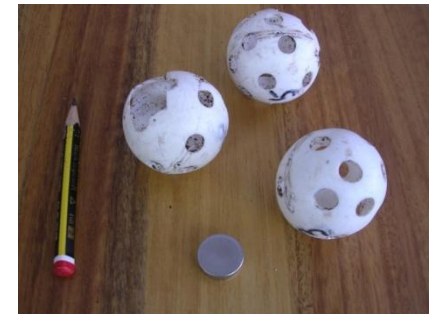
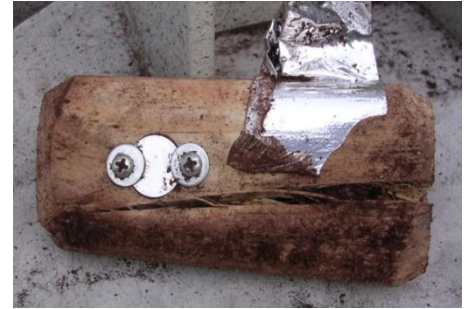
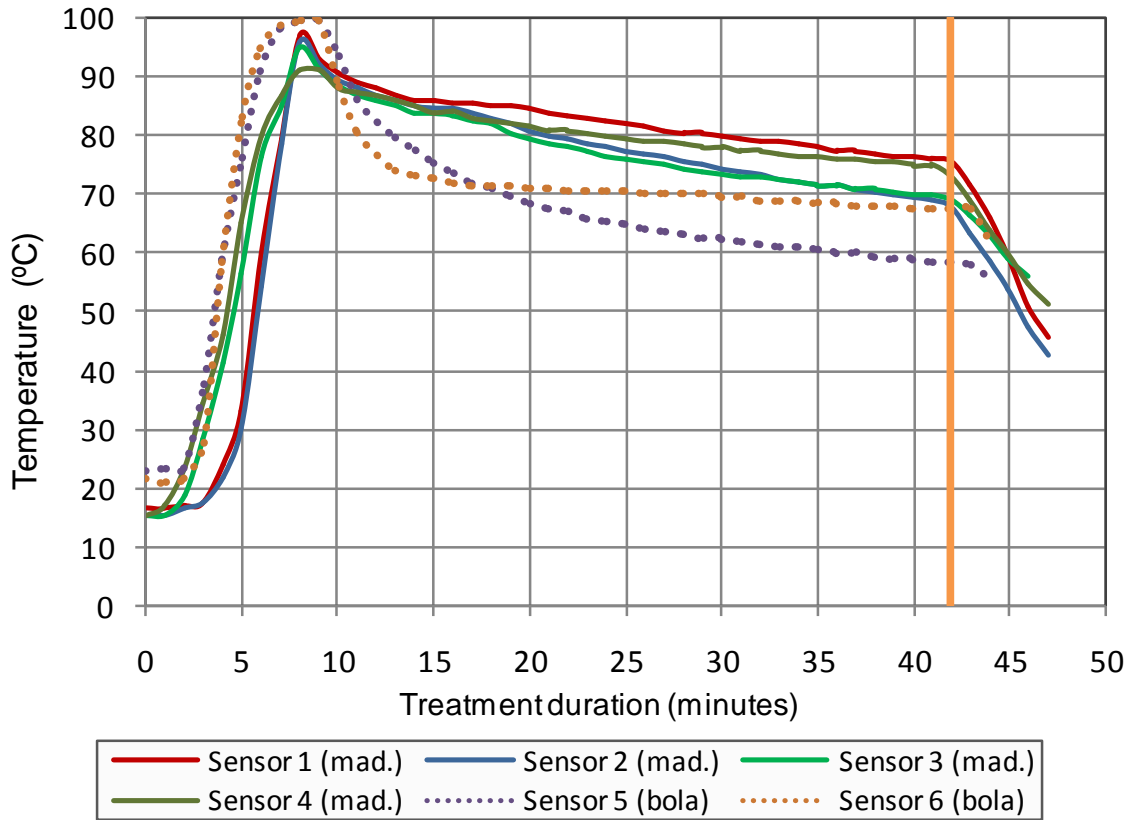


Bark bags

Madeca



Madeca - Temperature (wood and balls)  
(12 Decembre 2012)



	sensor 1	sensor 2	sensor 3	sensor 4	sensor 5	sensor 6
Time (h:m:s) ≥ 64 °C	00:37:00	00:36:00	00:37:00	00:38:00	00:21:00	00:38:00
Max. Temp. (°C)	88.0	87.0	86.0	87.0	82.5	76.6

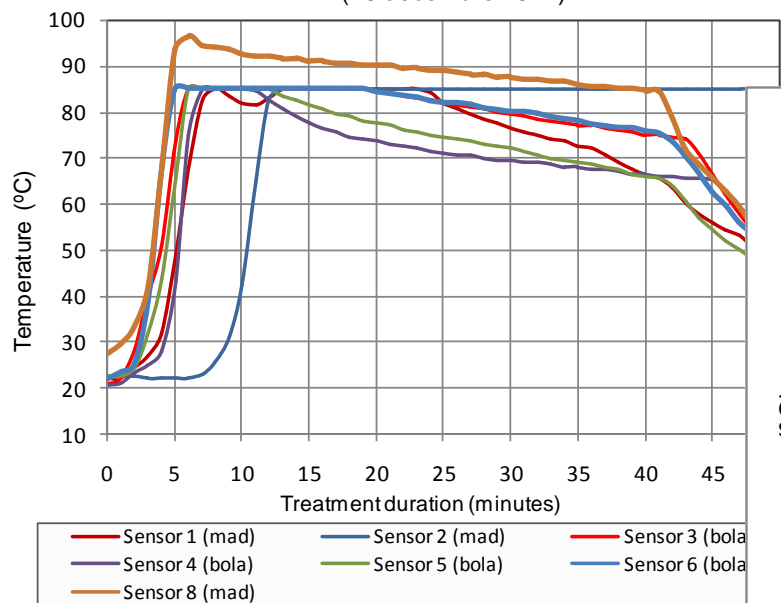
	sensor 5
Tempo (h:m:s) ≥ 56 °C	00:40:00
Temp. máx. (°C)	99.5



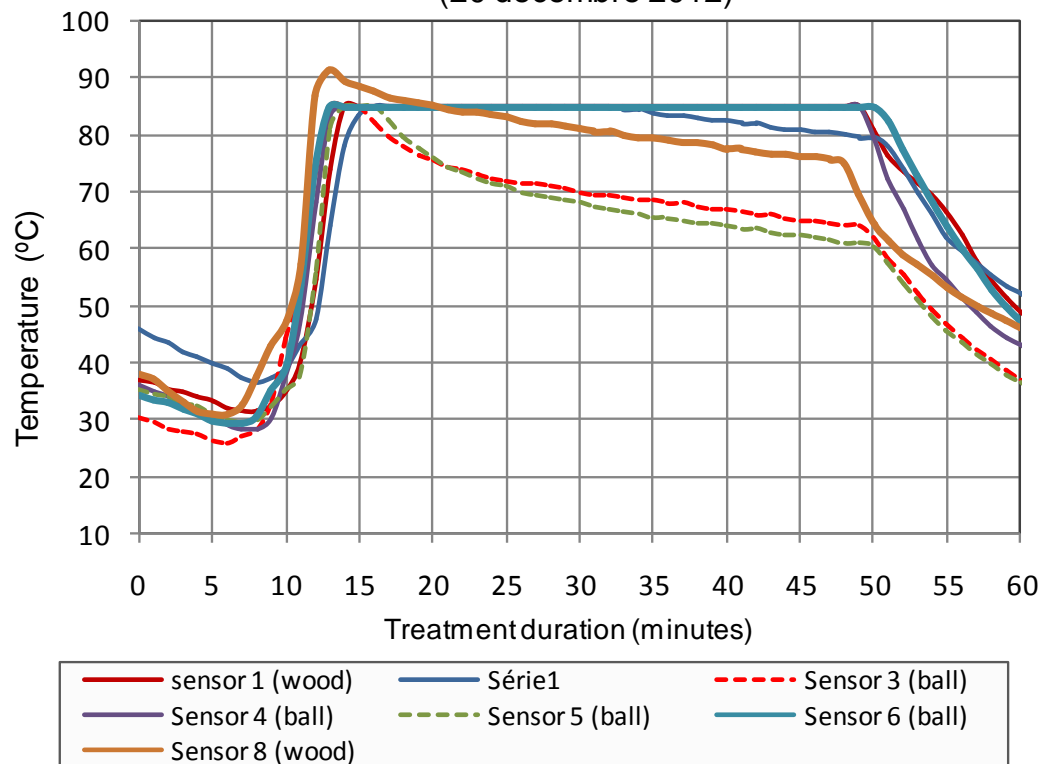
# Alfarroxo



Alfarroxo - Temperature profile (1° test)  
(20 decembre 2012)



Alfarroxo - Temperature profile (repetition)  
(20 decembre 2012)

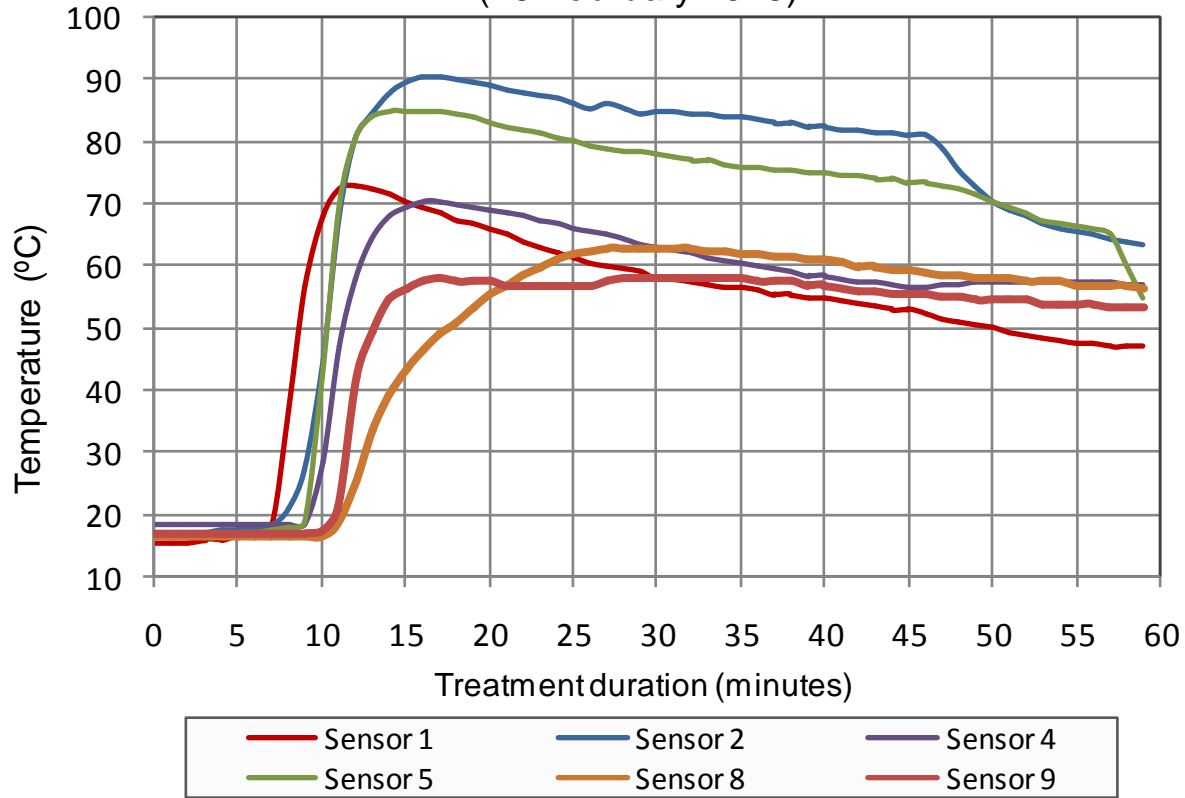


	sensor 1	sensor 2	sensor 3	sensor 4	sensor 5	sensor 6	sensor 7	sensor 8
Time (h:m:s) ≥ 64 °C	00:42:00	00:41:00	00:37:00	00:40:00	<u>00:27:00</u>	00:43:00	No reading	00:38:00
Max. Temp. (°C)	85.0	85.0	85.0	85.0	85.0	85.0	No reading	91.5

sensor 5	00:39:00
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Time (h:m:s) ≥ 56 °C	00:39:00
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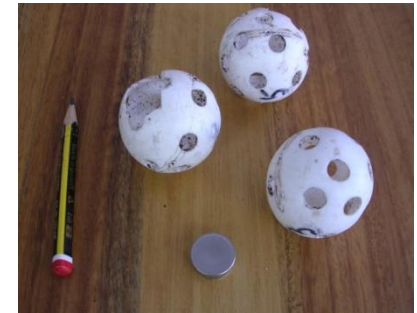
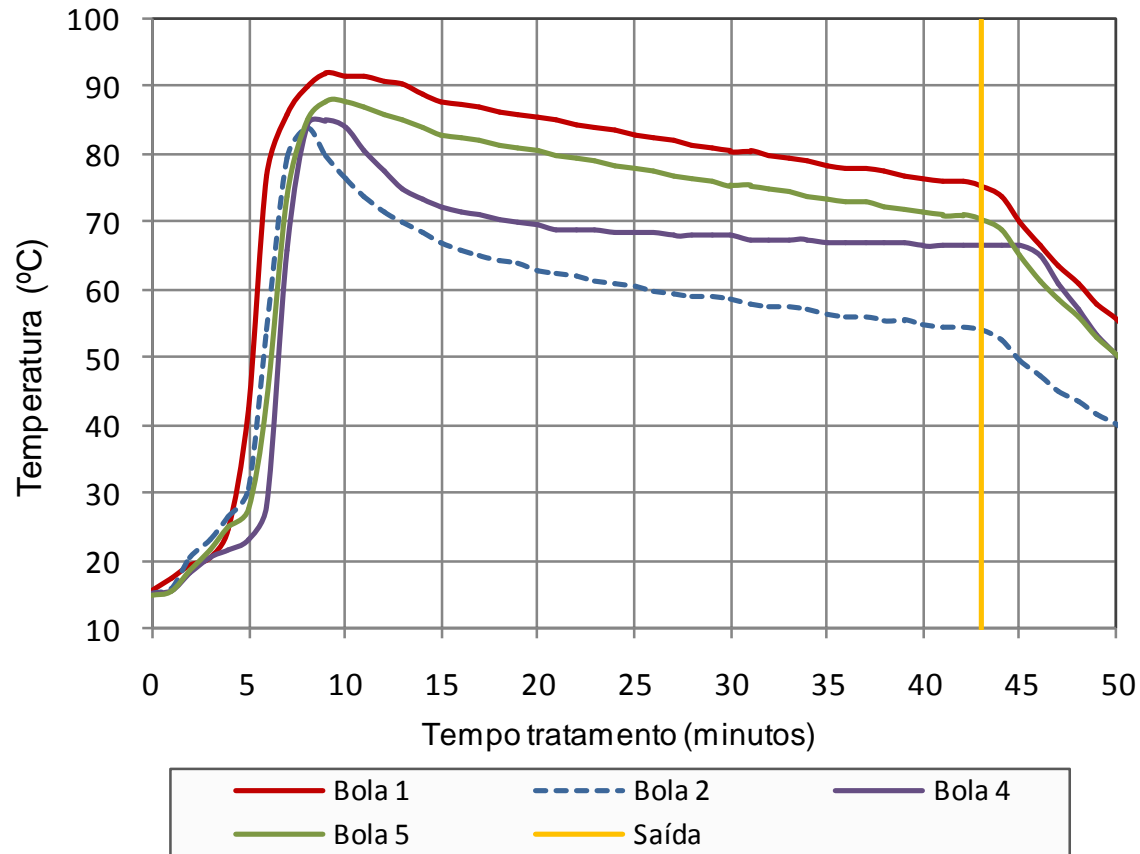
Alfarroxo - Temperature profile (inside bark begs)  
(15 February 2013)



ISPM 15						
	sensor 1	sensor 2	sensor 4	sensor 5	sensor 8	sensor 9
Time (h:m:s) $\geq 56$ °C	00:27:00	00:48:00	00:47:00	00:47:00	00:38:00	00:28:00
Temp. máx. (°C)	73	90.5	70.5	85	63	58

Other sensors didn't register or were lost

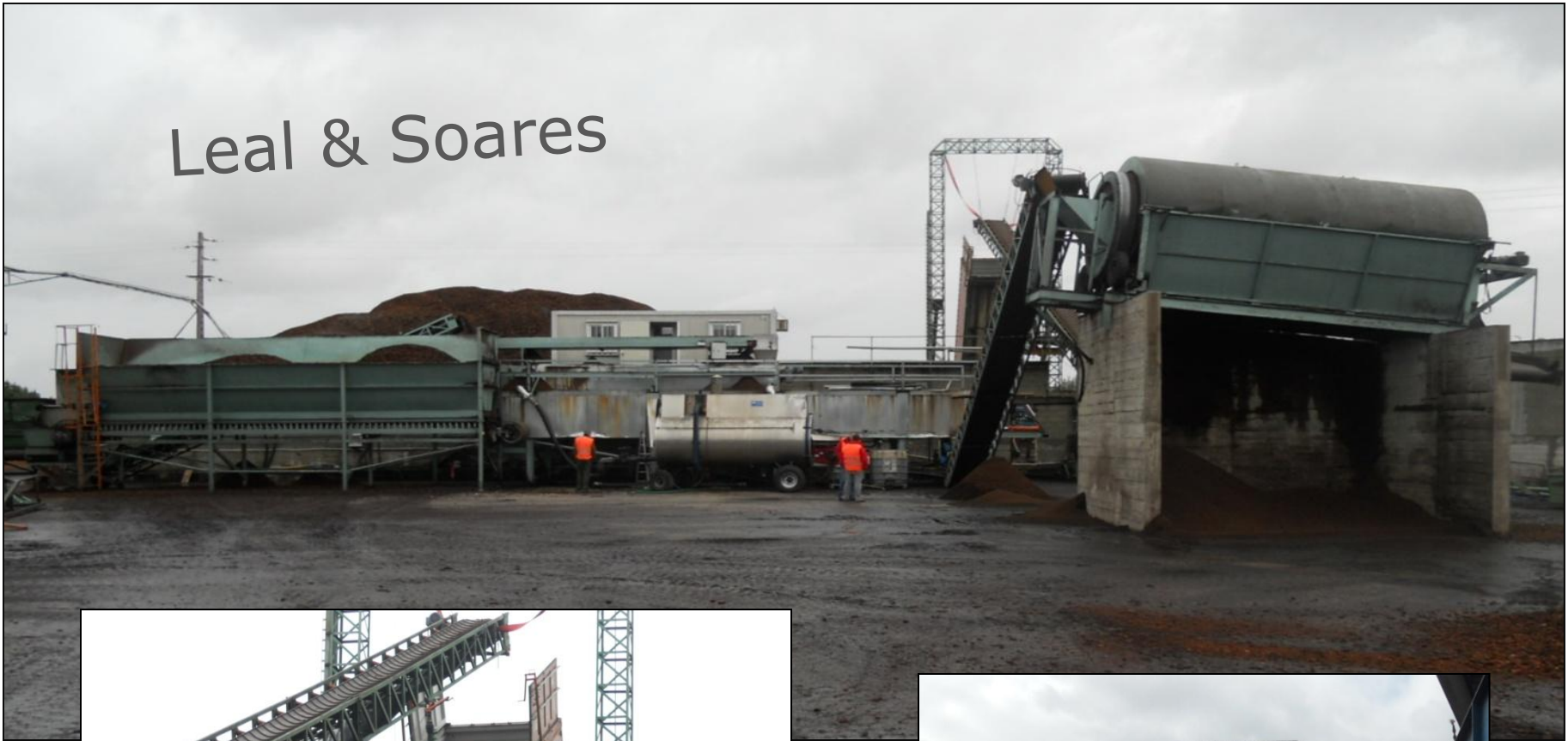
Alfarroxo - Temperatura tratamento (bolas ping-pong)  
(15 Fevereiro 2013)



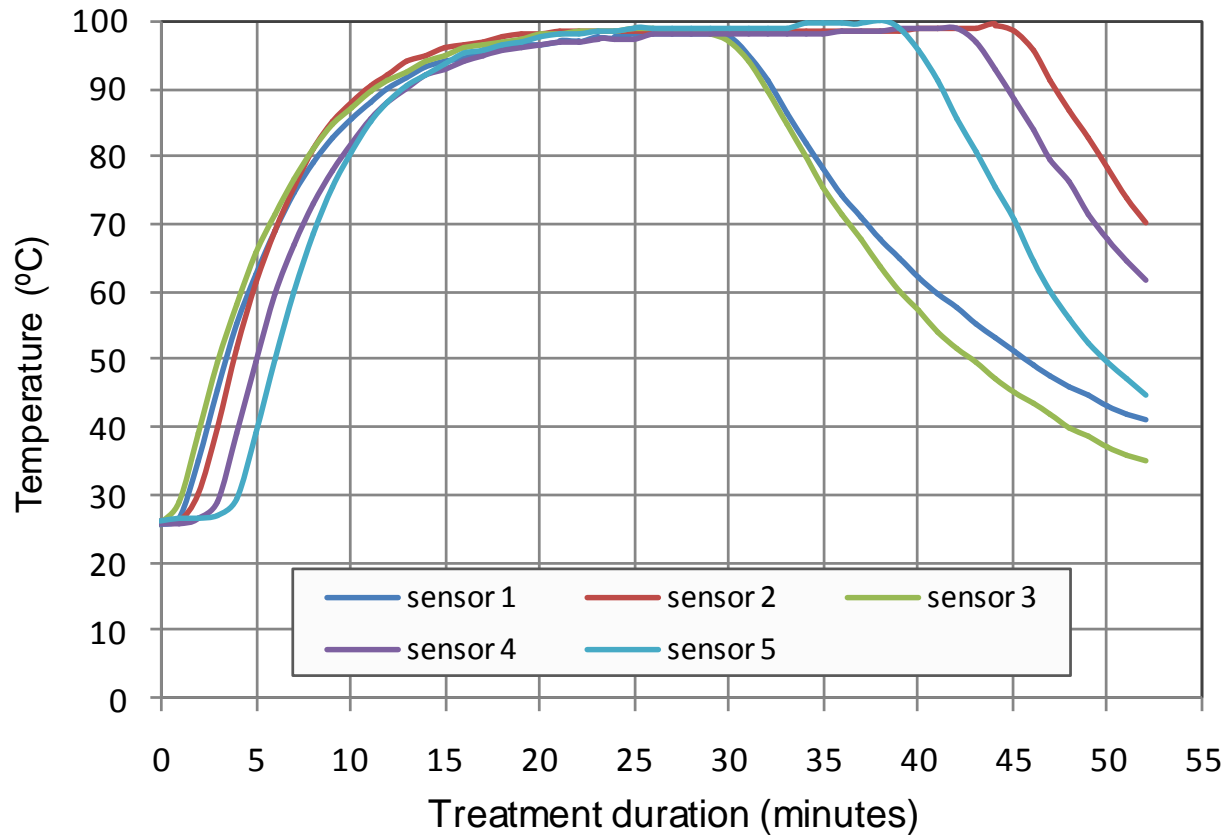
ISPM 15

Dentro da casca	sensor 1	sensor 2	sensor 4	sensor 5
Tempo (h:m:s) ≥ 56 °C	00:43:00	00:30:00	00:41:00	00:41:00
Temp. máx. (°C)	92.0	84.0	85.0	88.0

# Leal & Soares



## Continuous steam treatment of bark



	sensor 1	sensor 2	sensor 3	sensor 4	sensor 5
Time (min) $\geq$ 64 °C	33	47	32	44	38
Time (min) $\geq$ 56 °C	37	51	36	48	41
Max. temp. (°C)	98.0	99.5	98.9	98.9	100.0

Further improvements are being introduced  
as required, to enhance the security of treatments

Thanks for your attention

