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MODIFICATION OF WOOD WITH AN ANTI-OXIDANT TANNIN DERIVATIVE **- PRELIMINARY STUDY -**

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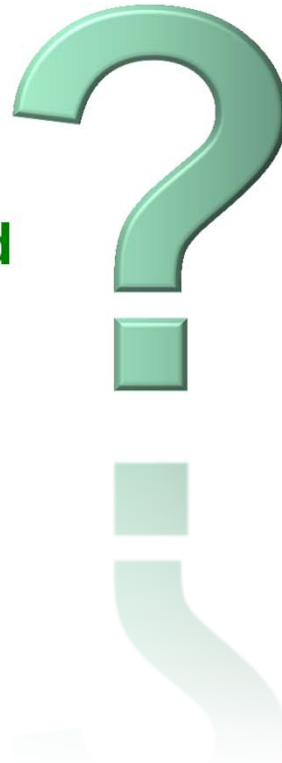
Aim

- Non-metal organic fungicide
 - *derivative from gallic acid contained in tannins of wood*



Reactivity with wood

Thermal stability



UV protection

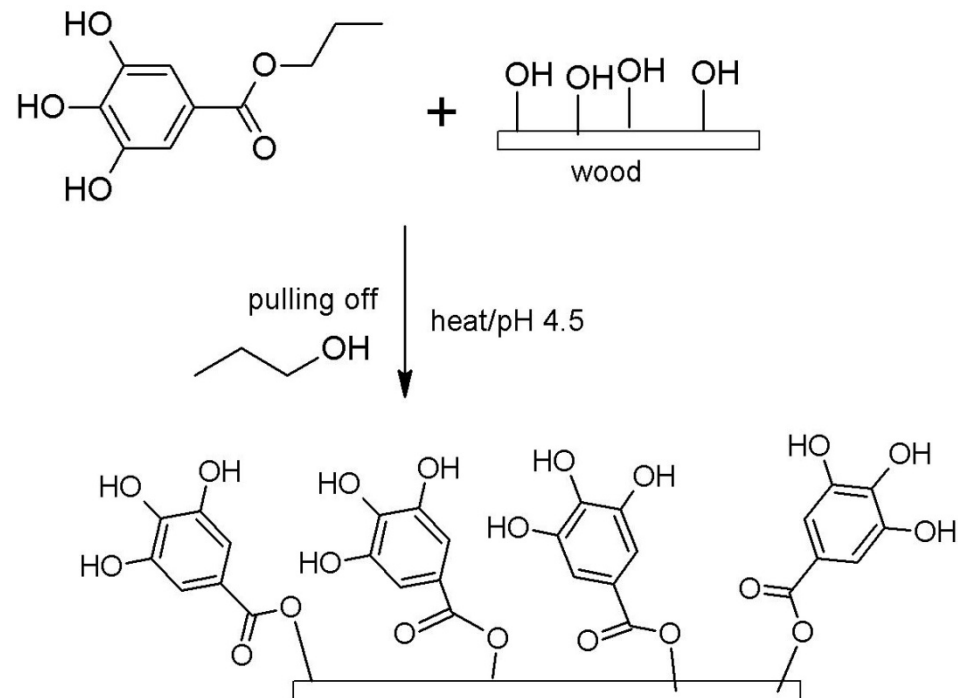
Water resistance



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Why propyl gallate?

- Natural product from wood
- Chelates trace metals that enzymes need to break down wood
- Radical scavenging ability
- Theoretically can be covalently attached to wood by transesterification reaction:



Wood Modification Procedure

Scots pine: veneers (1x10x100) blocks (15 x 25 x 50)

Impregnation solutions with 1:1 methanol:water

- propyl gallate 10 wt%
- Arquad (quarternary ammonium fungicide) 0.1 wt%
- propyl gallate 10 wt% + Arquad 0.1 wt%
- reference

- Vacuum Pressure impregnation (2 h, 10 bars)

- Post treatment

Oven dried
120°C

*Difference
in
reactivity?*

Vacuum dried
50°C

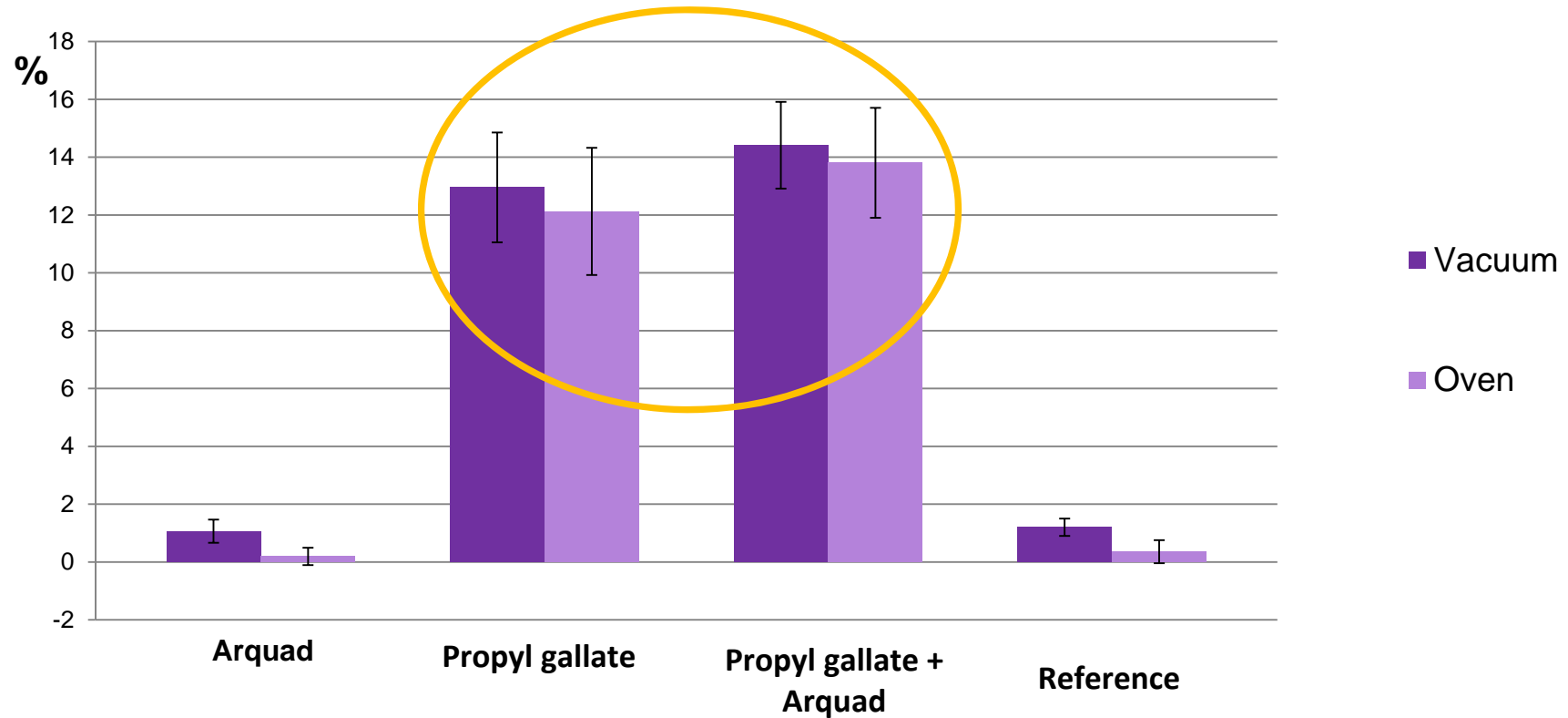


Characterization Outline

- Wood Property modification
 - Additive WPG */blocks*
 - Water uptake */blocks*
- Chemical reactivity
 - FT-IR (Fourier-Transform Infrared spectroscopy) */veneers*
 - Leaching studies (EN-84) */blocks*
- Thermal characterization
 - DSC (dynamic scanning calorimetry) crystallinity, melt T */veneers*
 - TGA (thermal gravimetric analysis) degradation T, volatiles in the sample */veneers*
- UV light resistance
 - QUV and colour measurements */veneers*



Weight percent gain after impregnation

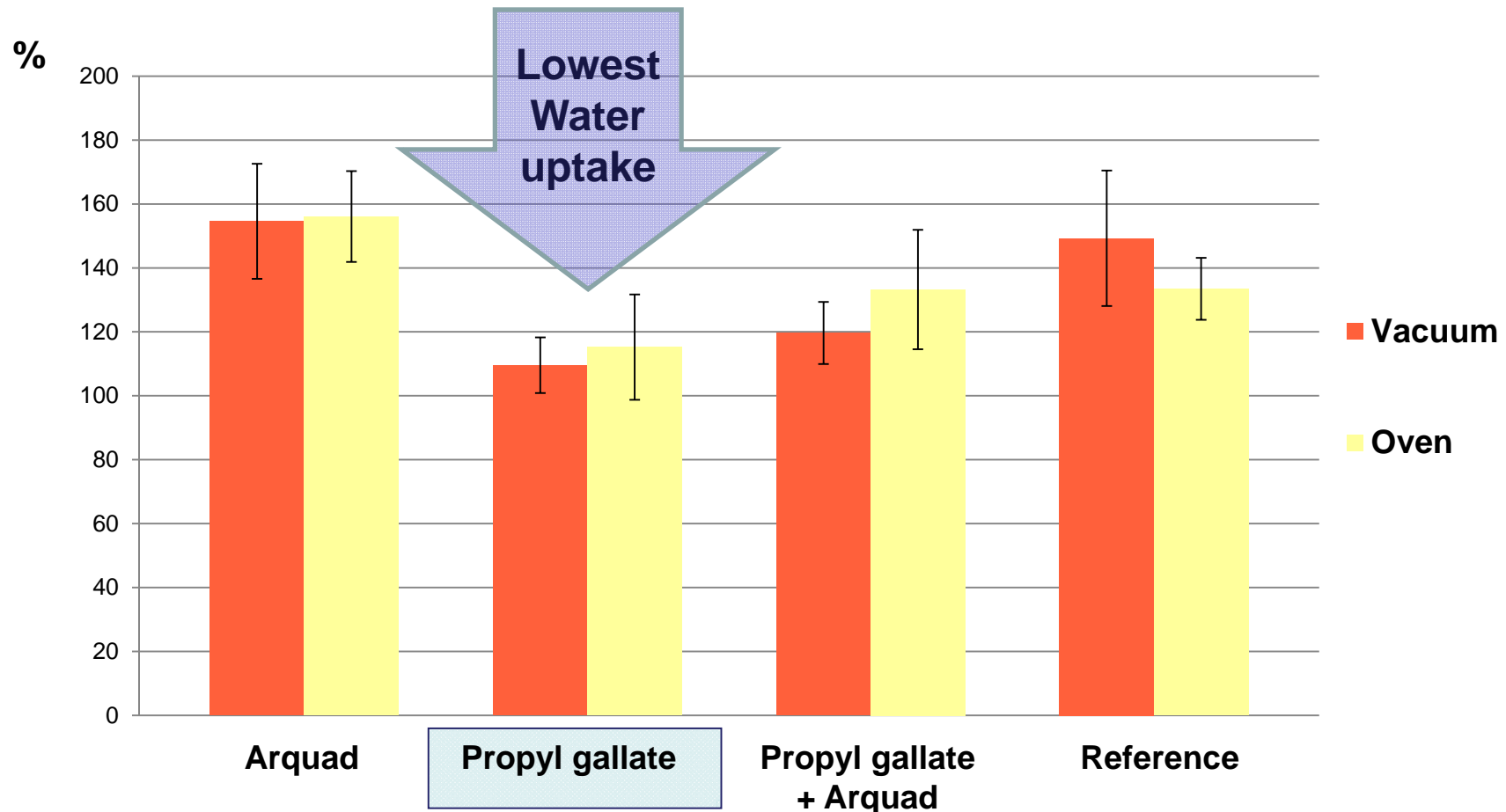


Propyl gallate treated wood:
highest weight percent gain 12-14%

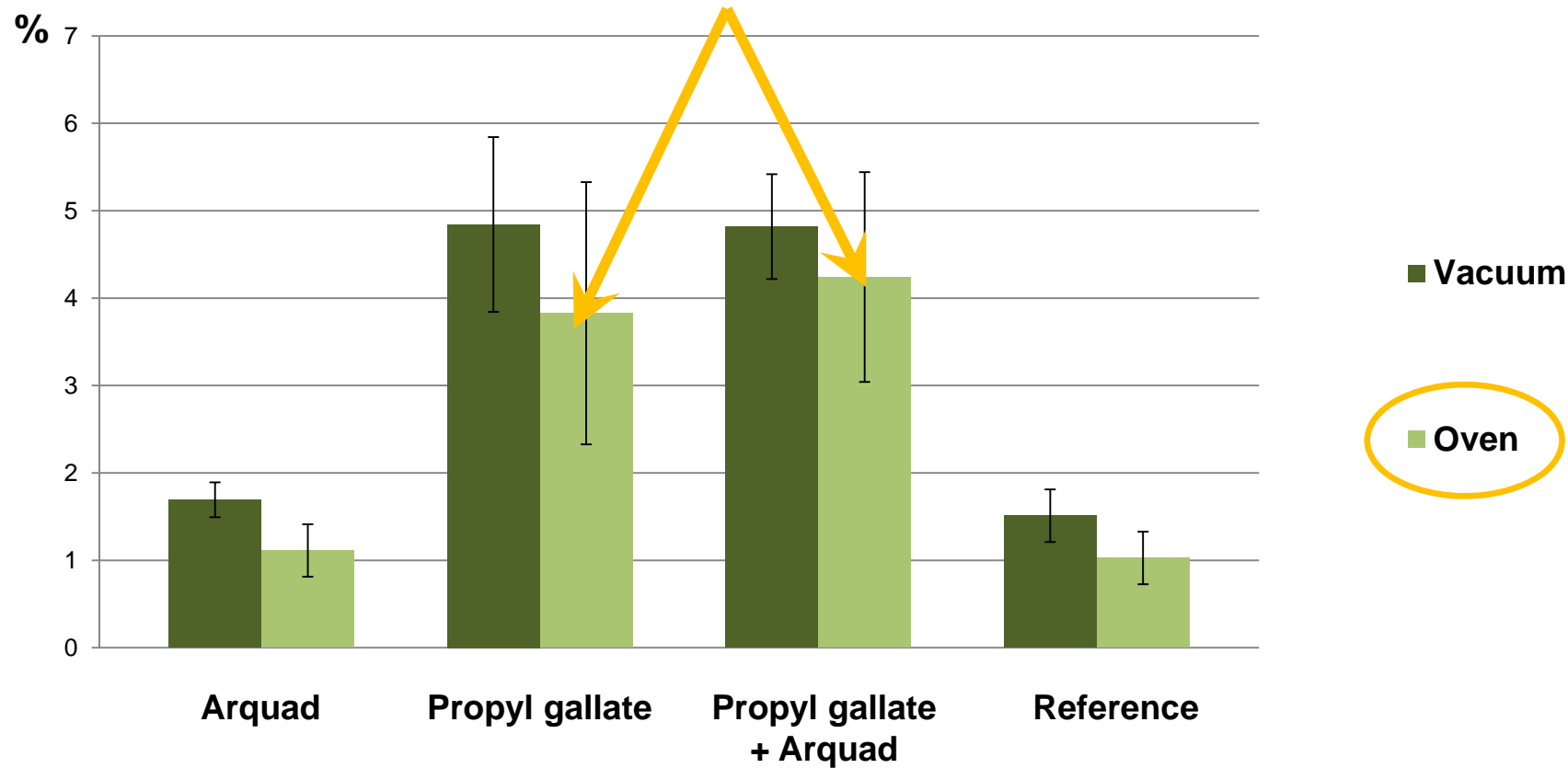


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Water uptake after 14 days submersion in water



Weight decrease after submersion in water (14 days) and drying in oven

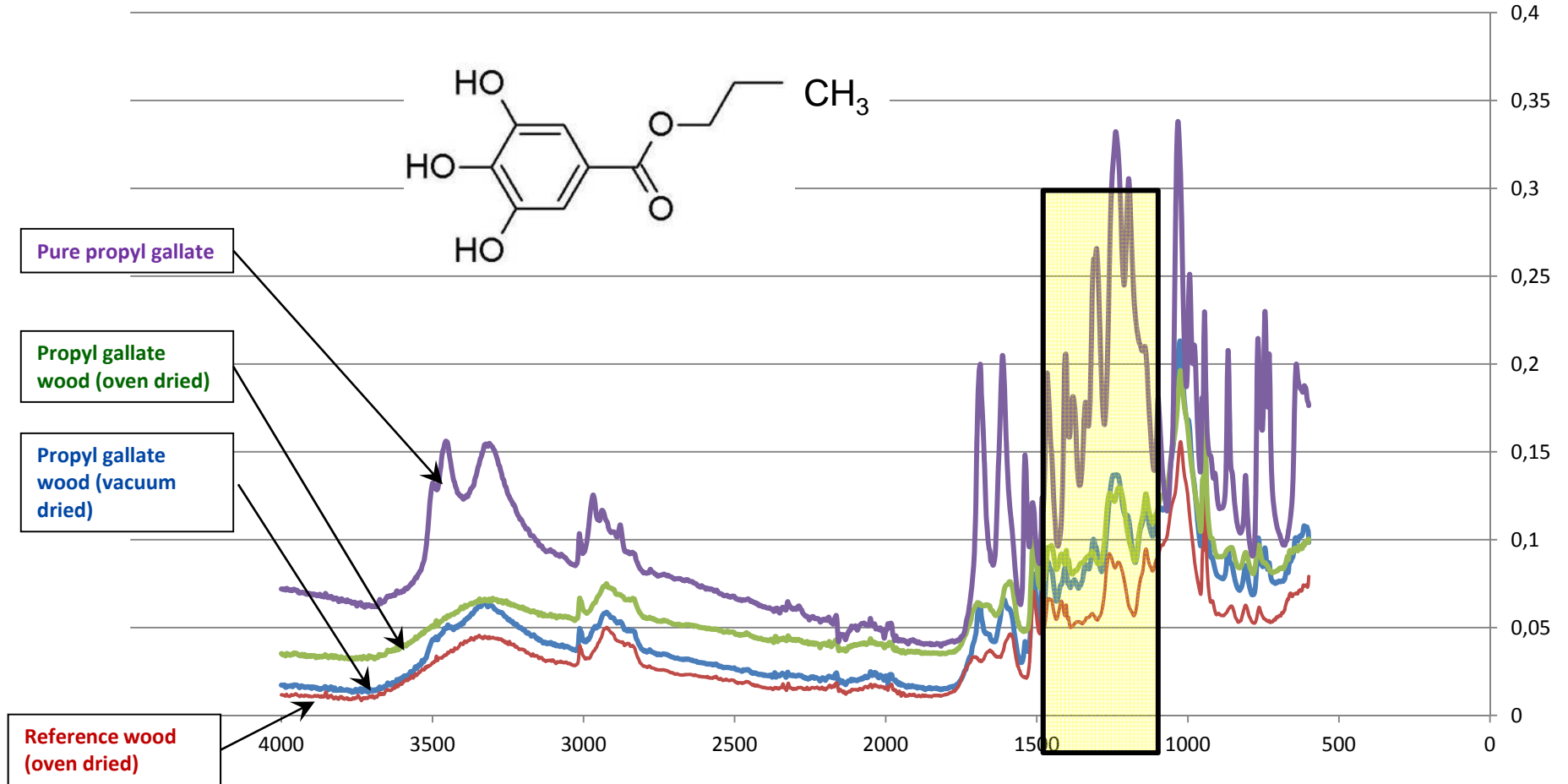


~ 70% of chemical is left



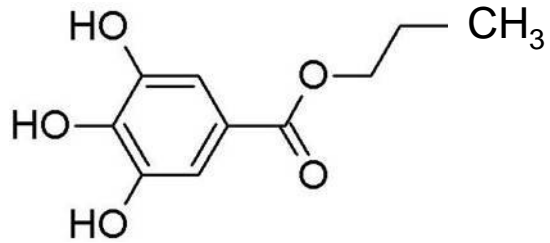
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FT-IR (Fourier-Transform Infrared spectroscopy)



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FT-IR



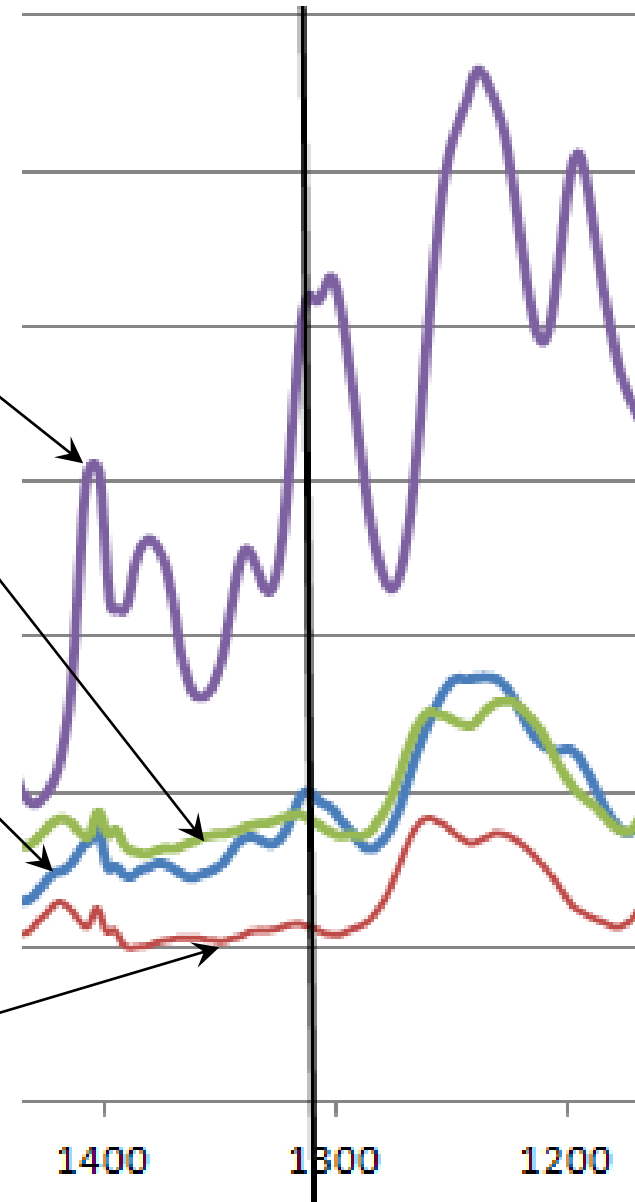
Disappearance of CH₃ on propyl gallate treated wood with oven treatment => reaction with wood

Pure propyl gallate

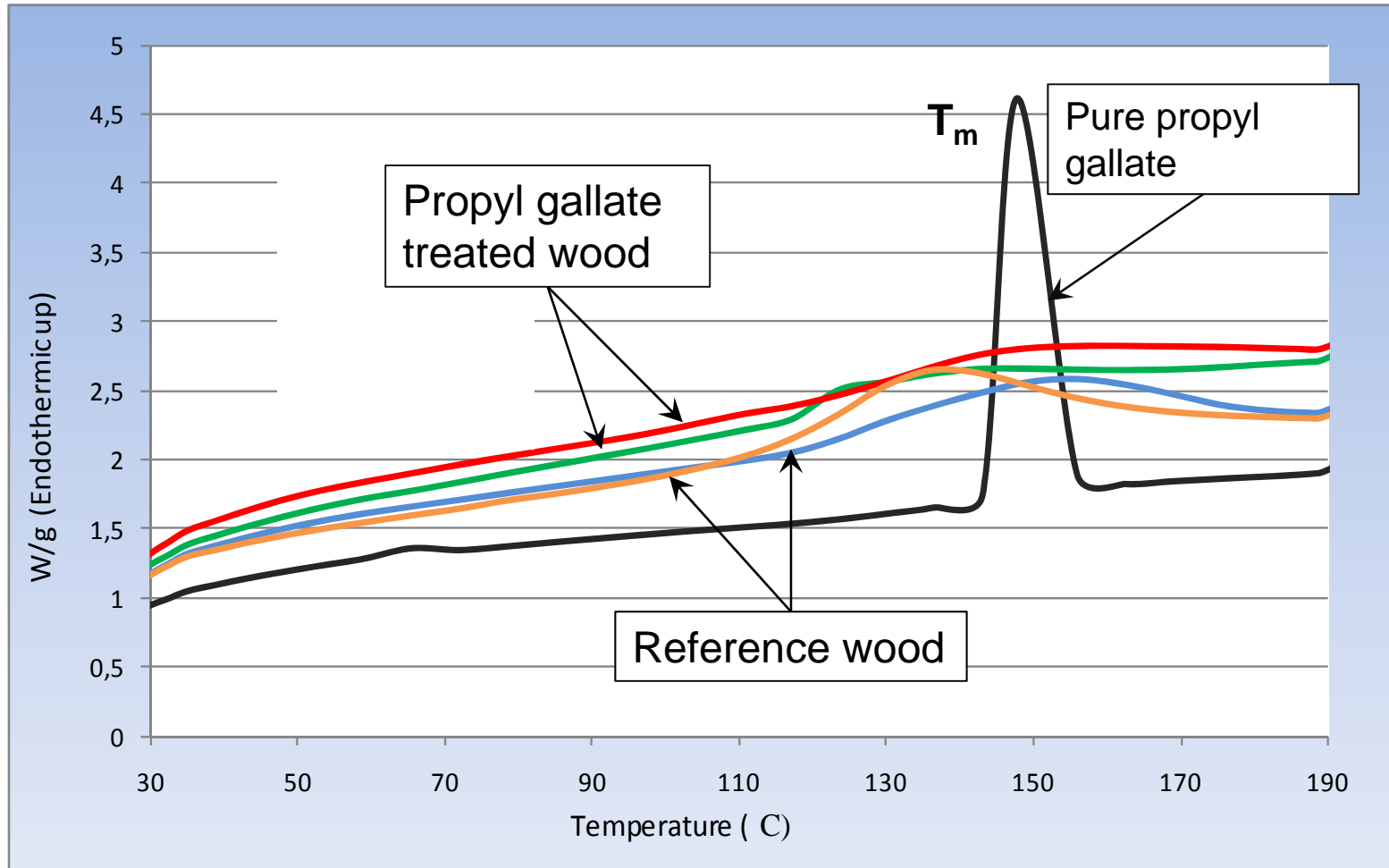
Propyl gallate wood (oven dried)

Propyl gallate wood (vacuum dried)

Reference wood (oven dried)



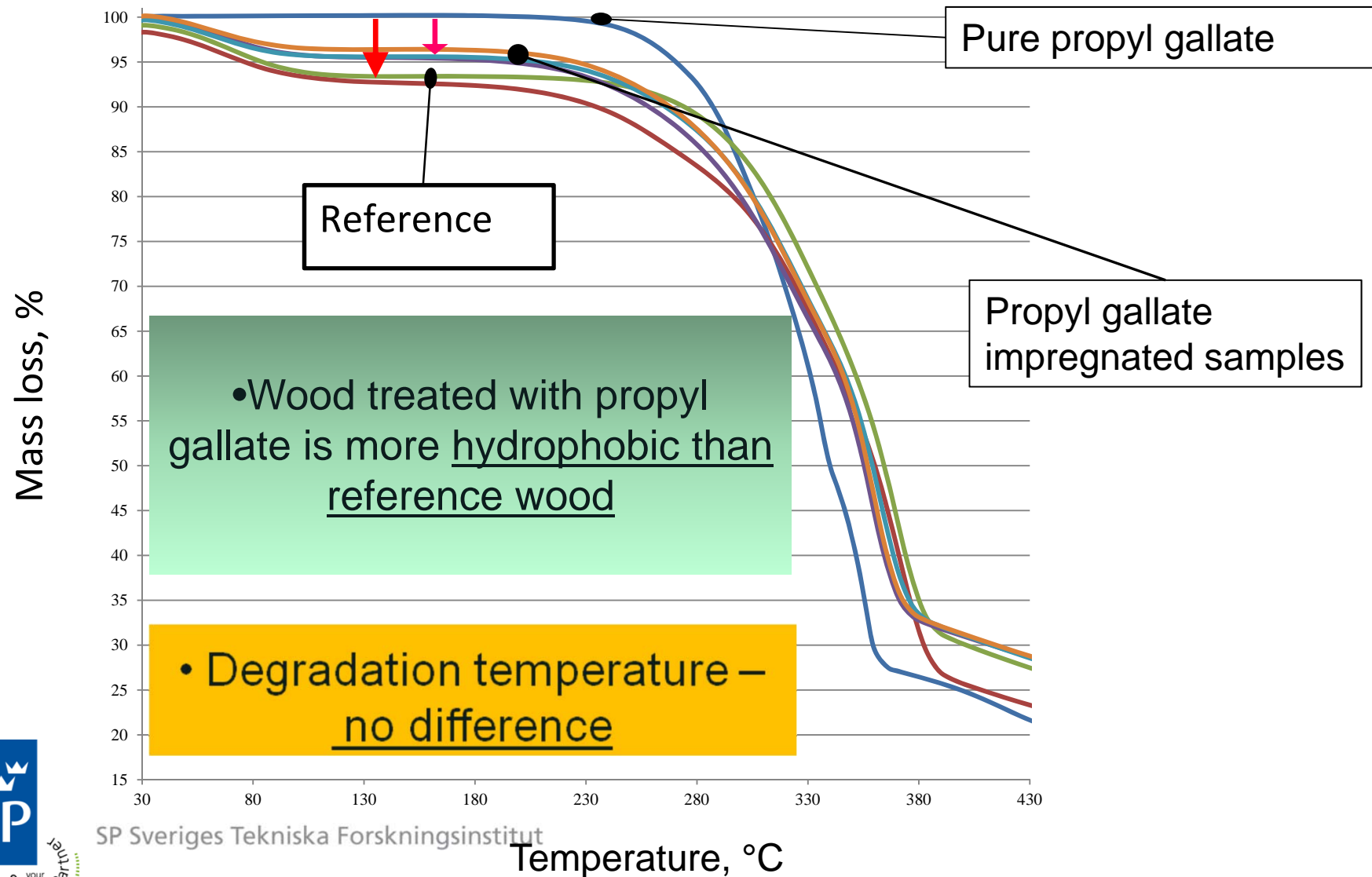
DSC (dynamic scanning calorimetry)



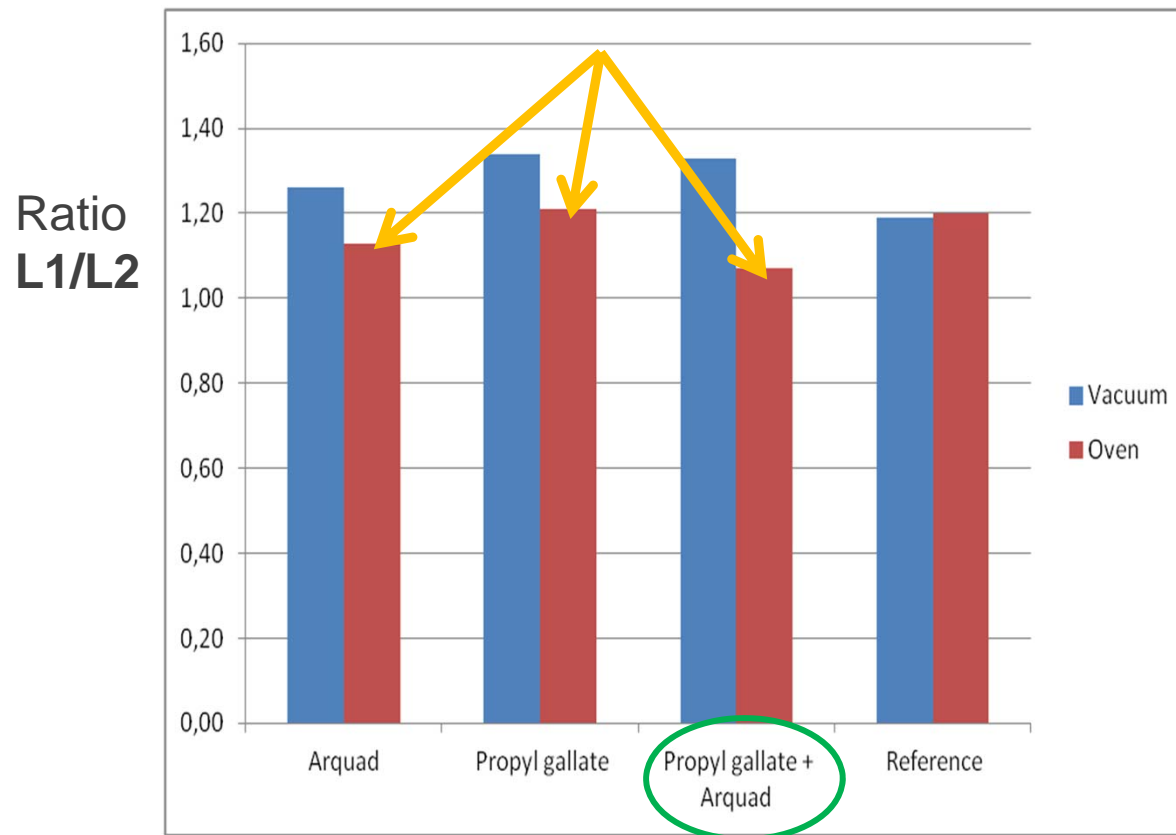
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No crystalline gallate in treated wood =>
Propyl gallate interacting with wood

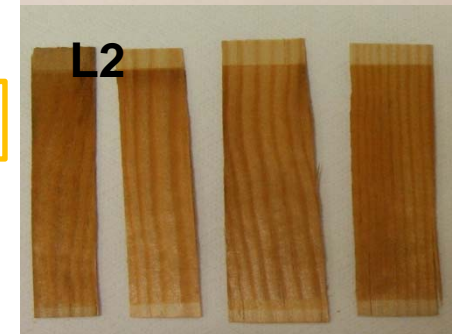
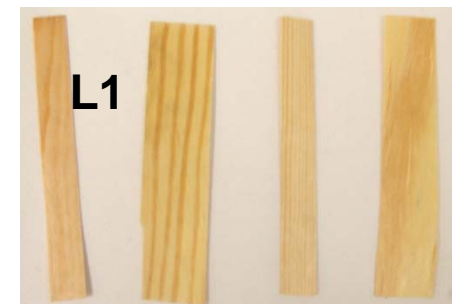
TGA (thermal gravimetric analysis)



UV exposure 3 weeks + colour measurements: How much darker wood became?



L
lightness



Oven treated – better UV protection

Propyl gallate+Arquad: Slightly better UV protection

Conclusions

- **Reactivity of propyl gallate with wood:** Yes, after oven treatment (leaching studies, FTIR)
- **Water resistance:** Propyl gallate treated wood – more hydrophobic (water absorption and TGA studies)
- **Thermal stability:** no significant improvement (TGA)
- **UV protection:** Slightly better when oven-treated (QUV)



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Thank you!