Evaluation of Furfural/Urea complexes to improve properties of commercial birch wood (*Betula pendula*)

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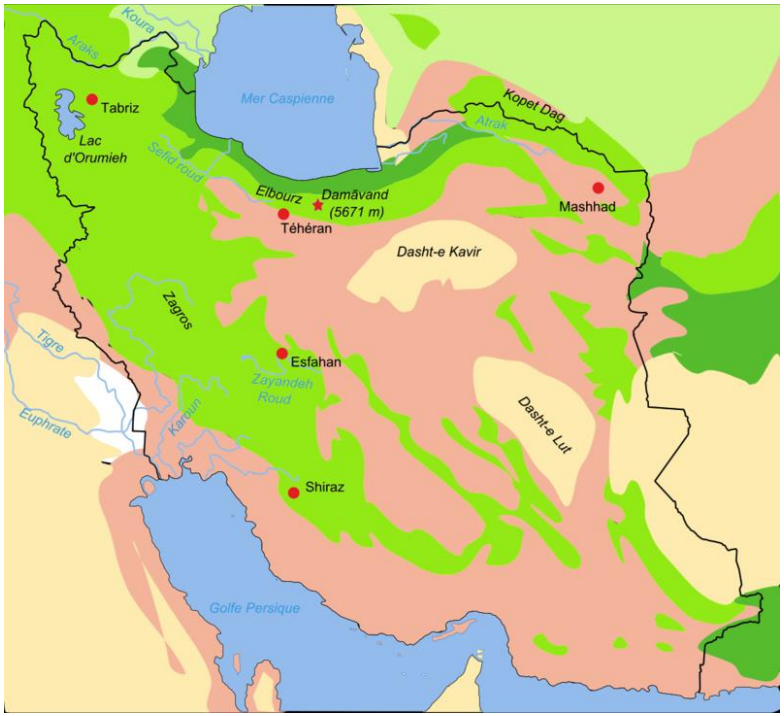
LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

Biomass Wood Energy Bioproducts

iufro2019 Curitiba · Brazil

The context



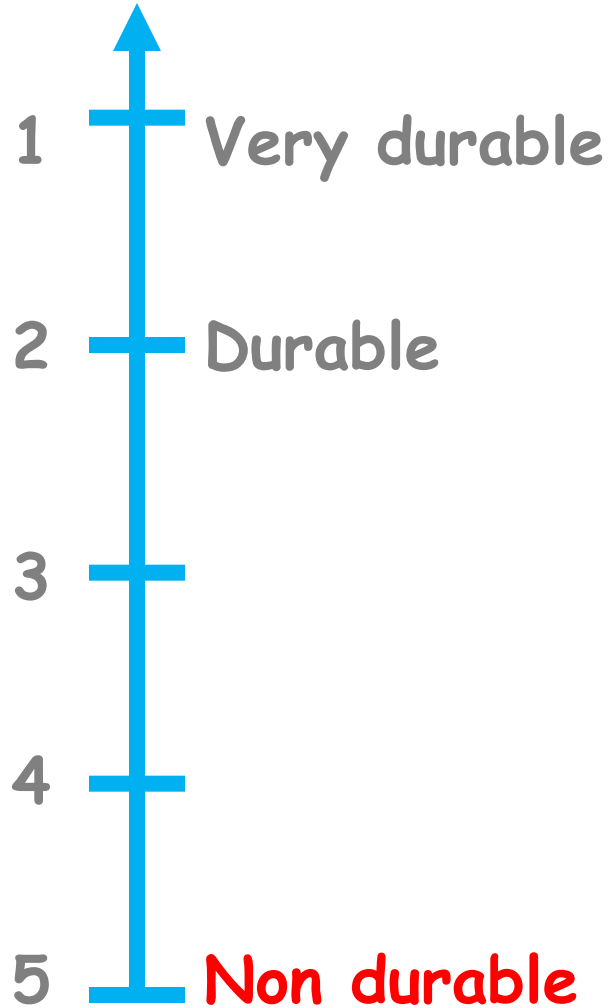
Iran

Native Beech (*Fagus orientalis*)

Wood Shortage

Birch (*Betula* sp.) from Russia on the market

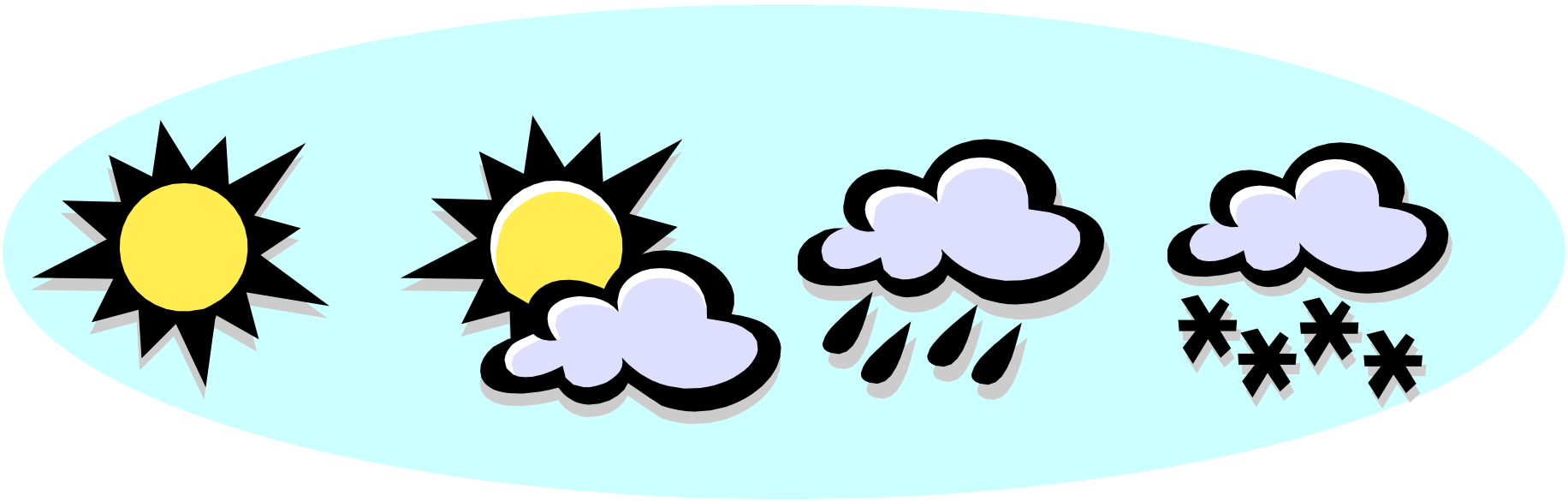
Birch Durability



Fungi

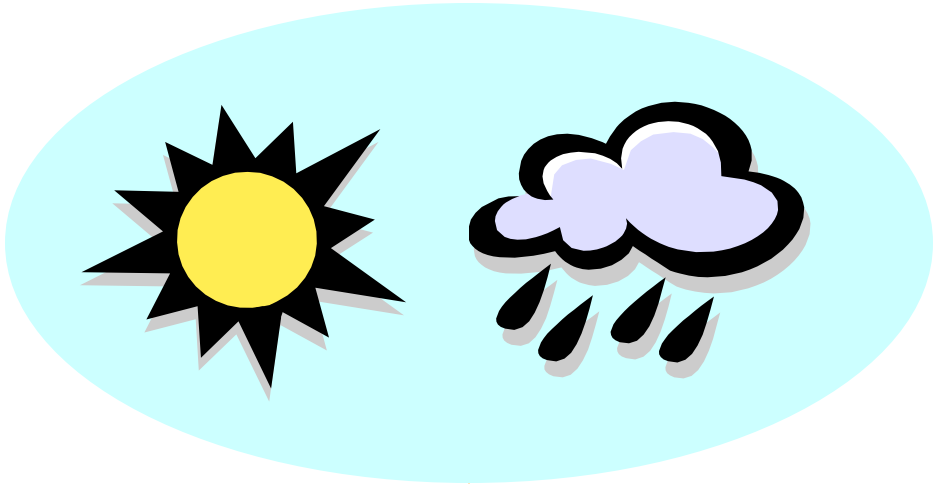
Termites

Wood in service

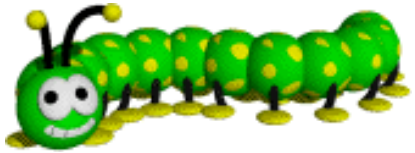


- Temperature
- Humidity
- Light

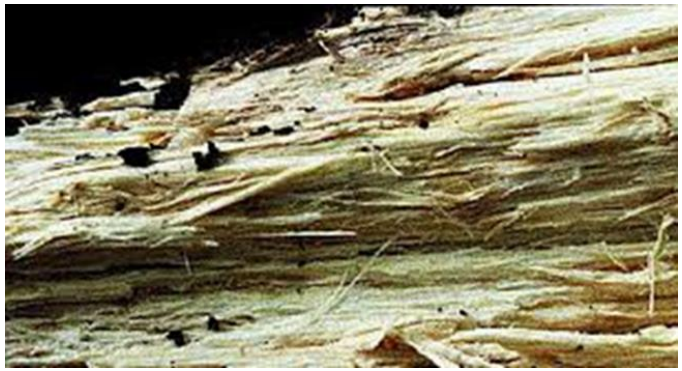
Use class



Wood in service



Degradations



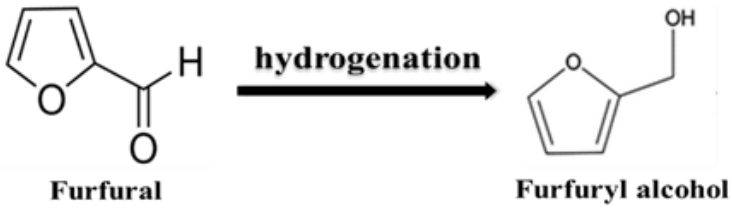
Wood Treatment

Wood Protection sector under scrutiny in EU

Wood chemical modification is an alternative

Iran : Large amount of waste sugar cane bagasse

Production of Furfural – Furfuryl alcohol



Furfural Furfuryl alcohol

Wood modification

Parameters

Birch logs – Wood samples

Wood treatment

Different sample sizes

Different combinations

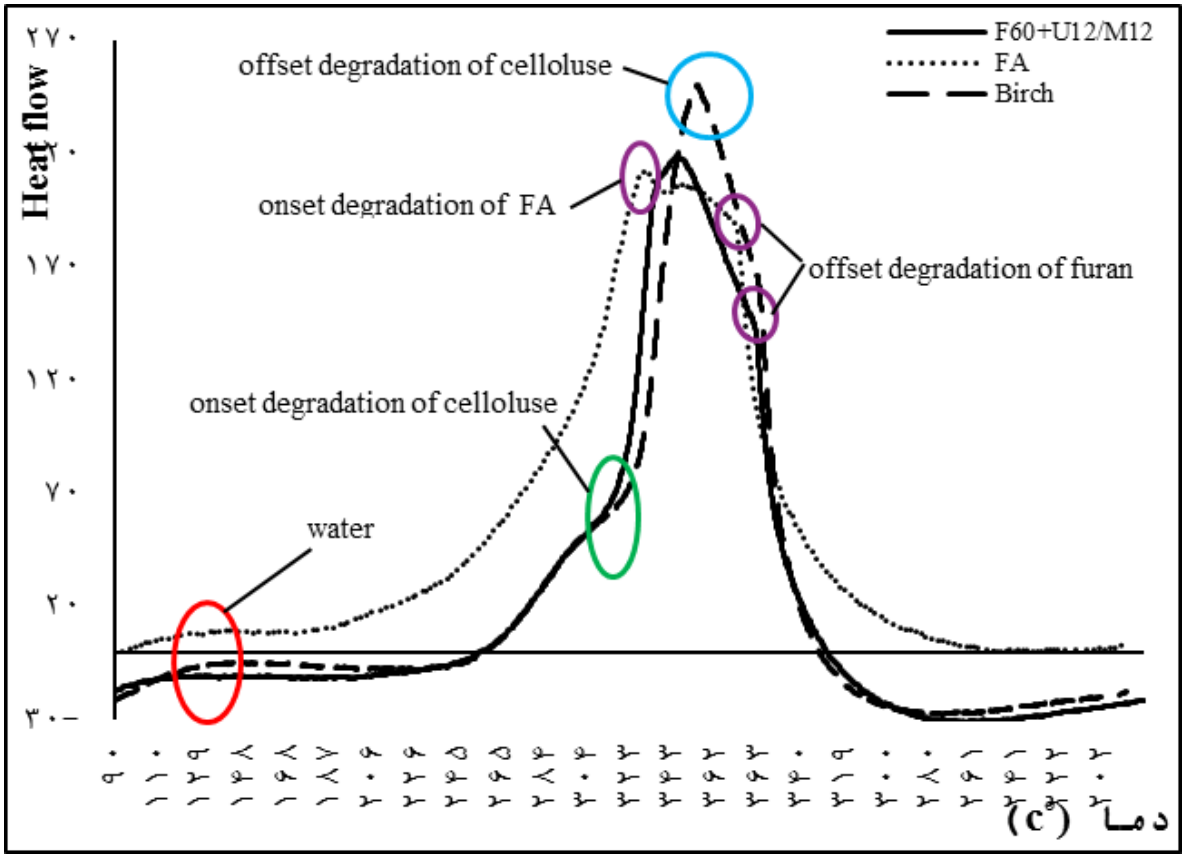
No.	Treatment	Code
1	Control	C
2	Furfural 20% + Urea 10% + Maleic Anhydride 10%	$F_{20}+U_{10}/M_{10}$
3	Furfural 40% + Urea 12% + Maleic Anhydride 12%	$F_{40}+U_{12}/M_{12}$
4	Furfural 60% + Urea 12% + Maleic Anhydride 12%	$F_{60}+U_{12}/M_{12}$
5	Furfural 70% + Urea 15% + Maleic Anhydride 15%	$F_{70}+U_{15}/M_{15}$

Vaccuum/pressure

50°C – 12 hrs → 70°C – 24 hrs → 103°C

In situ reaction - polymerization

Differential scanning calorimetry (DSC)



Treatment and Properties

Anti Swelling Efficiency – 336 hrs in water

Treatment	WPG	ASE
C	-----	-----
F20+U10/M10	27.29 ± 3.53	17.44
F40+U12/M12	37.35 ± 4.56	17.45
F60+U12/M12	43.48 ± 5.81	29.69
F70+U15/M15	57.65 ± 8.57	41.62

Treatment	WPG	MOE
C	-----	15556±1982
F20+U10/M10	27.29 ± 3.53	18258.3±2215
F40+U12/M12	37.35 ± 4.56	18018±2223.9
F60+U12/M12	43.48 ± 5.81	18430±1777.5
F70+U15/M15	57.65 ± 8.57	

Modulus of Elasticity

Fungal tests EN113

Birch

Trametes versicolor

White rot

Treated / Unleached & Leached

Beech control : Mass Loss > 30%

Untreated Birch : Mass Loss > 30%

Modified Birch : Mass Loss < 5%

Any treatment – Unleached & Leached

Controls in the flask : Mass Loss > 20%

Termite tests EN117

Birch /Treated / Unleached & Leached

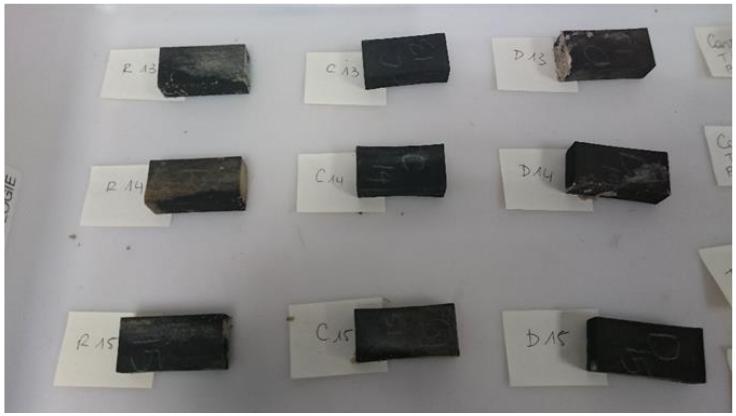
Reticulitermes flavipes

Controls : Rating 4 – Degradation +++

Treated : Any treatment

All termites dead after 8 weeks

Rating 1 max (nibbling)



Great but….

Birch easily treated / Effective wood modification

Different sample sizes / Different combinations

Improved dimensional stability and biological resistance

But…

Better like dark wood !

Cracks and collapse

Outdoor weathering in progress

Gundishapur Project n°40916 NJ
Henri Curien Partnership
France / Iran
MEAE – MESRI / CISSC