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Biological resistance of Innovative particleboards made of chemically modified sugarcane bagasse

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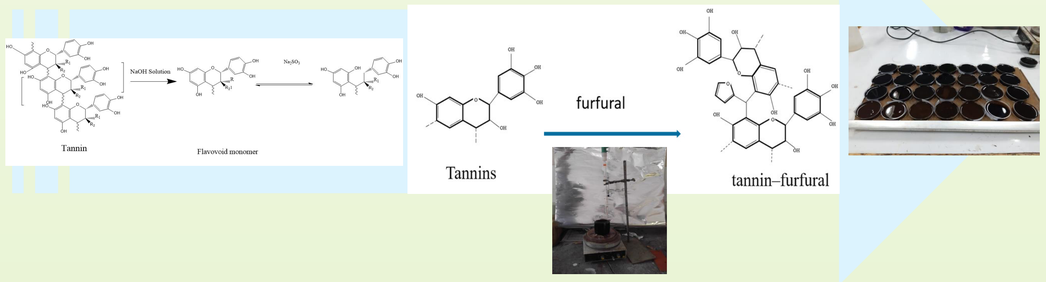
Context and Objectives

Wood-based composites are suggested as viable substitutes for solid wood, offering increased dimensional stability and homogeneity. In Iran, the "Forest breathing plan" has led to a shortage of wood for particleboard production, prompting the investigation of alternatives, with waste sugarcane bagasse emerging as a sustainable option. However, bagasse-based composites face challenges related to their low natural durability and high moisture absorption, especially when used in wet conditions. The solution proposed is furfurylation, an environmentally friendly method, to impregnate bagasse particles with suitable tannin-furfural resins and produce environmentally friendly bagasse particleboards. This research involves the impregnation of sugarcane bagasse with tannin-furfural resins, the particle boards production and the evaluation of the biological resistance of such produced particleboards.

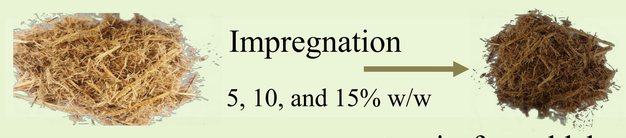
Materials & Methods

The synthesis of tannin furfural (TFu) resin for bagasse treatment is detailed in Ahmadi et al. (2022)

★ Pre-treatment of tannin and furfural for tannin-furfural resins production



★ Bagasse impregnation with 5, 10, and 15% w/w tannin/furfural resins



★ Treated bagasse gluing

tannin-formaldehyde (TF)
tannin-formaldehyde modified by furfural (TFFu)
tannin hexamine (TH)
melamine-urea-formaldehyde (MUF)

Particleboards

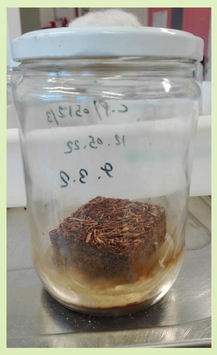
★ Addition of Boric Acid (BA) in the glue for some panels (anti-fungal & anti-termite product)

★ Durability evaluation towards fungi and termites

Decay tests were performed strictly according to EN113-3 (2023)

Coniophora puteana
(brown rot)
16 weeks
at 22°C, 70% RH

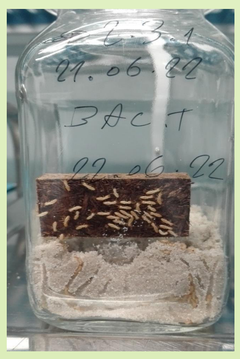
Mass loss evaluation



Termite non-choice tests were performed strictly according to EN117 (2013)

Reticulitermes flavipes
8 weeks
at 27°C, 75% RH

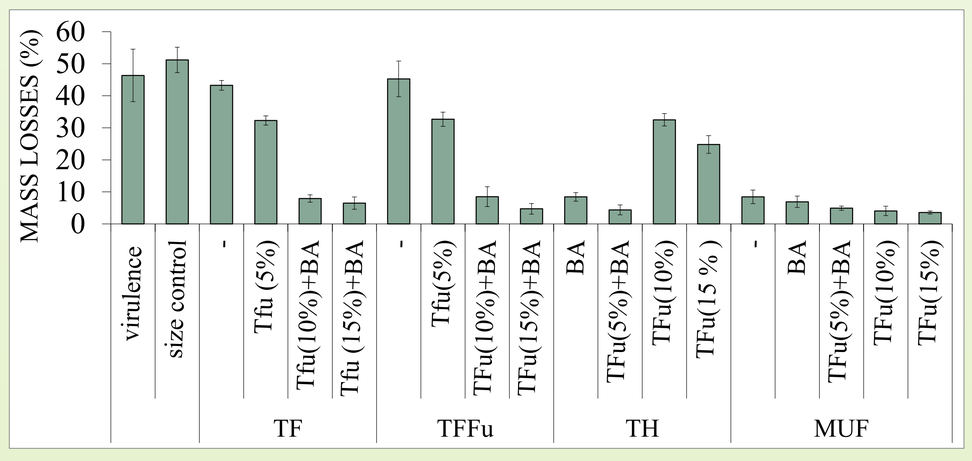
Visual rating
of the samples
Survival rate
of the termites



Results & Discussion

★ Impregnating bagasse particles with tannin-furfural resins enhances particleboard biological resistance & adding boric acid significantly improves biological resistance.

FUNGAL TESTS



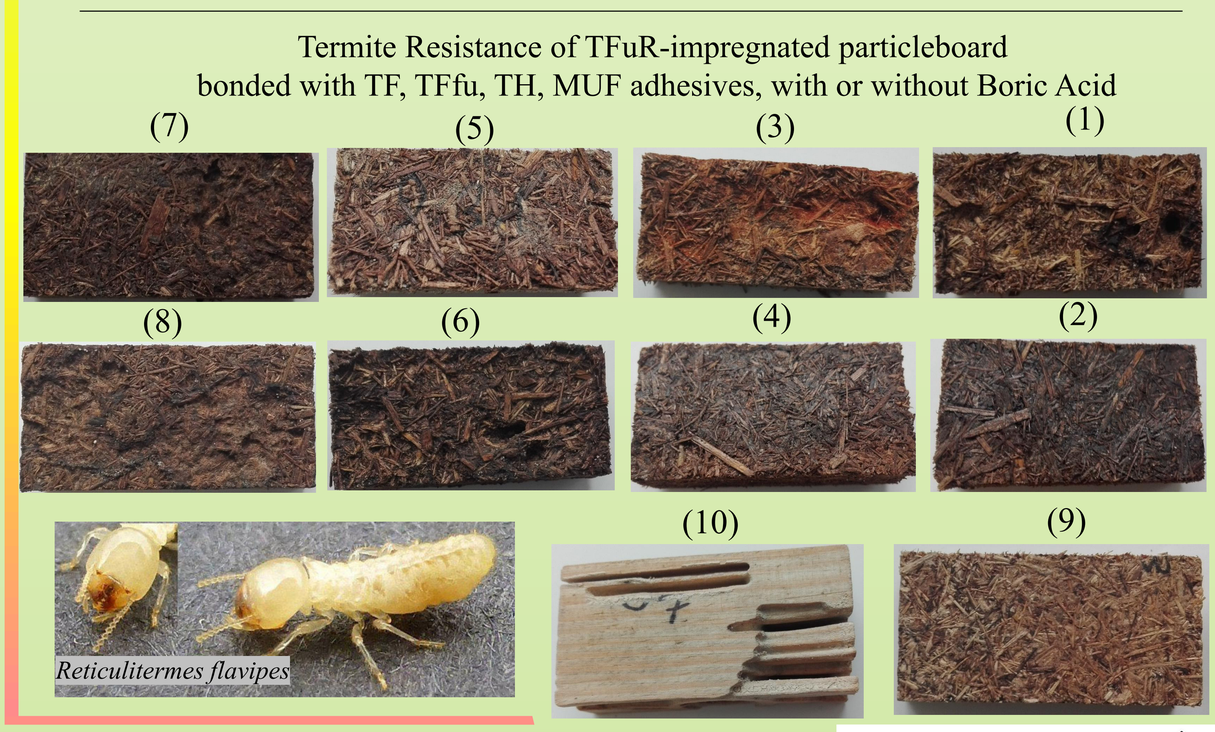
Mean values of mass loss of the particleboard exposed to *Coniophora puteana*

TERMITE TESTS

Adhesive Type	Impregnation Resin (%)	BA (0.5 %)	Termite Survival rate (%)	Visual Rating (*)	Sample distribution for the visual rating classes (%) 0	1	4	Photo N°
TF	-	-	51	4			100	
	Tfu (5%)	-	25	4			100	1
	Tfu(10%)	+	0	0-1	70	30		
	Tfu (15%)	+	0	0-1	80	20		2
TFFu	-	-	23	4			100	
	Tfu(5%)	-	21	4			100	3
	TFu(10%)	+	0	0-1	75	25		
	TFu(15%)	+	0	0-1	70	30		4
TH	-	+	0	0	100			5
	TFu(5%)	+	7	4			100	
	TFu(10%)	-	29	4			100	
	TFu(15%)	-	26	4			100	6
MUF	-	-	15	4			100	
	-	+	0	0-1	60	40		9
	TFu(5%)	+	0	4			100	7
	TFu(10%)	-	5	4			100	
	TFu(15%)	-	5	4			100	8
Virulence control			56	4			100	10

(*) Rating of wood according to EN 117 (2013)
0 = No attack, No destruction - 1= Attempt to attack - 4 = Strong attack

Termite Resistance of TFuR-impregnated particleboard bonded with TF, TFfu, TH, MUF adhesives, with or without Boric Acid



Conclusion

This approach using tannin-furfural resin treatment shows promise in improving both biological and physical properties, making bagasse-based particleboards potential solutions for addressing wood shortages in composite production in Iran.

Acknowledgements

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References

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