LIGNI COAT

Sustainable coatings based on lignin resins and bio-additives with improved fire, corrosion and biological resistance

CLEAR FIRE-RETARDANT LIGNIN-BASED BIOCOATINGS

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Introduction

Lignin is an **organic natural raw material** derived primarily from the pulp and paper industry as a **byproduct**.

Being an **attractive feedstock for the industry** due to its abundance and low cost, lignin is used in the LIGNICOAT project.

The LIGNICOAT project aims to **increase the biobased content of PU water-borne coatings**, replacing fossil-based standard binders with newly developed bio-resins.

This innovative approach holds the promise of developing **clear fire-retardant (FR) water-borne biocoatings** that not only meet stringent fire performance requirements but also adhere to principles of environmental sustainability.

Materials and Methods

Materials:
The development of biocoatings includes:
- **Bio-PUD resins**, synthesized from lignin polyols *.
- **Phosphorous-based** flame-retardant additives.

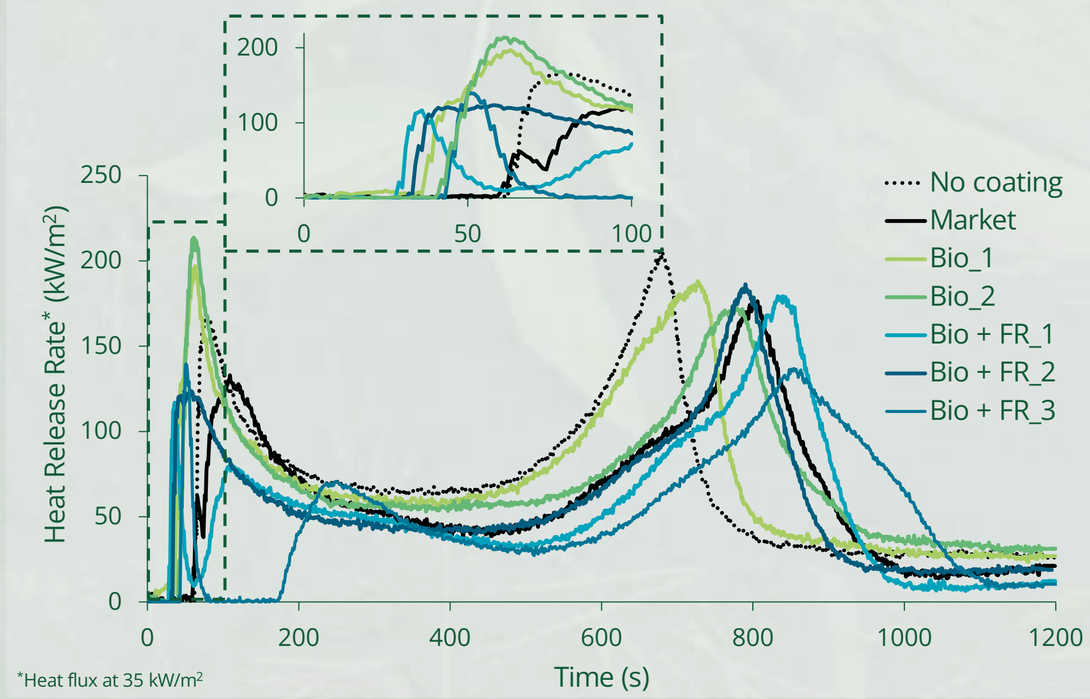
FR water-borne biocoatings are applied on wood substrates as an FR alternative to market solvent-borne coating (*CHAR18*, IRIS Coatings).

Methods:
- Hardness by Persoz Pendulum.
- Transparency and colour by colorimetry.
- Fire performance evaluation by cone calorimeter on particleboard (PB) at a heat flux of 35 kW/m^2.

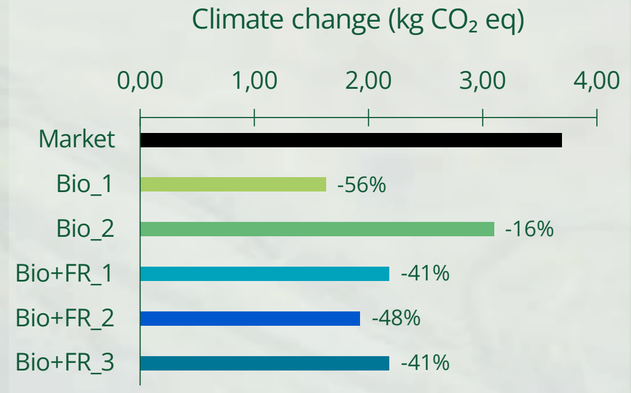
* *Process Patented by TECNALIA (WO2020/109460A1).*

Results and Discussion

- Bio-PUD coatings without any FR additives (Bio_1 and Bio_2) showed even worse fire resistance behaviour than the PB without coating.
- FR additives (P or Cl) significantly improved the fire performance of Bio-PUD coatings (Bio+FR_1, Bio+FR_2, and Bio+FR_3).
- The **developed FR water-borne biocoatings have similar fire performance to the market benchmark in terms of heat release**.
- The biocoating **Bio+FR_3 could be a suitable candidate for replacing fossil-based ones** as a 26%, and 38% improvement of the maximum average rate of heat emission (MARHE) was noticed compared to the market reference and the PB with no coating, respectively.



Bio-PUD coating with fire retardant (Bio+ FR_1) during and after cone calorimeter test.



- The **climate change impact for all biocoatings are significantly lower** compared to the market reference.
- Using **bio-based isocyanate allows further decrease** in climate change impact (see Bio+FR_2).

Coating	Composition	NCO	% Bio-based	$t_{IGNITION}$ (s)	HRR Peak (kW/m²)	MARHE (kW/m²)	TSP (m²)	Persoz Hardness (s)	Colour dE*ab (D65)
No coating	-	-	-	67	208	89	2.3	-	-
Market	Solvent-borne PU 2K (10% Cl)	HNCO	0%	67	176	75	3.5	115	2.4
Bio_1	Bio_PUD	-	46%	43	197	95	3.4	55	17.4
Bio_2	Bio_PUD	HNCO	42%	45	214	94	2.5	62	17.2
Bio+FR_1	Bio_PUD + 15%P + 3%Cl	HNCO	47%	35	179	67	2.4	29	12.6
Bio+FR_2	Bio_PUD + 15%P + 3%Cl	Bio-HNCO	50%	38	186	73	2.9	19	17.8
Bio+FR_3	Bio_PUD + 20%P + 1%Cl	HNCO	47%	41	137	55	2.3	26	16.5

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