



Effects of flame retardants on flammability of flax fibre-reinforced composites

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Biocomposites are made of natural fibers which are an attractive alternative to conventional synthetic fibers such as glass or carbon fibers not only because their intrinsic properties but also because they contribute to a more sustainable material. However, both **bioresins and biofibres are flammable and need to be protected against fire** for safety reasons but also to meet the strict EU regulations on the construction market



Fig. 1: indoor panels (a), seatback panels (b)

The aim of this work is to enhance the fire retardant performance of natural fiber biocomposites by means of combinations of four different “greener” FR additives, *APP*, *ATH*, *DMPP* and *Exolite740*.

Laminates prepared by hand-lay up and cured in hot-press

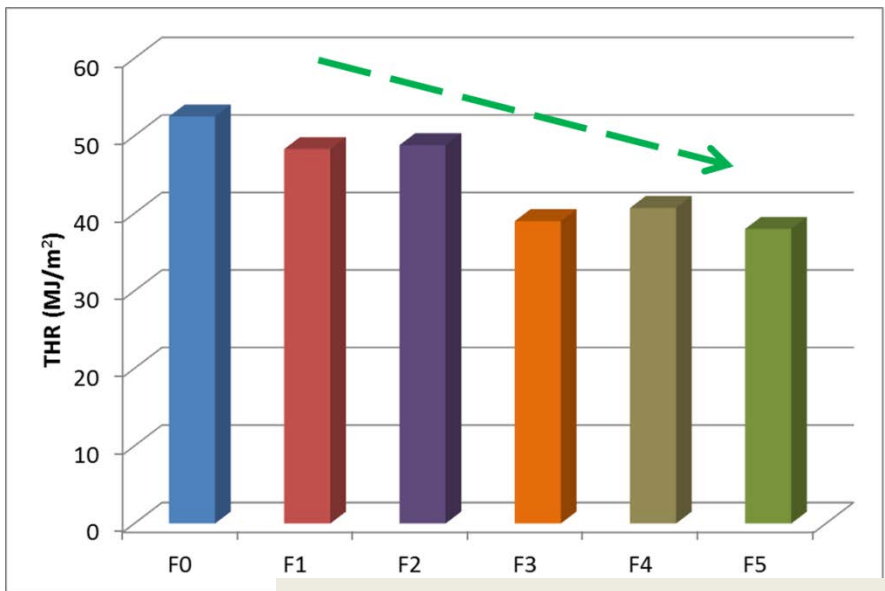
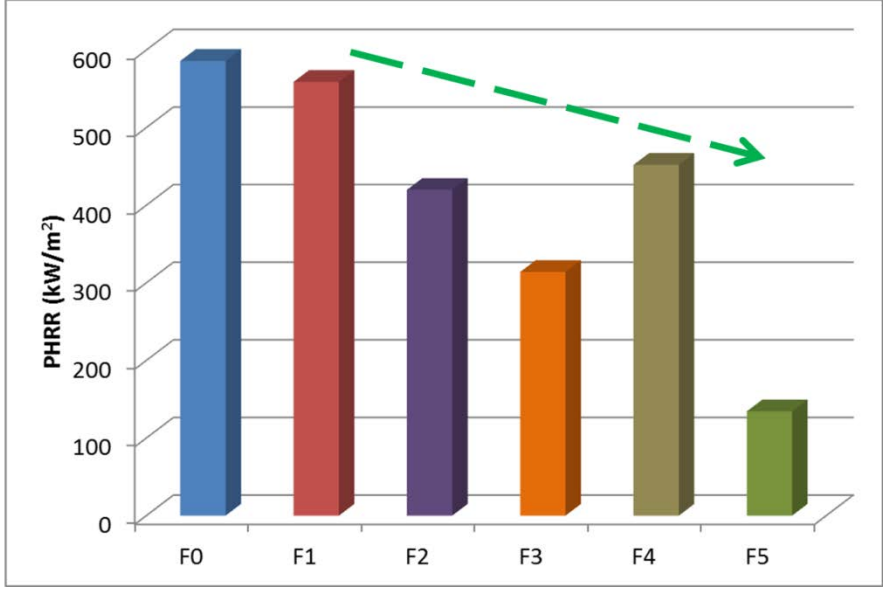


Formulations	[FR] phr	Thickness (mm)
F0	-	2.78
F1	APP FR- 422	25
F2	APP FR- 422	25
	ATH	
F3	APP FR- 422	150
	ATH	
F4	APP FR- 422	7
	ATH	
	DMPP	
F5	Exolite 740	100

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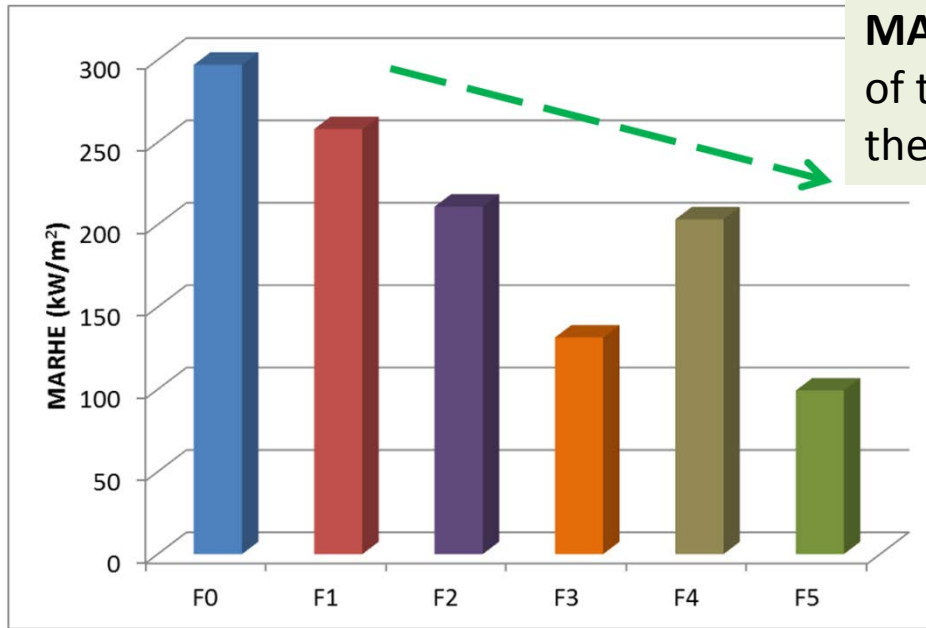
The fire performance was measured with a **cone calorimeter** according to ISO 5660 under an external heat flux of **50 kW/m²**.

Next graphs correspond to **maximum peak heat release rate PHRR, total average heat release rate, aTHR, and maximum average rate of heat emission, MARHE.**



All composites with FR additives displayed lower HRR and PHRR than the reference sample due to the combined action of the selected additives (vapour and condensed phase).

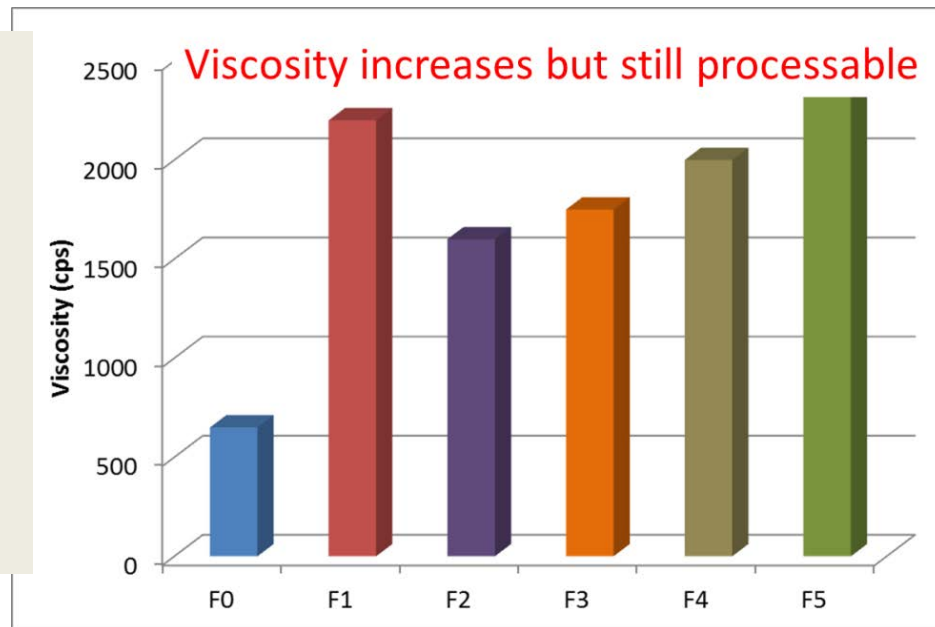
New bio-composites exhibit enhanced fire retardant performance.



MARHE can be considered a good measure of the propensity for a fire development in the case of a real situation

- Addition of APP or APP/ATH fillers results in a reduction of MARHE. This reduction increases significantly with increasing ATH loading degree.
- DMPP did not show any FR enhancement

- **Viscosity increases** upon addition of either ATH or APP to the resin, this increment is larger in formulations containing only APP than in the formulation containing both APP and ATH.
- Formulation F4, with DMPP did not show a viscosity reduction even if its viscosity is 250cps



- The use of **ATH** in combination with **APP** imparts an improved flame retardant to effect in the laminate.

Reductions of up to 60% are achieved with loading degrees of 175 phr.

- The most promising result was obtained with **Exolite 740**, the synergistic behavior among all the additives in the proprietary formulae, produces a large additional reduction while do not affect to its processing performance.

INNOVATION

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