

Synthesis and application of multifunctional flame retardant additives

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Novel phosphorus-containing multifunctional additives were synthesized with the aim to provide flame retardancy to natural fibre reinforced biocomposites in an economical way [1].

Glycerol phosphate (GP), a plasticizer of starch with flame retardant potential, and a novel phosphorous-silane (PSil), applied as a surface treating agent of reinforcing biofibres, were successfully combined to reduce the flammability of poly(lactic acid) (PLA) based biocomposites. The modified starch proved to have enhanced char promoting capability when applied in PLA, and thus provided improved flame retardancy to PLA/TPS blends. On the other hand, a newly synthesized reactive flame retardant modifier (PSil) of flax fibres (Figure 1) allowed the phosphorus - silicon synergism to be utilized. The inherent harmful candle-wick effect of the applied fibrous substances ceased completely due to the PSil-treatment.

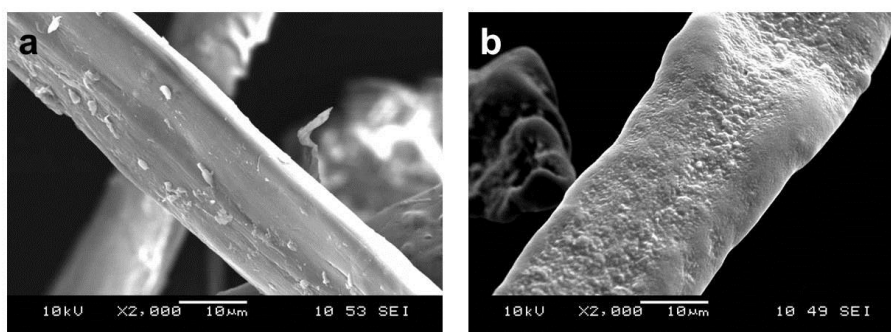


Figure 1. SEM images of the surface of (a) neat and (b) PSil-treated natural fibres

Owing to the beneficial effect of the applied multifunctional additive system, a loading of as low as 10 wt% of ammonium polyphosphate proved to be sufficient to provide prominent levels of flame retardancy to the biocomposites, i.e. V-0 rating according to UL94 standard, 33 vol% LOI and a 40% reduction of heat emission were achieved. Furthermore, the phosphorus containing species, being present both on the surface of the reinforcing flax fibres and in the biodegradable matrix material, provided well-balanced strength and stiffness for the effectively flame retarded biocomposites.