Keratin fibres recovered from tannery industry wastes as fire retardant agents on PLA composites

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As it is well known, tannery leather process is a high pollutant emissor. During beamhouse stage, the wastes have a strong negative environmental impact because of the effluents and solids have a high content of organic matter. Hair skin derived from this stage, which is thrown in sanitary fills without any usual treatment. However, wasted hair is considered an important keratin fibre source with interesting applications in polymer materials. In this work keratin fibres (KFs) were recovered from tannery industry wastes [1]. A specific treatment was applied to KFs in order to obtain polymer composites base on PLA, KFs and aluminium tri-hydroxide (ATH) by extrusion process. The effect of KF content and the joint action of KFs in combination with ATH as fire retardant for poly(lactic acid) -PLA- was studied by thermogravimetric analyses, UL94 classification, dynamical-mechanical, mechanical and rheological analysis. According to collected data, the fire retardant potential of keratin fibres recovered from tannery industry wastes on PLA composites have been demonstrated. Following UL94 classification PLA composites were classified as V2 rating with only KFs (3, 5 and 10 phr). However, when KFs were added to 30 phr ATH, the composites reached V0 rating, the same classification obtained using 50 phr ATH. Therefore, by using low KF content (3 phr), it is possible to replace 20 phr ATH. In addition, KF-based composites exhibited higher mechanical properties than that containing only ATH. Flow behaviour under continuous simple and small amplitude oscillatory shear flows demonstrated that KFs decrease the viscosity of the PLA composites in a remarkable way improving the processability of PLA composites. Materials containing both KFs and ATH exhibited a higher elastic behaviour than those loaded with only KFs. The latter result represents an important advantage from an economical and environmental point of view in flame retarded materials.

References

1. G. Sanchez-Olivares, A. Sanchez-Solis, F. Calderas, J. Alongi, *Polym. Degrad. Stab*., **2017**, *140*, 42.

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