# Study and Fire test of natural fibre reinforced composites with flame retardance properties

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1. Introduction – Among the many environmental problems that exist today, it is studied how to improve the sustainability of the environment and the management of a huge amount of polymer waste. Thanks to its renewable origin, recycling possibilities and biodegradability of its derivatives, natural fibres are suitable as reinforcement of polymeric materials in the industrial sector. However, it is necessary to know the interaction of these materials with fire, not only to ensure its use in industries, but more importantly, the protection of lives and property from the derived risks associated with fire. Due to the fact that natural fibres have a high combustibility, it is necessary to improve the fire behaviour properties of the composite. The fire resistance can be improved by strategies that include reducing the flammability of the matrix and/or the fibre reinforcement and/or the composite as a whole [1]. The objective of this work is to evaluate the fire resistance of polymer composites reinforced with natural fibre weave, using flame retardant for the polymeric matrix and alkali treatment for the fibre. The additive used is magnesium hydroxide and a level between 60 to 65% is required to obtain a fire-resistant material [2].

2. Experimental – The polymeric matrix used is an homopolymer PP (PPH 9069) in pellets from Total S.A. Magnesium hydroxide was purchased from VWR Chemicals with 99% assay. The fabrics of natural fibres have been the result of the research project BANTEX (MAT2013-47393-C2-1-R). The three types of used material are: banana, banana with cotton and linen. In addition, banana fibre has been used for the formation of the nonwoven. The composites have been manufactured by compression moulding with the Collin P 200 P/M machine and a mould of 190x190 mm, using and additive percentage of 45 and 60%. For the characterization of the composites, optical microscopy, bending, tensile and impact tests have been carried out. The fire test is based on the UNE-EN ISO 9773 standard, adding the quantification of flame speed.

3. Results and Discussion – In relation to mechanical properties, elastic modulus, maximum tension and impact resistance decrease regarding to percentage of additive, while flexural modulus increases. In the fire test, a decreasing tendency of flame speed is observed (Image 1). 4. Conclusions – Throughout the test it is verified that the flame retardant influences the mechanical properties of the material, giving it rigidity. In relation to chemical treatment, the maximum tension is improved. In the fire test, the effect of the retardant on flame speed is clearly observed. It is concluded that non-woven of banana fibre with 60% additive is in fact a flame retardant composite.

5. References [1] S. Chapple, R.Anandjiwala. Flammability of Natural Fiber-reinforced Composites and Strategies for Fire Retardancy: A Review. Journal of Thermoplastics Composite Materials 23 (6) (2010) 871-893 [2] Velasco J. Microestructura y propiedades mecánicas de compuestos de polipropileno con hidróxido de magnesio y de aluminio moldeados por inyección. Universidad Politécnica de Cataluña (2001)