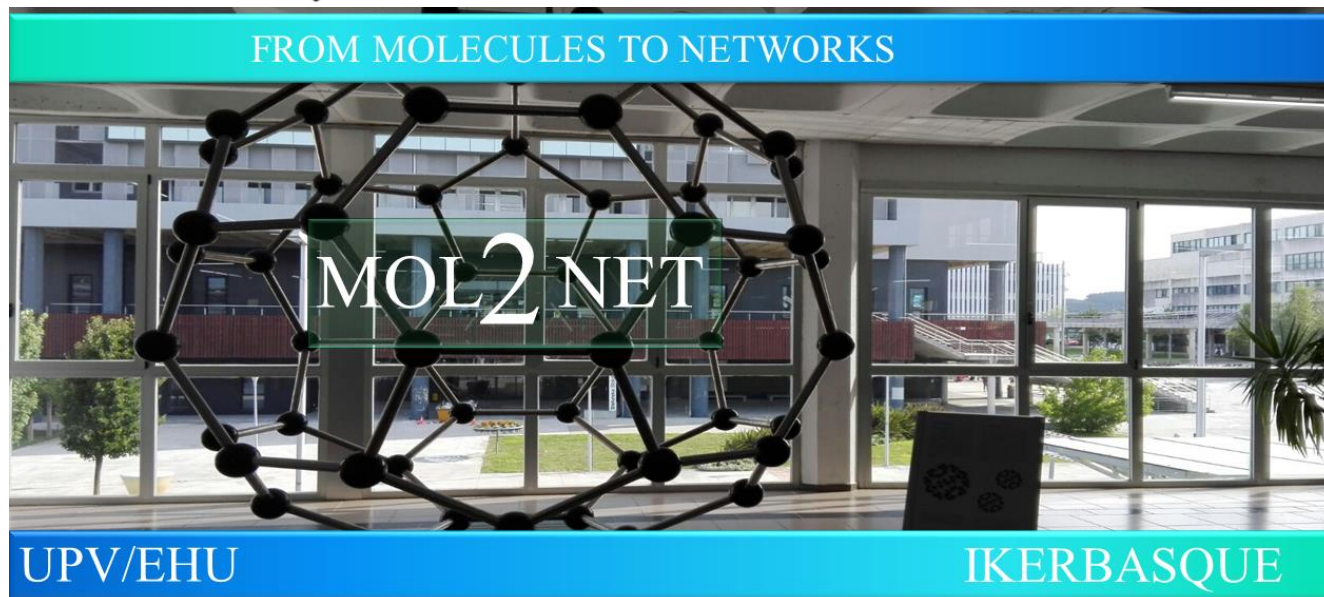




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Eco-friendly flame-retardant coating deposited on cotton fabrics

Maidar Baltasar Marchueta, PhD student

*Department of Organic and Inorganic Chemistry, Faculty of Science and Technology,
University of Basque Country (UPV/EHU), Leioa, Biscay, Spain
IKERDATA S.L.*

Abstract.

With the increasing awareness of environmental protection, the greening of flame retardants has become an inevitable choice for flame retardant technology. The use of bio-based materials in nature as a flame retardant meets the requirements of a green strategy, which not only mitigates the energy crisis, but also does not cause environmental pollution.

All the time, fire problems caused by cotton fabrics pose a serious threat to people's lives and property. Therefore, it is of great practical significance to improve the flame retardant properties of cotton fabrics. Moreover, with the development of science and technology and the advancement of society, the greening of flame retardants has become an inevitable choice for flame retardant technology. The use of bio-based materials in nature as a flame retardant meets the requirements of a green strategy, which not only mitigates the energy crisis, but also does not cause environmental pollution.

To begin with, Zhang *et al.* [1] did a research on chitosan and phytic acid as intumescent flame-retardant system and metal ion as a synergist built on cotton fabrics to achieve efficient flame retardancy by facile dip-pad-dry process. Microscale combustion calorimetry results manifested that the heat release rate values of coated samples were lower than that of uncoated samples. Scanning electron microscopy confirmed that there were much more bubbles on the surface of fibers for the coated CH/PA/Ba/PA after horizontal flame tests. The results indicated that the synergy of the intumescent flame-retardant system was achieved by the addition of metal ions which could accelerate the produce of a large number of nonflammable gases. As a result, they stated that the coating is expected to be applied in practice in the future.

Moreover, Liao *et al.* [2] prepared a halogen-free, formaldehyde-free, efficient, durable, NP flame retardant, the ammonium salt of meglumine phosphoric ester acid (ASMPEA). The results indicated that the cotton fibers treated with ASMPEA were endowed with excellent durable flame retardancy. Moreover thermogravimetry (TG), cone calorimetry, and vertical flammability tests were performed. The results showed that ASMPEA-treated cotton decomposed into phosphoric acid or polyphosphoric acid during combustion, which promoted the thermal degradation and charring of treated cotton fabrics and hindered the spread of flames. Overall, these results confirm that ASMPEA achieved excellent durable flame retardancy when used to coat cotton fabric.

Last but not least, Xu *et al.* [3] synthesized a water-soluble phosphoramidate siloxane polymer (PDTSP), by sol-gel technology and flame-retardant cotton fabrics were prepared with a multistep coating process. A vertical flammability test, limited oxygen index (LOI), thermogravimetric analysis, and cone calorimetry were performed to investigate the thermal behavior and flame retardancy of PDTSP-coated fabrics. All results presented that PDTSP-coated cotton fabrics had good flame retardancy and char-forming properties. PDTSP coating was demonstrated to possess gas-phase flame-retardant mechanism as well as a condensed phase flame-retardant mechanism, which can be confirmed by thermogravimetric analysis-Fourier transform infrared spectroscopy (TG-IR) and cone calorimetry test.

In conclusion, bio-based materials have the advantages of wide source, recyclability and green environmental protection, and have received extensive attention. In this review we saw different eco-friendly flame retardants including chitosan, phytic acid, ASMPEA and PDTSP. These coatings would not only work as flame retardants but also it will help the environment.

References

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