ECO-FRIENDLY FLAME RETARDANTS FOR TEXTILES

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Abstract: The prevention of fire incidents through the use of flame-retardant materials has gained significant importance in recent decades. Even today, fires remain a global problem with serious social, environmental and economic consequences. Textiles, used in many aspects of daily life and made from both natural and synthetic polymers, have an increased flammability due to their organic origin and large fiber surface area [1]. To counter the risk of material ignition and/or flame propagation, textile carrier materials are treated with flame retardants (FR), to reduce their flammability, thus impeding or suppressing the ignition, spread, and intensity of fires. Major approaches to achieve flame-retardant properties are based on environmentally harmful finishings, usually involving halogen-based compounds. Due to the restriction of various substances, environmentally friendly and halogen-free alternatives are needed.

Keywords: *flame retardands, washing stability, textiles*

Specialized in the use of textiles and chemicals for industrial applications, we have developed several halogen-free and wash-resistant FR systems for textile carrier materials (Figure 1). These novel FR systems are based on phosphorus and nitrogen compounds [2] and can be immobilized from aqueous media, thus potentially reducing the risk of environmental persistence and bioaccumulation. The combination of phytic acid, derived from industrial by-products of grain processing, with chitosan, the deacetylated polyaminosaccharide of chitin found in crustaceans, insects, and fungi, has proven to be effective in providing flame-retardant properties. Artificial and water-soluble FRs, synthesized from cyclophosphazene, also allow waterborne textile finishings. Since nylon-cotton blends are known to be challenging substrates regarding their flame-retardant functionalization and its durability, Nyco was treated with two different cyclophosphazene derivatives [3]. A comprehensive investigation of the flame-retardant performance and mechanism of the different textile finishings and coatings was conducted. By elucidating the flame-retardant mechanisms of treated textiles, we contribute to the targeted combination of textile substrates and FRs in future applications and to the optimization of established flame-retardant systems.

Figure 1 Cotton after flame test according to ISO 15025, without flame-retardant finishing (left) and finished with phytic acid/chitosan.

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