Use of fungal metabolites as flame retardants for cotton fabrics

Thousands of people worldwide lose their lives each year due to house and enclosed space fires. Textile products such as flooring, drapes, bed sheets…play an important role in house fires and their spreading. Therefore, the need for textile treatments bringing flame retardant properties is constant.

Flame retardants (FRs) may exhibit different chemical compositions: they may contain halogens (bromine and chlorine), phosphorus, nitrogen, aluminum, magnesium, boron, antimony, molybdenum, but also nanofillers. Although the halogen-based compounds are the most efficient and widely used FRs, some of these molecules have been proven to be persistent, bioaccumulative, and/or environmentally toxic for animals and humans. Thus, current attention is focused on the production of effective halogen-free additives for coatings and backcoated textiles.

As far as cellulosic substrates are concerned, FRs containing phosphorus and nitrogen have been proven to be the best performing systems currently used. However, there is a continuing search for novel and environmentally sustainable FRs. In this context, the use of fungi could represent an alternative to the traditional FRs as fungi are known to produce a large variety of compounds which are associated to a wide range of biological activity. From a chemical point of view, various compounds are reported in the literature to possess heteroatoms such as halogens (like griseofulvin), sulphur (cysteine related compounds of sulphated compounds) and phosphorus (such as phospholipids).

The aim of the project is to investigate the flame retardant properties of cotton fabrics treated with fungal metabolites. First, the solutions containing the different types of fungal metabolites at various concentrations will be prepared. Then, the cotton fabrics will be treated by the padding method and the flame retardant properties will be evaluated using the mass loss cone calorimetry and determining the horizontal flame spread rate. The final part of the work will be devoted to the understanding of the mode of action of fungi as FRs using characterization techniques like electronic microscopy, thermogravimetric analyses (coupled or not with infrared spectroscopy), solid-state NMR, pyrolysis-Gas Chromatography coupled with mass spectrometry as well as microcalorimetry.

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