

## Enhancing of Flame Retardancy and Hydrophobicity of Cotton by Coating a Phosphorous, Silica, Nitrogen Containing Bio-Flame Retardant Liquid for Upholstery Application

**Authors :** Li Maksym, Prabhakar M. N., Jung-Il Song

**Abstract :** In this study, a flame retardant and hydrophobic cotton textile were prepared by utilizing a renewable halogen-free bio-based solution based on chitosan, urea, and phytic acid, named bio-flame retardant liquid (BFL), through facile dip-coating technology. Deposition of BFL on the surface of the cotton was confirmed by Fourier-transform infrared spectroscopy and scanning electron microscope coupled with energy-dispersive X-ray spectrometer. Thermal and flame retardant properties of the cottons were studied with thermogravimetric analysis, differential scanning calorimetry, vertical flame test, cone calorimeter test. Only with 8.8% of dry weight gain treated cotton showed self-extinguish properties during fire test. Cone calorimeter test revealed a reduction of peak heat release rate from 203.2 to 21 kW/m<sup>2</sup> and total heat release from 20.1 to 2.8 MJ/m<sup>2</sup>. Incidentally, BFL remarkably improved the thermal stability of flame retardant cotton from expressed in an enhanced amount of char at 700 °C (6.7 vs. 33.5%). BFL initiates the formation of phosphorous and silica contain char layer which restrains the propagation of heat and oxygen to unburned material strengthened by the liberation of non-combustible gases, which reduce the concentration of flammable volatiles and oxygen hence reducing the flammability of cotton. In addition, hydrophobicity and specific ignition test for upholstery application were performed. In conjunction, the proposed flame retardant cotton is potentially translatable to be utilized as upholstery materials in public transport.

**Keywords :** cotton fabric, flame retardancy, surface coating, intumescent mechanism

**Conference Title :** ICCM 2022 : International Conference on Composite Materials

**Conference Location :** Amsterdam, Netherlands

**Conference Dates :** August 08-09, 2022