

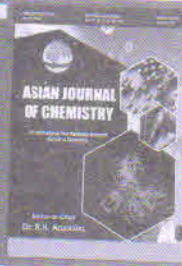


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Synthesis of Phosphoric Acid Ester-based Flame Retardants and their Application *via* Sol-Gel Process to Enhance Flame Retardancy of Cotton Fabric

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In order to enhance the flame retardancy of cotton fabric and expand its use in regions with strict fire safety regulations, phosphoric acid esters-based organic compounds such as diphosphoric acid ethyleneglycol ester (diPEG), triphosphoric acid glycerol ester (triPGE) and tetraphosphoric acid pentaerythritol ester (tetraPPE) were synthesized and characterized by ¹H NMR, ³¹P NMR and HRMS methods. The cotton fabric was treated with these compounds and aminopropyltriethoxysilane (APTES), a sol-gel precursor, by using sol-gel process. FTIR spectrum of treated fabric shows additional peaks at 1240 (P=O), 1044 (Si-O-Si) and 794 cm⁻¹ (Si-O), which shows the presence of flame-retardant coating on fabric. Thermogravimetric analysis was employed to study the change in pattern of thermal degradation of treated cotton fabric. The behaviour of flame retardancy was assessed through auto-flammability and limiting oxygen index examinations. The treated cotton fabric exhibits outstanding flame-retardant properties during combustion and is extinguished promptly once the ignition is eliminated. The limiting oxygen index value of the cotton fabric after treatment with tetraPPE/APTES flame retardant reached 38.3%, which is sufficiently above the flame-retardant value of about 27%. The morphological structures of fabric were also investigated using FESEM.

Keywords: Cotton fabric, Sol-gel, Flame retardancy, Thermal studies, Morphology.