Linear Polyamidoamines as Novel Biocompatible Intumescent Flame Retardants for Cotton

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Since the middle of the last century, many industrial and academic researchers have devoted a lot of effort to the development of safe and effective flameretardants (FR). As regards cotton, phosphorylated compounds were the predominant FR for several decades ^[1] despite many of them had been shown to be bioaccumulative.^[1] Recently, biomolecules including proteins have been proposed as FR.^[2] Many linear polyamidoamines (PAAs), a family of synthetic polymers with exceptional structural versatility.^[3] have high thermal stability coupled with chain structure and side substituents reminding those of proteins.^[4] These features suggested that PAAs could act as FR. This presentation reports on the results obtained with a library of eight PAAs applied as coatings on cotton fabrics from aqueous solutions. All tested PAAs warrant remarkable potential as surface-confined intumescent FR. In ignitability tests, six of them exposed to direct flame for 10 s do not burn, but produce carbonaceous crusts sheltering the underneath sample. Thermogravimetric analyses show that at $T \ge 400$ °C all PAAs leave in air substantial char residues that oxidize at T > 500 °C. At 450 °C they form porous carbonaceous structures indicating the tendency to intumesce. In horizontal flame spread tests, cotton stripes impregnated with most PAAs extinguish flame at add-ons ranging from 4 to 20%, whereas untreated cotton vigorously burns without leaving residues. Upon 35 kW/m² heat flux, all PAAtreated samples significantly reduce the main combustion parameters.

References

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