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Dyestuff Free: Coloring Fabrics by Graft Polymerization

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Laundering durable functional fabrics are obtained by means of radiation-induced graft polymerization methods, via the graft polymerization of functional monomers or co-graft polymerization of the monomers and certain nanoparticles[1-4]. The laundering durability lies in the formation of the covalent bonds between the cellulous macromolecules and the graft chains or together with the nanoparticles, which is the most advantage of the radiation methods in fabric modification.

Dyestuffs, normally referring to the organic molecules which can be dissolved or dispersed in solutions, are used to coloring cotton fabrics since they can be absorbed by the nanoporous structure and the non-crystalline zone, or even the lamella of the crystalline zone of the fabrics. Reactive dyestuffs can react with the hydroxyl groups on the cellulous macromolecules under high temperature and basic conditions. Although dyestuffs are well-developed chemical products and the dying process is mature too, the long treating period and high pollution of the waste water are need to be solved.

In our previous study, we found that radiation-induced graft polymerization methods will be a dyestuff-free way to color the cotton fabrics by co-graft polymerization the colorful nanoparticles. For example[5], MIL-101, a typical metal organic framework (MOF) which comprises a nontoxic chromium(III) cluster and benzene-1,4-dicarboxylate ligand, was co-graft polymerized onto nylon fabric with 2-hydroxyethyl acrylate (HEA), owing to the abundance of benzene rings in MIL-101 which is favor for free radicals generation on its surface. The color of MIL-101 is dark green, and the color of the grafted nylon fabrics is green and darkens with the increasing degree of grafting of MIL-101. More important, the robustness of the product was demonstrated by 30 hours dry-cleaning test using tetrachloroethylene as the organic solvent, and most of the MIL-101 particles still adhered to the nylon fabric after the washing.

Base on the above facts, we are now developing the dyestuff-free coloring fabric procedure by fixing pigments micro- or nanoparticles onto the cotton fabric under radiation-induced co-graft polymerization methods.

References:
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