

## WHAT IS 'PHENOLIC YELLOWING' AND HOW IS IT INFLUENCED BY ACIDIC AND ALKALINE CONDITIONS?

Phenolic yellowing is caused due to the presence of Phenolic compounds on the textile material, reacting with the oxides of nitrogen in an alkaline medium. The phenomenon of Phenolic yellowing is associated with the storage of finished textile material, packed in polyethylene/aromatic polymer material or cardboard cartons.

Aromatic amines (PPD-Para Phenylene Di-Amine) and Phenolic compounds (BHT-Butylated Hydroxyl Toluene) are increasingly used as anti-oxidants and stabilizers in organic polymer packaging materials, lubricants and foam. These and the Phenolic derivative from the lignin in cardboard form the yellowing precursors.

Oxides of nitrogen are generated in warehouses/households from direct heating systems or from automobile emissions in the urban environment. Neither the oxides of nitrogen nor the Phenolic compounds by themselves because yellowing, but when united, form the yellowing products. The BHT or the Phenolic derivatives of lignin from the packing materials migrate to the surface and get transferred to the textile material, which in turn, when exposed to the oxides of nitrogen in the ambient atmosphere, because yellowing.

Such situations are much more common in cold countries where the warehouses or households require atmospheric heating and hence, resort to direct heating. Indirect heating systems would mitigate this problem. Automotive emissions and propane burning-both sources of oxides of nitrogen-are most prevalent in all urban ambiances.

The alkaline condition that is required for the reaction between the phenol and oxides of nitrogen is inherent in cotton textiles. This is because, the fabric is processed predominantly in an alkaline medium and unless it is fully neutralized with specialty acids; it would tend to get alkaline while in storage, and become more prone to yellowing. This is particularly true in case of whites.

### **Phenolic yellowing can be mitigated by the following methods:**

Avoidance of Phenolic antioxidants and stabilizers in the packaging materials or in the synthetic polymer fibres used in the blends

Rendering the finished textiles at a slightly acidic pH (neutralization with specialty acids)

Avoiding exposure to oxides of nitrogen pollution.