ABSTRACT

Synthetic tanning agents (syntans) are indispensable for making any type of leather article. There is a challenge for syntans to be processed low or without formaldehyde to meet strict regulations in the leathergoods. Conventional amino resins based retanning agents possess excess free formaldehyde and are sensitive to pH as they are precipitated and deposit superficially on the surface of leather during their application in retanning process.

Present study provides methods for low formaldehyde and formaldehyde-free amino resins based retanning agents. Five methods of low formaldehyde sulfonated hydrazide modified amino resins based on succinic dihydrazide, adipic dihydrazide, glutaric dihydrazide; terephthalic dihydrazide and isophthalic dihydrazide were developed and prepared.

Sulfonated succinic, glutaric, adipic, isophthalic and terephthalic dihydrazide formaldehyde condensates were prepared by controlled reaction of dihydrazide, formaldehyde and sodium metabisulfite by varying mole ratio of sodium metabisulfite/dihydrazide and formaldehyde/dihydrazide molar ratio.

Two series of formaldehyde free retannings based on melamine, glyoxal, glutaraldehyde and sodium sulfamate were developed. Sulfonated melamine glyoxylated resins were prepared by controlled reaction of melamine with glyoxal and sodium sulfamate by varying glyoxal to melamine mole ratio and sodium sulfamate to melamine mole ratio. Sulfonated melamine glutaraldehyde resins were synthesized by controlled reaction of melamine with glutaraldehyde by varying glutaraldehyde to melamine mole ratio and sodium sulfamate to melamine mole ratio. All stabilized resins were characterized by Fourier Transform Infra Red Spectrometer (FTIR) and proton NMR spectroscopy. It was observed in five dihydrazide based series that viscosity of resin solutions increases by increasing formalin/dihydrazide mole ratio and decreases by increasing sodium metabisulphite/dihydrazide mole ratio. The same trend of viscosity behavior was also observed in two series of free formaldehyde melamine based resin, i.e., viscosity decreases with increasing degree of sulfonation. Molecular weight of the resins was determined by intrinsic viscosity method. Molecular weight shows a direct relationship with the viscosity of
Resins with higher viscosity have higher molecular weight and vice versa. After attaining a critical molecular weight during condensation, resins turned into a gel form.

Stabilized resins of the series were applied comparatively as retanning agent against a standard retanning agent on leather by a retanning procedure. Organoleptic properties of the resins were visually assessed. Tensile and tear strength, percent elongation at break, grain cracking of re-tanned leathers were comparatively evaluated and resins with optimum performance were selected respectively.

Morphological analysis of the grain surface and cross section of the leather fibers re-tanned by control and optimized synthesized resins were analyzed by scanning electron microscope (SEM) which showed more compactness of grain and fiber structures of experimental re-tanned leather. Organoleptic properties of optimally re-tanned leather show better performance in comparison to control re-tanned leather. Free formaldehyde contents in the five series of hydrazide based resins were found <0.05% and free formaldehyde contents in re-tanned leather was found upto 10 ppm. There was, however, no detection of formaldehyde in two series of melamine based resins and their re-tanned leathers.

Resins with optimum re-tanning performance showed good thermal stability evaluated by thermal gravimetric analysis. Retanned leathers with optimum performance were also assessed for thermal stability by thermogravimetric analysis and showed better thermal stability.