FINISHING TECHNOLOGIES FOR WOOLEN SHEEPSKINS

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In this paper, a finishing composition and technology for nappalan woolen sheep skins are presented. The finishing composition contains a new feel agent – Wax-AGE 7 – based on beeswax, lanolin and triethanolamine monostearate and stabilized with lauryl alcohol ethoxylated with 7 moles of ethylene oxide. The performance of finishing film was investigated by physical-mechanical analysis, optical microscopy and ATR-FITR. Good results for feel and physical-mechanical properties were obtained.

Keywords: woolen sheepskin, finishing, nappalan, feel agent

INTRODUCTION

Disperse systems used for finishing nappalan leather and fur contain various auxiliaries: pigments, binders, dyes, natural and synthetic waxes, preservatives, plasticizers, thickening agents, fillers, penetrating agents, solvents (Lange, 1982; Heidemann, 1994).

Nappalan furs are processed from lower quality finished suede leather, with superficial flaws which can be corrected by coating with polymer films.

Nappalan leather finishes differ from classic ones in terms of the requirements imposed. Thus, film thickness must be minimal, so as not to alter softness and extensibility specific to suede furs on which they are deposited. Film-forming polymers must be selected so as to be compatible with those embedded in the impregnation layer, deposited on the velour surface before applying the film, and the adhesion of film to the substrate must have a high value. As nappalan finish is applied to clothing items to be worn in the cold season, the film-forming mixture must maintain its highly elastic properties up to temperatures of about 12°C (Maier, 2008; Maier, 2010).

In nappalan fur finishing operations there are restrictions regarding the use of heavy metals in pigment pastes, ethoxylated alkylphenols, formaldehyde and other toxic crosslinking agents (OSPAR, 2004).

The paper presents finishing technologies for nappalan finished sheepskin furs with matte or glossy effect. In the final dressing a new feel agent was used, Wax-AGE 7, obtained by emulsifying a mixture of beeswax, lanolin and ethanolamine monostearate and stabilized using lauryl alcohol ethoxylated with 7 moles of ethylene oxide (Niculescu, 2013).

EXPERIMENTAL

Materials

Woolen sheep skins chrome tanned, retanned, fatliquored and dyed (black and brown), 0.9-1.2 mm thick from Taro tannery, Romania.

Finishing auxiliaries from Triderma, Germany (Triderma, 2010).

Feel agent – Wax-AGE 7 – obtained by a process described in Niculescu (2013). The product was used as handle modifier containing beeswax, lanolin and triethanolamine monostearate and stabilized with lauryl alcohol ethoxylated with 7 moles of ethylene oxide with the following characteristics: dry substance – 18.96, pH (10% solution) – 7.3, Ford cup viscosity Φ4 – 27 s, kinematic viscosity, cSt – 10.48, density – 0.975 g/cm^3.

Methods

Optical microscopy images were captured using a Leica stereomicroscope S8AP0 model with optic fiber cold light source, L2, with three levels of intensity, and Magnification 40X.

Physical-mechanical analyses were performed for the finished leathers: tensile strength and elongation using the Shopper dynamometer pendulum (Louis Shopper, Germany), according to SR EN ISO 3376:2003; colour resistance to friction using the Veslic device (Giuliani, Italy), according to SR EN ISO 5402:2003.

Attenuated Total Reflectance Fourier transform infrared spectroscopy (ATR-FTIR) measurements were run with a Jasco instrument (model 4200), in the following conditions: wavenumber range – 600-4000 cm^{-1}; data pitch – 0.964233 cm^{-1}; data points – 3610: aperture setting – 7.1 mm; scanning speed – 2 mm/s; number of scans – 30; resolution – 4 cm^{-1}; filter – 30 kHz; angle of incident radiation – 45°.

Nappalan Woolen Sheepskin Finishing Technologies

Surface finishing technologies have been developed for black (P1) and brown (P2) nappalan sheepskins (Niculescu, 2007 and 2014). Finishing composition of nappalan type finishing of woolen sheepskins included acrylic and polyurethanic binders in the base coat and a special wax in final coat, namely 20-50g/L Wax-AGE 7 wax emulsion was added to improve the final feel of finishing films. Finishing composition was applied on dermal side of the furs.

The finishing technology and composition are presented in Table 1 for black nappalan and Table 2 for brown nappalan.

Table 1. Technology for finishing black nappalan woolen sheepskins (P1)

Operation	Composition of dispersion/Method of application
Applying dispersion I (basecoat)	200 g/L Roda-base 4088 200 g/L Roda-base 4095 600 g/L water Application by spraying (2 passes)
Intermediate plating	Hydraulic press using mirror or steam plate, parameters: 50-60°C, 50-80 bar
Applying dispersion I	By spraying (2-3 passes)

Applying final dressing (fixing)	700 g/L Roda-pure 5011 50 g/L Wax -AGE 7 250 g/L water Application by spraying (2 passes of final dressing)
Final plating	Hydraulic press using mirror plate, parameters: 60-70°C, 50-80 bar

Table 2. Technology for finishing brown nappalan woolen sheepskins (P2)

Operation	Composition of dispersion/Method of application
Applying dispersion I (basecoat)	80 g/L Casicolor Brown R 40 g/L Roda wax MONO 100 g/L Roda-cryl 510 100 g/L Roda-pur 302 100 g/L Roda-bind TLC 327 560 g/L water Application by spraying (2 passes)
Intermediate pressing	Hydraulic press using mirror or steam plate, parameters: 50-60°C, 50-80 bar
Applying dispersion I	By spraying (2-3 passes)
Applying final dressing (fixing)	700 g/L Roda-lac 93 20 g/L Wax -AGE 7 280 g/L water Application by spraying (2 passes of final dressing)
Final plating	Hydraulic press using mirror plate, parameters: 70-90°C, 50-100 bar

RESULTS AND DISCUSSION

Optical microscopy images show that the finishing films are uniformly on the dermal support for nappalan finished woolen sheepskins. Magnification was 40X for surface of finished fur.

P1 – black nappalan

P2 – brown nappalan

Figure 1. Images for nappalan finished woolen sheep skins (40X)

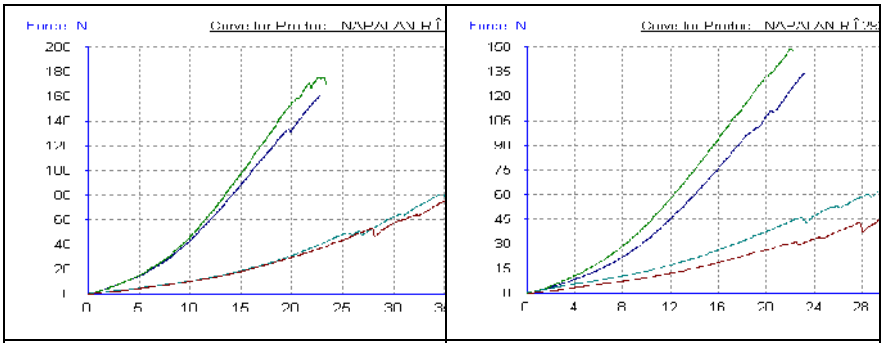
Physical-Mechanical Characteristics of Nappalan Finished Woolen Sheepskins

As Table 3 shows, physical-mechanical characteristics of nappalan finished woolen sheepskins P1 and P2, fall into the limits provided by the standards in force.

Table 3. Mechanical performances of fur samples P1-P2

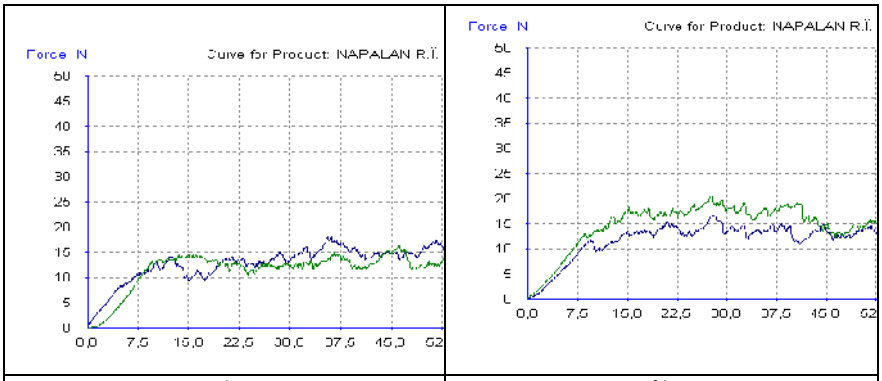
Leather sample	Tensile strength (N/mm^2)	Tear Resistance (N/mm^2)	Elongation (%)	Resistance to dry friction (mark)	Resistance to wet friction (mark)
P1	Parallel -168 perpendicular-94	17	Parallel - 46 Perpendicular-80	5/5	4-5/4
P2	Parallel-141 Perpendicular-80	18	Parallel-45 Perpendicular-65	4-5/4	4/3
SR EN ISO 3376:2003	Direction Parallel-min.100 perpendicular min.70	min. 15	Direction Parallel-min.40 perpendicular min.45	min. 4-5/3	min. 4/3

Physical-mechanical characteristics of nappalan finished woolen sheepskins are also presented in Figure 2 and Figure 3.



a) b)

Figure 2. Tensile strength for nappalan finished woolen sheepskins P1 and P2



a) b)

Figure 3. Tear Resistance for nappalan finished woolen sheepskins P1 and P2

FT-IR Characterization of Obtained fur Assortments

Figure 4 presents the spectral characteristics of the untreated fur samples M1, compared with those of the treated ones P1, used polyurethane final dressing containing AGE 7 wax emulsion. The main spectral bands of the unfinished fur samples M1 are found in the following regions: 2922 and 2853 cm^{-1} ($-CH_3$, $-CH_2-$), 1632 cm^{-1} (-OC-N), 1540 cm^{-1} (NH), 1450 cm^{-1} (C–H), 1229 cm^{-1} (NH-CO), 1085, and 1037 cm^{-1} (C-O). The spectra of the top coated fur samples P1 have the following characteristics, compared to those of the untreated ones: the intense peak at about 1632 cm^{-1}, characteristic for C=O and –OC-N groups, from the spectrum of the untreated fur, is absent in the spectra of the treated samples; these last ones present a peak at about 1724 cm^{-1}, corresponding to C=O stretching in saturated ester of polyurethane top coat; the two peaks at about 1237 and 1187 cm^{-1} assigned to the couplings of C-O and C-C stretches and to the stretching vibration of C-O-C of acrylates appear in the spectra of the finished fur; the broad band in the region 3200-3500 cm^{-1}, assigned to hydroxyl and amide groups vibrations, is diminished in the spectra of the top coated leather samples compared with the untreated ones.

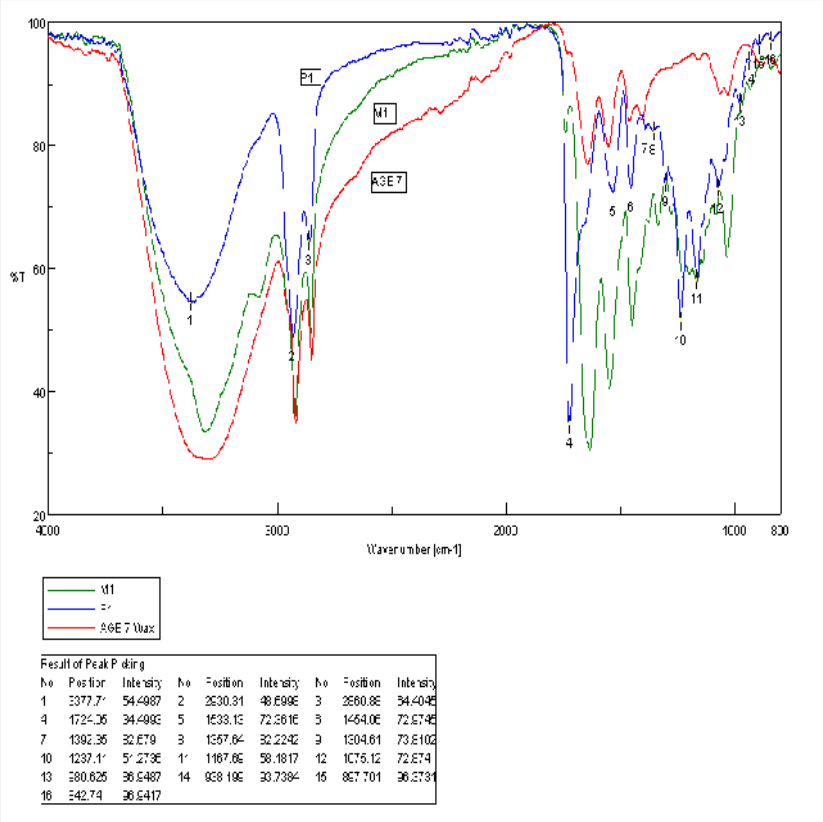


Figure 4. Superposed FT-IR spectra of unfinished dermal surface (M1), with finishing (P1) and of Wax AGE 7 emulsion used in the final dressing

The above differences between the IR spectra of finished and unfinished dermal surface may be considered as a proof for the chemical bonding of the top coat on base coat components. The polyurethane top coat containing the Wax AGE 7 emulsion is also bound chemically on base coat. Thus, the band from about 1645 cm^{-1} characteristic for C=O and –OC-N groups from the spectrum of the emulsion film is absent from the spectrum of the finished fur samples.

FTIR spectra of fur sample treated with polyurethane coating agent, to which the Wax AGE 7 emulsion was added, show that the latter is chemically bound to the leather surface.

CONCLUSIONS

In this paper a finishing composition and technology for nappalan woolen sheepskins are presented. Finishing composition contain a new feeling feel agent – Wax-AGE 7 – based on beeswax, lanolin and triethanolamine monostearate and stabilized with lauryl alcohol ethoxylated with 7 moles of ethylene oxide.

The investigations on performance of finishing film showed good results of feel and physical-mechanical properties.

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