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A NOVEL APPROACH FOR LIGHTFAST WET-WHITE LEATHER MANUFACTURE BASED ON SULFONE SYNTAN-ALUMINIUM TANNING AGENT COMBINATION TANNAGE

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Herein, we have investigated a novel combination tannage for lightfast wet-white leather based on sulfone syntan and aluminium tanning agent. By optimizing the technology, 10% sulfone syntan (BC) and 3% aluminium tanning agent (BN) at final pH 4,0 – 4,5 can raise the shrinkage temperature (Ts) of the wet-white leather to ~81°C. Scanning electron microscope-Energy dispersive X-ray spectroscopy (SEM-EDX) results reveal that sulfone syntan and aluminium tanning agent can be evenly bound within *the leather matrix, and promote the formation of tightly woven networks of collagen fibres. The novel combination tanning approach not only improves light fastness and lighter shade, but also confers high physical and mechanical properties to the wet-white leather.*

Keywords: *wet-white leather, sulfone syntan, aluminium tanning agent, combination tannage, light fastness.*

1.1 BC-BN combination tannage

Note that when the dosage of BN increases from 3% to 5%, the *T*s of the combination tanned leather increases slightly, but its uptake does not increase anymore, and even decreases instead. Therefore, 10% BC and 3% BN are used in the subsequent combination tanning experiments, which can

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confer the wet-white leather with shrinkage temperature of ~81°C. The duration of most leather manufacture processes is determined by the duration of penetration of chemicals through the skin layers, as the interaction of chemicals with the dermis is much faster than those substances are absorbed into the skin. For this reason, a lot of effort is being put into developing methods or equipment for hide/leather treatment that would speed up the penetration of solutions into the skin.

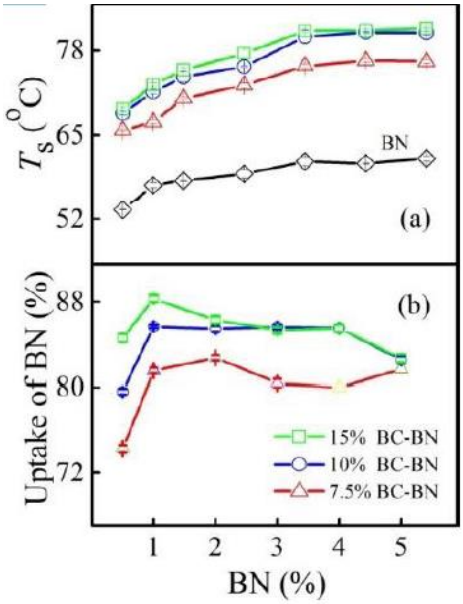

Figure 1 - *T*s of wet-white leathers (a) and uptake of BN (b) as a function of BN dosage

Figure 2 shows the effect of final pH on *T*s of wet-white leathers. It is clear that pH ranging from 4,0 – 4,5 can mostly benefit the improvement in *T*s. Therefore, the final pH of 4,0 – 4,5 is preferred in the combination tannage.

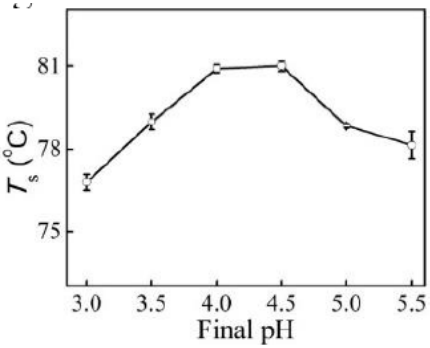

Figure 2 - *T*s of combination tanned leathers as a function of final pH

1.2 SEM-EDX analysis

As can be seen from Figure 3a, solo BC tanned collagen fibres are closely woven with each other to form a stratified collagen fibre bundles. At a higher magnification level (Figure 3b), it shows clear fibrils with smooth surface. After the introduction of BN (Figure3c and d), the combination tanned collagen fibres are more tightly woven due to the effect of Al3+ tanning agent.

The distribution of tanning agents in collagen fibres was also studied as shown in the corresponding EDX spectra (Figure 4). Both sulfur (S) and aluminium (Al), the feature elements in BC and BN, respectively, are homogeneously distributed in the vertical section of the wet-white leather, demonstrating that BC and BN can uniformly penetrate into leather matrix. It can be expected that a reasonable good wet-white leather properties can be resulted.

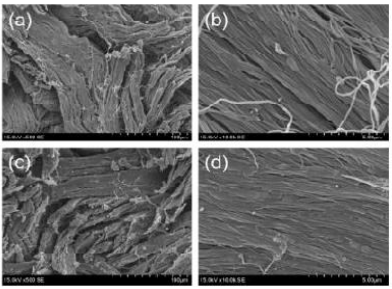

Figure 3 - SEM images of cross sections of solo BC tanned leather (a and b) and BC-BN combination tanned leather (c and d)

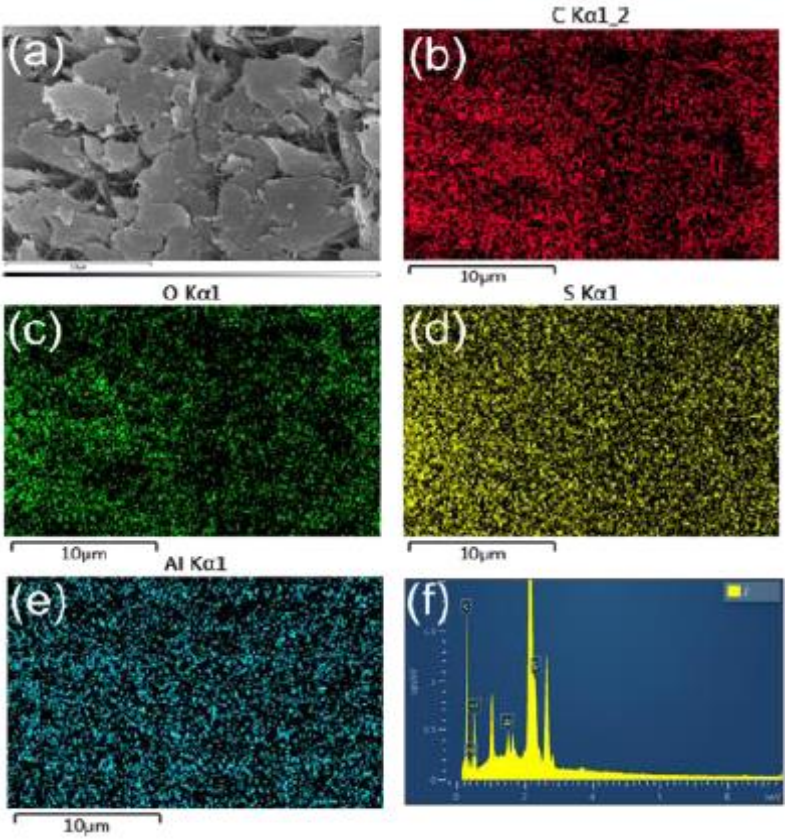

Figure 4 - SEM image of vertical section of the BC-BN combination tanned leather (a); EDX elemental mappings of carbon (b), oxygen (c), sulfur (d) and aluminium (e); and corresponding EDX spectrum (f)

1.3 Color analysis

Compared with solo BC tanning, the BC-BN combination tanned leather gives a lighter shade, as indicated in the L^* value (Figure 5a). Light fastness is assessed by the exposure of the wet-white leathers in UV irradiation.1 It can be seen that the L^* value of the combination tanned leather is always higher, whereas the color difference (ΔE) is lower (Figure 5b) for an extended irradiation time, suggesting that the introduction of BN can endow wet-white leathers with better light fastness. A solution with the following composition was used to study the unhairing process: NaCl 80

g/l, NaOH (100%) - 100 g/l, Na_2S (100%) - 80 g/l. The samples were treated by the solution in two ways.

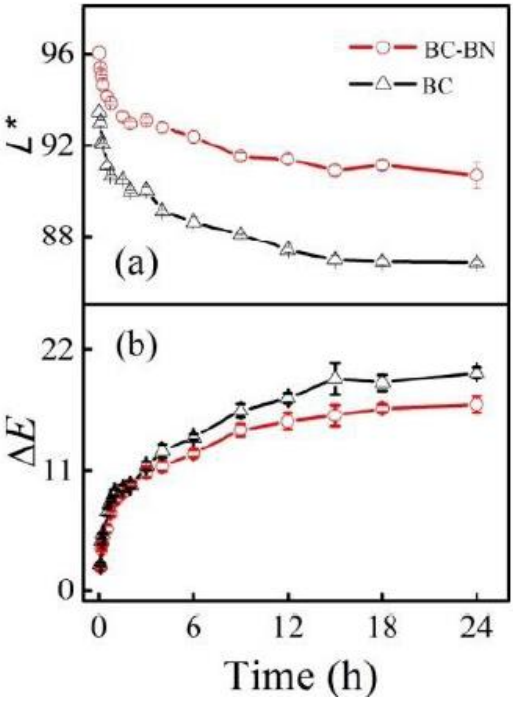

Figure 5 - L^* (a) and ΔE (b) of wet-white leathers under UV radiation for 24 h

1.4 Physical and mechanical properties measurements

Table I - Physical and mechanical properties of BC-BN combination tanned leathers

Parameters	BC-BN tanned leathers	Standard for shoe upper leather
Tensile strength (MPa)	17,2±1,3	-
Tear strength (N)	40,0±1,6	≥20
Elongation at 10N (%)	16,9±2,4	≤40
Bursting strength (N/mm)	207,4±3,8	≥200
Ts (°C)	80,9±0,4	≥80

Table presents physical and mechanical properties of the wet-white leather tested with the official methods recommended by IULTCS. All of these physical and mechanical properties can meet the Chinese standard requirements for shoe upper leather2. It suggests that the BC-BN combination tannage is a promising approach and can be applied in shoe upper leather manufacture.

Conclusions

In the present study, a novel combination tanning approach based on BC and BN for lightfast wet-white leather manufacture has been established. The 10% of BC and 3% BN at final pH 4,0 – 4,5 can endow the leather with *T*s above 80°C. Both of the two are evenly bound within the the leather matrix, and make the collagen fibres isolated and compact. The introduction of BN (Al^{3+}) into BC (sulfone syntan) gives it lighter shade and better light fastness. The combination tanned leathers have reasonable good physical and mechanical properties that can meet official standard requirements for shoe upper leather.

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