Spent Turmeric Oleoresin in Leather Processing

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Spent Turmeric Oleoresin in Leather Processing

V Ramadevi Pabbineedi†, Kalarical Janardhanan Sreeram†*, Aravindhan Rathinam‡

† Centre for Analysis, Testing, Evaluation and Reporting Services (CATERS) Department, CSIR-Central Leather Research Institute, Adyar, Chennai, Tamil Nadu, 600 020, India

‡Leather Process Technology Department, CSIR-Central Leather Research Institute, Adyar, Chennai, Tamil Nadu,

Ref. No. TI-110/O

600 020, India

Abstract:

This study explores the application of spent turmeric oleoresin (waste generated from turmeric industry) as a sustainable post-tanning agent in leather processing. It emphasizes filling and lubrication properties of spent turmeric oleoresin. In addition, from DPPH radical scavenging capacity of spent turmeric oleoresin, the potential of antioxidant property comes as an advantage. An esterified product of spent turmeric oleoresin was applied as a retan-fatliqour in the post-tanning process. Strength properties and softness of leather were on par with the control leather (commercial post-tanning agents). Hence, spent turmeric oleoresin has a great scope in leather industry as a sustainable alternative in post-tanning process and more feasibility exists in its application. Its utility in leather and leather products reduces the usage of commercial petrochemical originates and environ-mental pollution in leather sector.

Keywords: Spent turmeric oleoresin, leather, retan-fatliquor, sustainability

1. Introduction:

Identification and manufacturing of sustainable chemicals get challenging with imposed rules by ZDHC (Zero

Corresponding author E-mail : kjsreeram@gmail.com

Discharge of Hazardous Chemicals)1. Many alternatives have been developed for various chemicals in different stages of leather processing2. Sustainable perspective in sourcing of raw material to the synthesis of final product accounts for the impact assessment of final product. Spent

turmeric oleoresin is a viscous, dark orange fluid that remains after curcumin is extracted from turmeric oleoresin3. It has been used as a valuable ingredient in botanical fungicides4 and other applications instead of being treated as waste. In this study, feasibility of spent turmeric oleoresin as a post-tanning agent has been addressed.

2. Methodology:

Esterification of Spent turmeric oleoresin with Polyethylene glycol 200 in presence of p- toluene sulphonic acid was carried out at 160°C. The resulted ester was used in the post-tanning stage without any further purification. Wet blue goat skins were used as raw materials for leather processing and the quantity of chemicals applied on to leather were based on percentage of shaved weight. Procedure for leather processing using conventional post-tanning chemicals (Control) was described in Table 1 and for the ester as post-tanning agent (Spent Turmeric Oleoresin) in Table 2. The processed leathers were air dried, buffed and stacked, followed by their evaluation of mechanical strength properties as per standard protocols5–8.

Table 1. Process recipe for an upper leather using conventional post-tanning chemicals (Control)

Process Chemicals % Offered Duration (min) Remarks

Water 150 Wetting agent 0.5 Oxalic acid 1 Water 150 Neutralizing agent 0.3 30 Sodium formate 0.3 Sodium bicarbonate 0.3 60 Washing Water 100 10 Drain Water 50 Acrylic Syntan 3 30 Synthetic fatliquor 2 Wattle powder 3 30 Phenolic syntan 5 Protein filler 2 30 Water 100 Synthetic fatliquor 5 60 Vegetable oil fatliquor 1 Formic acid 3 40 Cationic fatliquor 1 30

Wet back 60 Drain Wash and Drain

Neutralization

Re-tanning

Fatliquoring

Fixing

Washing Water 100 10 Drain, piled, set, buffed

Table 2. Process recipe for an upper leather using ester as post-tanning agent (Spent Turmeric Oleoresin)

Process Chemicals % Offered Duration (min) Remarks

Water 150 Wetting agent 0.5 Oxalic acid 1 Water 150 Neutralizing agent 0.3 30 Sodium formate 0.3 Sodium bicarbonate 0.3 60 Washing Water 100 10 Drain Water 50 Ester 20

Wet back 60 Drain Wash and Drain

Neutralization pH 5.2-5.5; Drain

__ Re-tanning

and 120

Fixing Formic acid 3 40 Acid was given in three

Washing Water 100 10 Drain, piled, set, buffed

pH 5.2-5.5;

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Extension was Checked

Acid was given in three

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to uniform thikness

feeds

to uniform thikness

3. Result & Discussion

The mechanical strength properties of leather using control and spent turmeric oleoresin as a post-tanning agent were given in Figure 1. All strength properties suggest that leathers processed with spent turmeric oleoresin have similar/improved properties when compared to conventional post-tanning chemicals. As evident from

Figure 1. Mechanical strength properties of leather using conventional post-tanning agents (blue) and spent

turmeric oleoresin (grey) a post-tanning agent.

Conclusion

Spent turmeric oleoresin has been explored as a potential sustainable post-tanning agent. The synthesis and applicability in leather processing as a replacement for conventional chemicals is evident from the strength properties of leather. Been originated naturally and as a waste generated from turmeric industry, the environmental impact and sustainability of spent turmeric oleoresin is appreciable than the commercial petrochemical originates in the leather sector.

Reference:

(1) ZDHC-Manufacturing Restricted Substances List, 2026 .

Table 1 and 2, eight different types (18%) of post-tanning chemicals were used in conventional processing as against a single chemical (20%) for the spent turmeric oleoresin, without compromising in strength properties. Softness, tensile and tear strength values highlight the applicability of the synthesized product as a potential single-go retanfatliquor in the post-tanning phase.

(2) Sultana, R.; Rashid, T. U.; Rahman, M. M.

Sustainable Leather Processing: A Critical Review of Emerging Green Technologies and Practices. Sustainable Futures 2026, 11, 101562. https:// doi.org/10.1016/j.sftr.2025.101562.

(3) Antidiabetic and Antioxidant Potentials of Spent

Turmeric Oleoresin, a by-Product from Curcumin Production Industry.

(4) Gopika, S. K.; Subramanian, R. Recovery of

Bioactive Volatiles from Byproduct of Curcumin Manufacture by Membrane Processing. Industrial Crops and Products 2020, 158, 112984. https:// doi.org/10.1016/j.indcrop.2020.112984.

(5) IUP 2, Sampling. Journal of the Society of Leather

Technologies and Chemists 2000, (84), 303.

(6) IUP 6, Measurement of Tensile Strength and

Percentage Elongation. Journal of the Society of Leather Technologies and Chemists 2000, (84), 317.

(7) IUP 8, Measurement of Tear Load-Double Edge

Tears. Journal of the Society of Leather Technologies and Chemists 2000, (84), 327.

(8) IUP 9 Measurement of Distension and Strength

of Grain by the Ball Burst Test; 1996.