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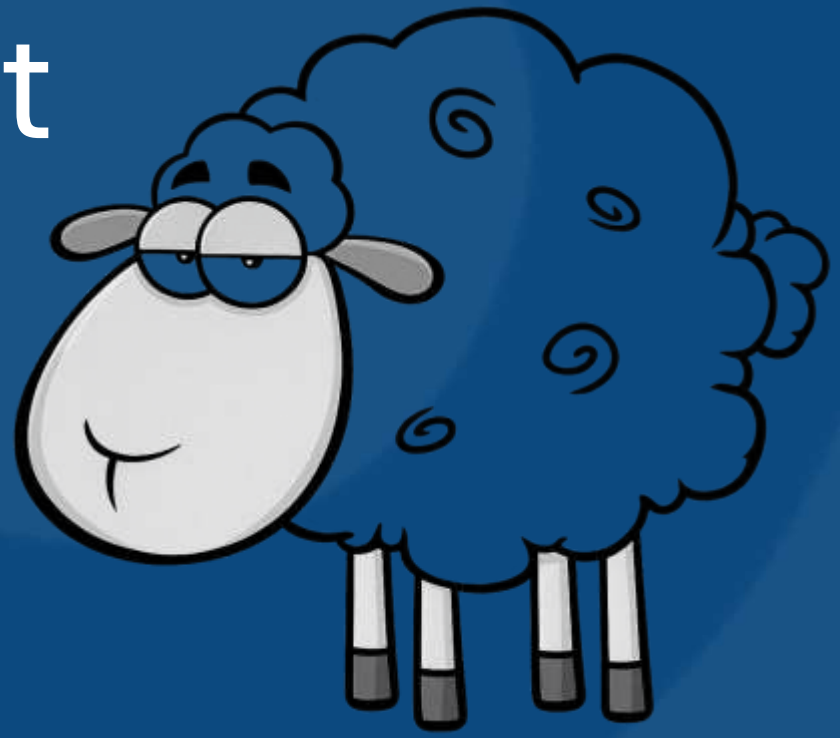
SPRINGWOOL project
Wool Biorefinery



Dr. Tielidy de Lima

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Bioengineering Organ-on-a-Chip Research Group

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TUS Ollscoil Teicneolaíochta na Sionainne: Lár Tire, An tIarthar Láir
Technological University of the Shannon: Midlands Midwest

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An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

SPRINGWOOL

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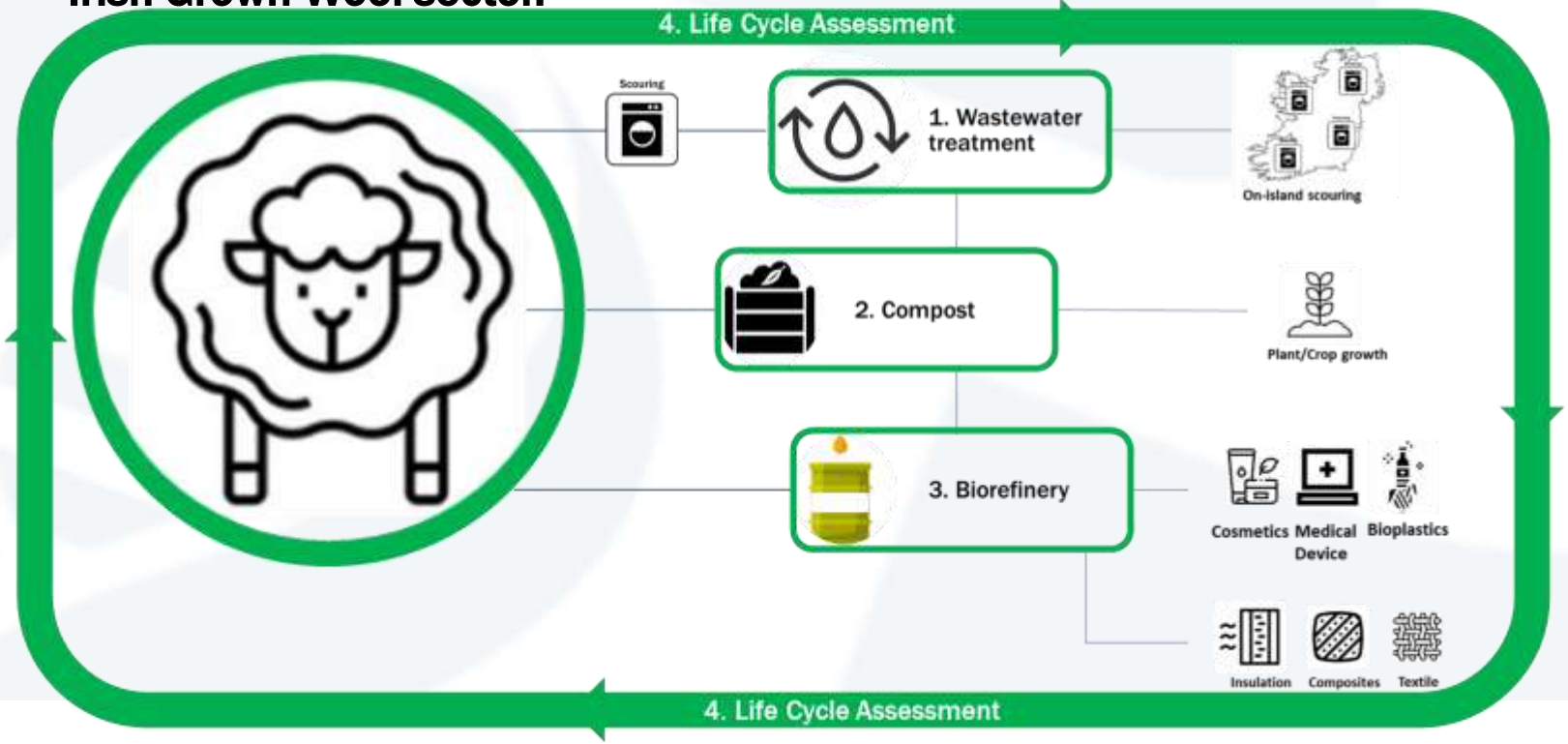
€574,773

Removing bottlenecks and providing a springboard for innovation in the Irish Grown Wool sector.



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Raw Wool: Processing & Applications



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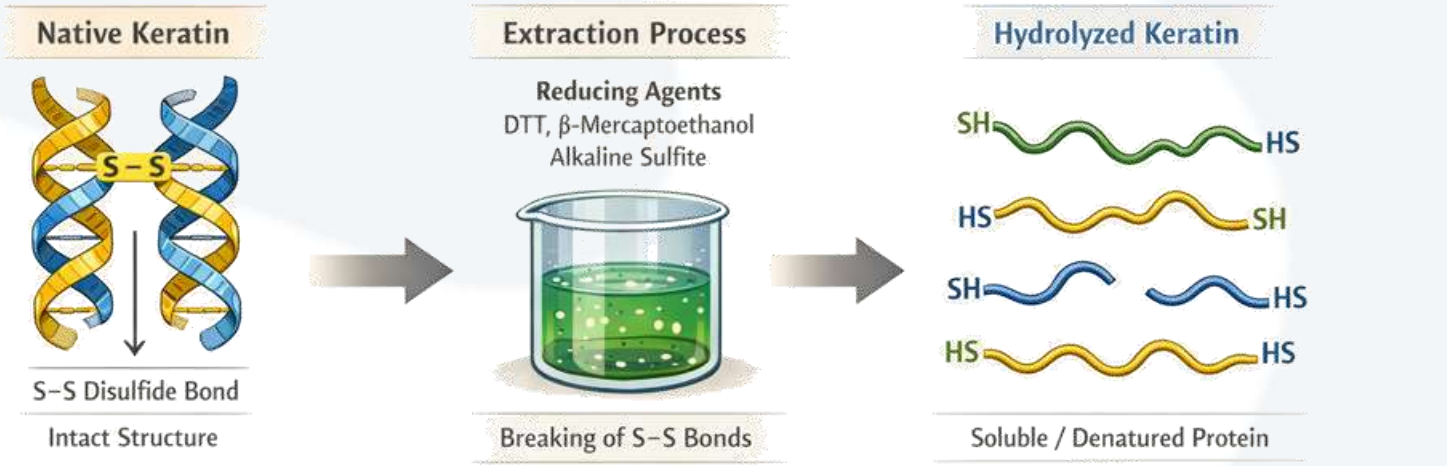
1) Wool Biorefinery: Keratin Extraction

Wool → ~ 95% Keratin fibres → Structure → Peptides chains → Amino acids







Sample 1 Urea | Sample 2 Urea | Sample 3 NaOH | Sample 4 NaOH

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1) Wool Biorefinery: Keratin Extraction

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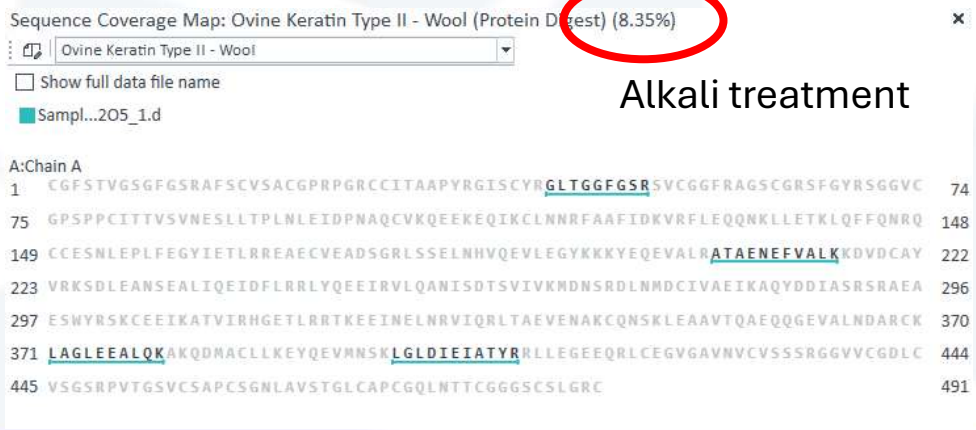
LCMS results

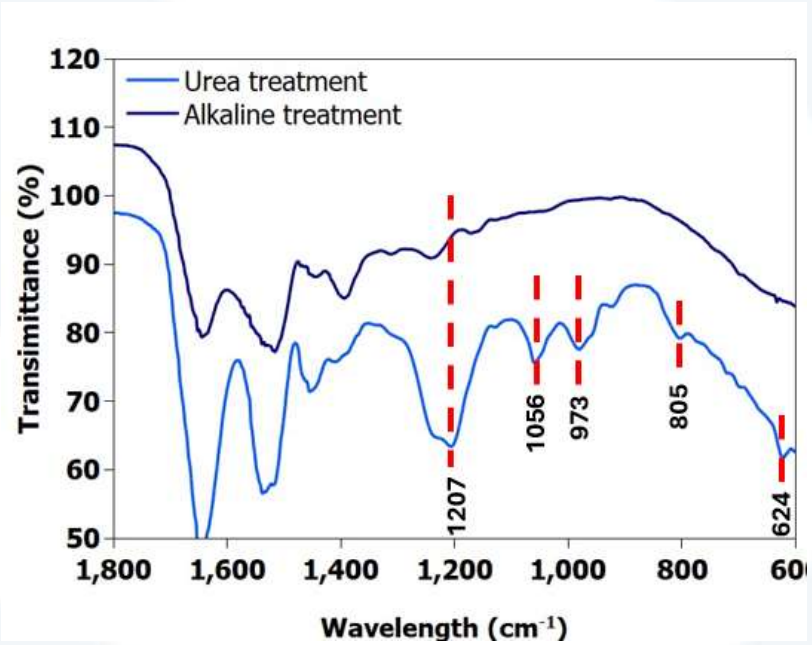
Urea treatment





Alkali treatment

FTIR results



Wavelength (cm^{-1})	Bond / Vibration
1207	C–N (Amide III)
1056	C–O / C–O–C (side chains)
973	N–H (out-of-plane)
805	C–S / secondary bonds
624	Peptide backbone / aromatic deformation

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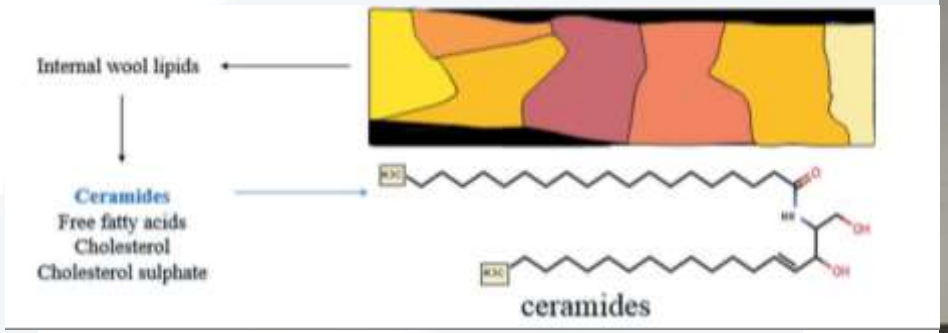
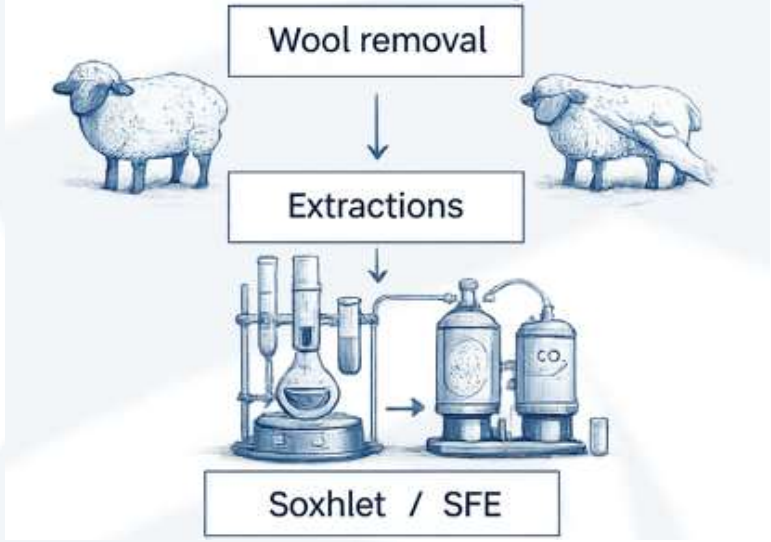
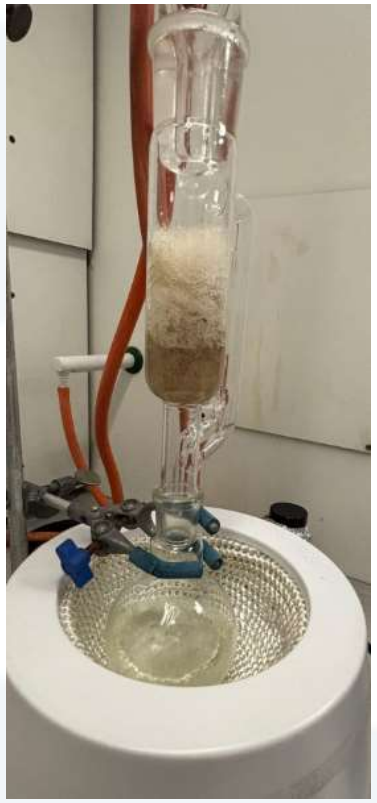
1) Wool Biorefinery: Ceramides Extractions

Wool → External lipids and internal lipids (1.5%) → high proportion of ceramides.









Soxhlet Extraction (SE)

High solvent consumption
Long extraction time
Organic Solvents

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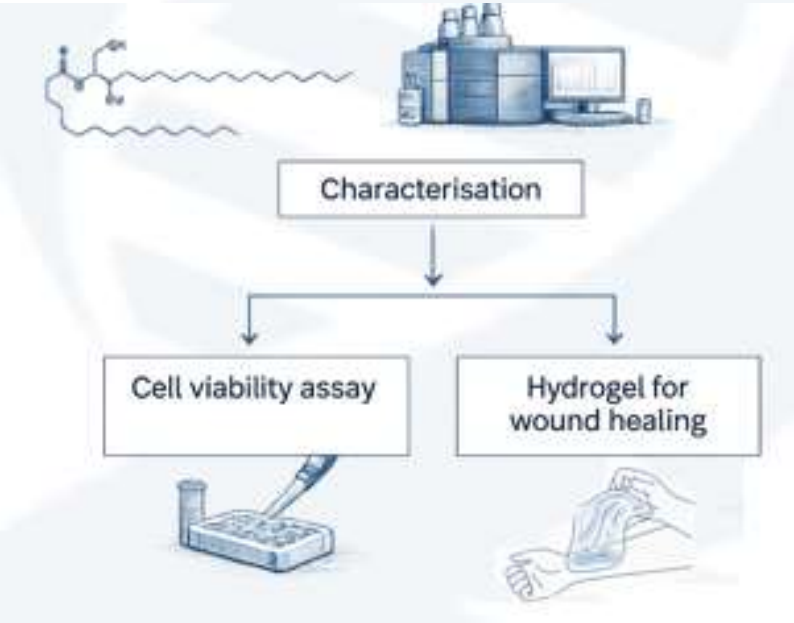
1) Wool Biorefinery – Ceramides Extractions





Supercritical Fluid Extraction (SFE)

Faster extraction
Environmentally friendly
Low solvent consumption
High efficiency and selectivity

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1) Wool Biorefinery – Ceramides Extractions

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Extractives after Soxhlet extraction



Solvent casting

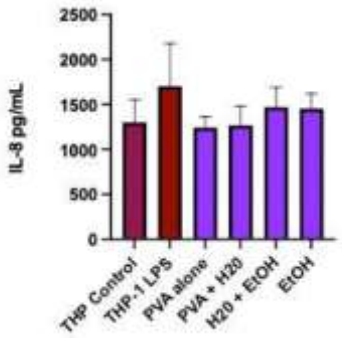


method to incorporate ceramide extracts into a film

Extract + PVA



stable matrix for testing





Evaluate the ability of ceramide extracts to improve skin barrier properties.

Potential application in cosmetic formulations for skin hydration and protection

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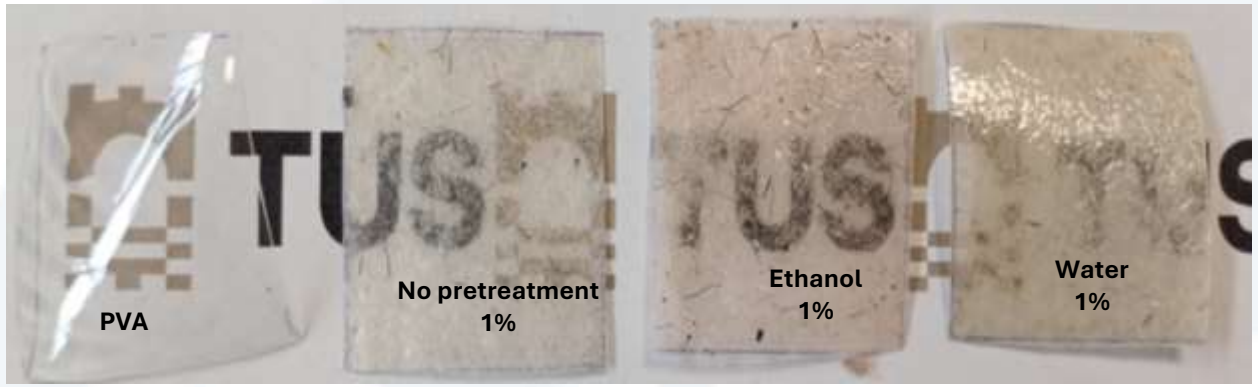
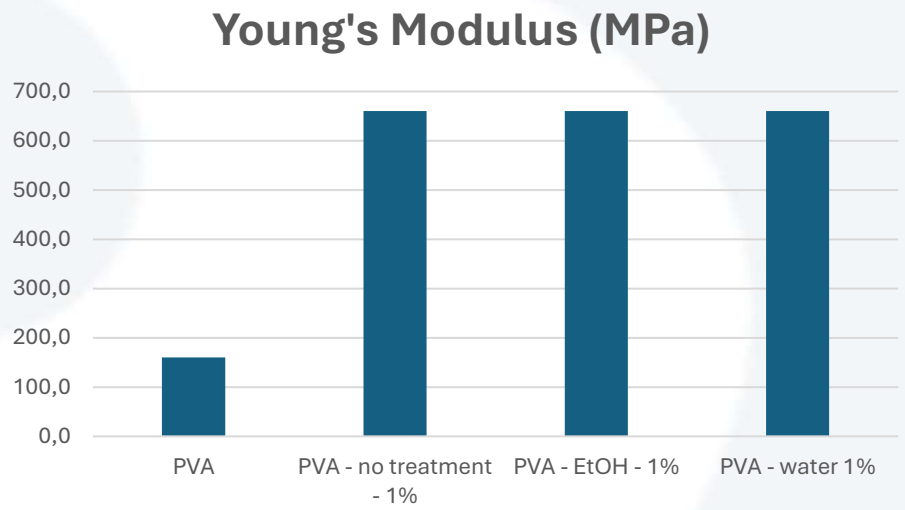
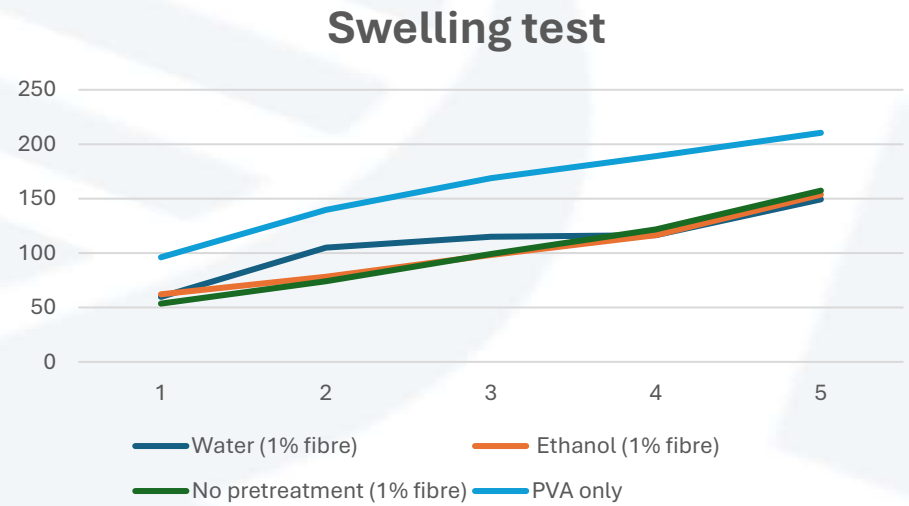
2) Wool fibres for packaging (PVA + fibres)







- ✓ Wool fibre addition significantly increased Young's modulus compared to neat PVA.
- ✓ Fibre incorporation reduced swelling, indicating improved dimensional stability.

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3) Treatment of scouring wastewater

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Characterise wastewater for physicochemical parameters and carry out pre-treatment to remove lipids and suspended solids.

1) Wastewater Characterisation:
BOD_5, COD, TSS, NO_3^-, TN, TP

2) Pre-Treatment of Wastewater

3) Recommendation of working mobile model for co-operative model approach



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Final Consideration

- Still need to explore greener, more sustainable extraction methods for keratin and ceramides.
- Isolation of ceramides from lipid samples.
- Preliminary characterisation from SE; next step is work with SFE.
- Studies on anti-inflammatory and wound-healing potential.

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European Wool Day®

Tralee, Ireland
28 March 2026

https://ewe.network/ewd2026/

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Thank you!

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