

Advanced Functional Materials for Sustainable Lubrication of Leather

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Principal Scientist

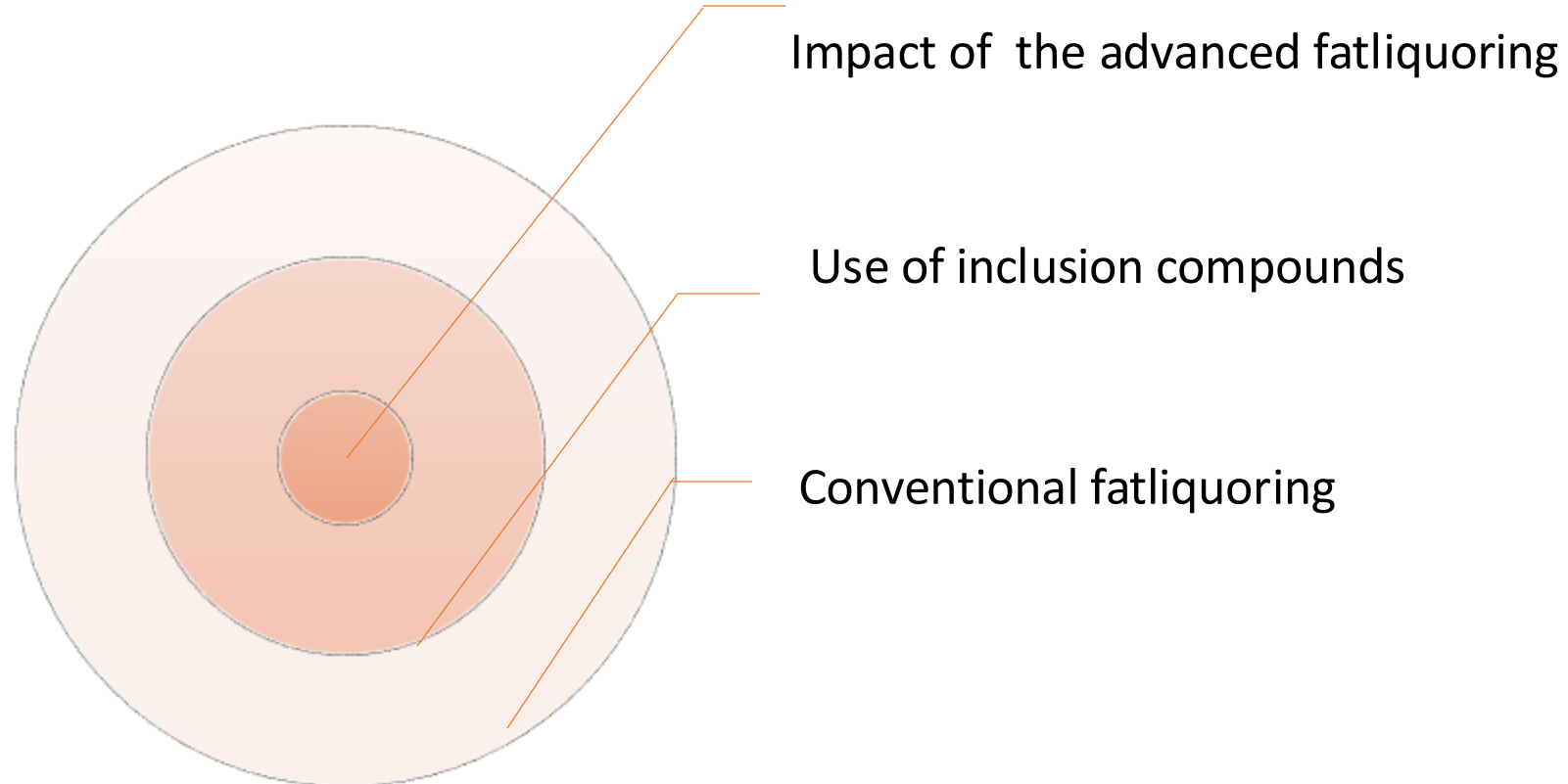
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An Overview of Work Carried Out



Fatliquoring-

Use of Surfactants

Chemical Modification of oil/fat

Issues-

Biodegradability

Surfactant environmental impact

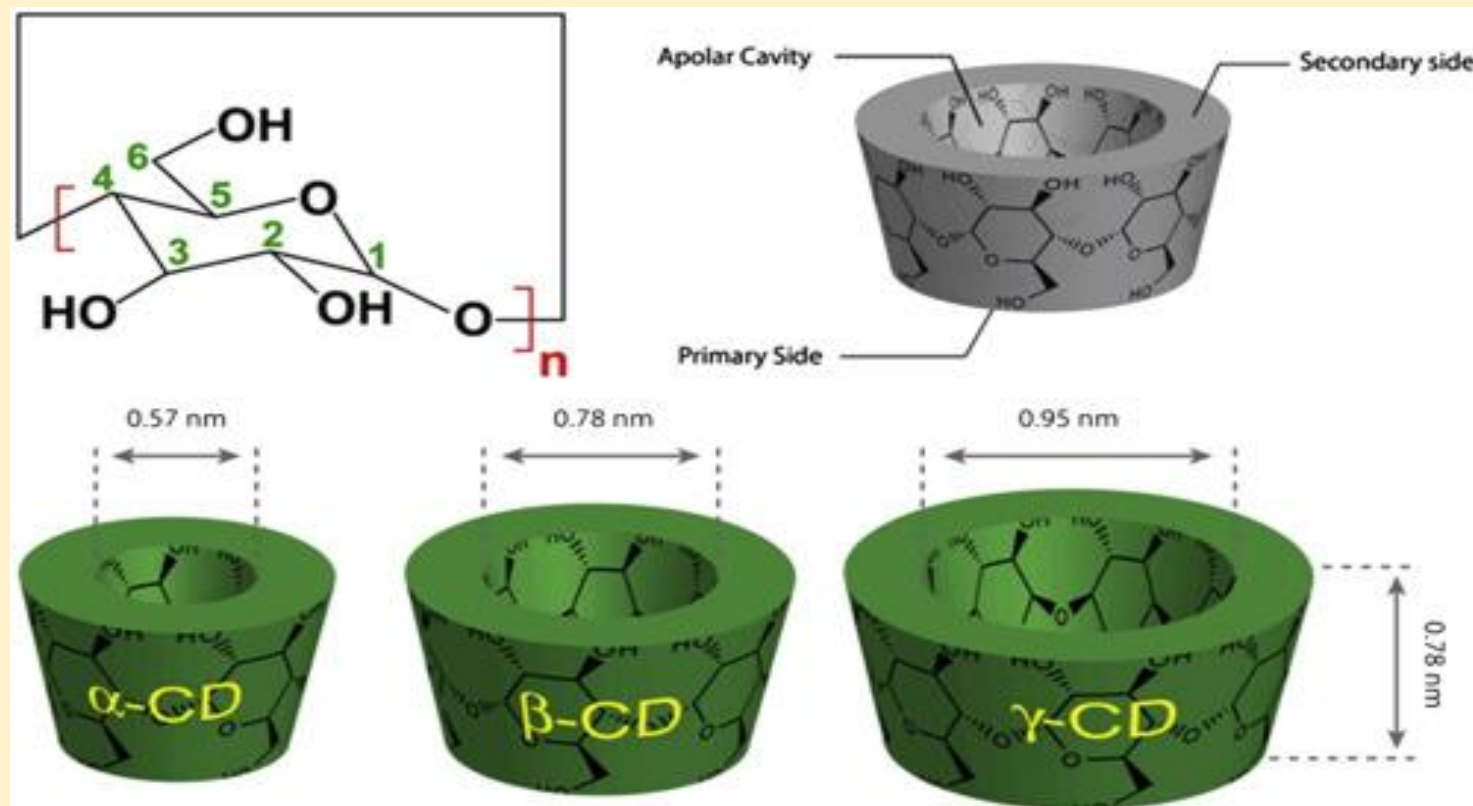
Solution

Less chemical uses

Without chemical modification of oil/fat

Without surfactants

Cyclodextrins (CDs) are cyclic oligosaccharides that contain at least six d-(+)-glucopyranose units linked by α -(1, 4) glucosidic bonds. The three natural CDs, α -, β -, and γ -CDs, have 6, 7, and 8 glucose units, respectively, and differ from each other in their size and solubility.

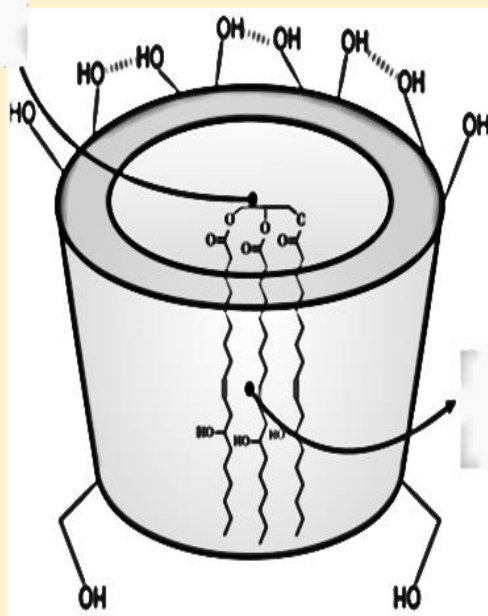


Inclusion compound- Cyclodextrin and fat/fatty acid-Surfactant free lubrication

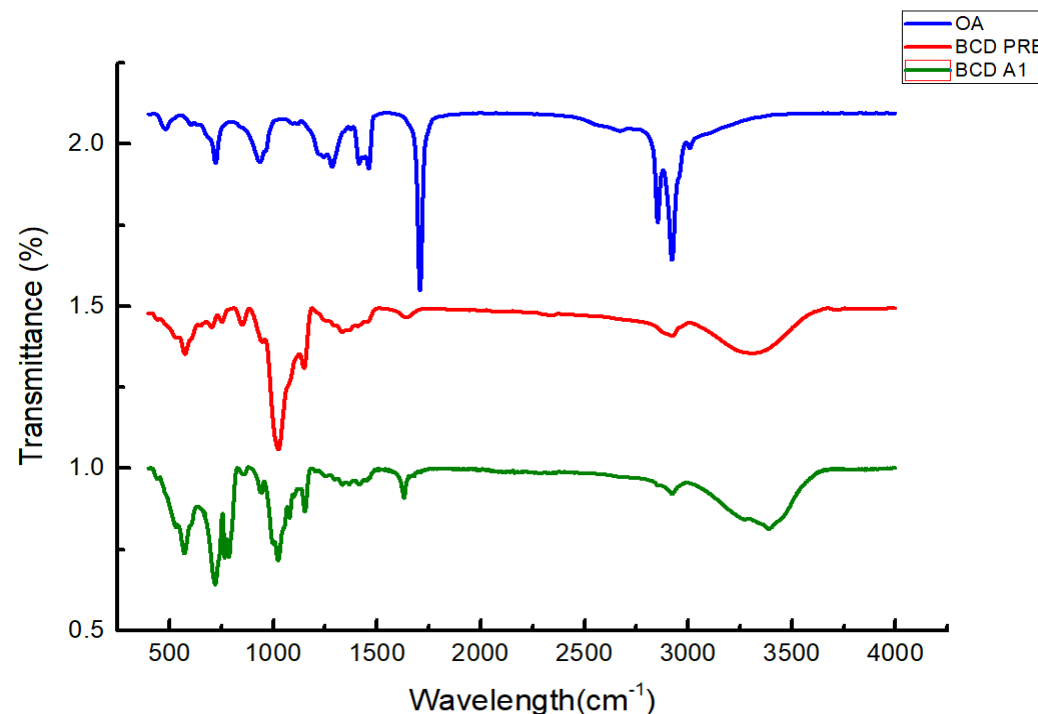
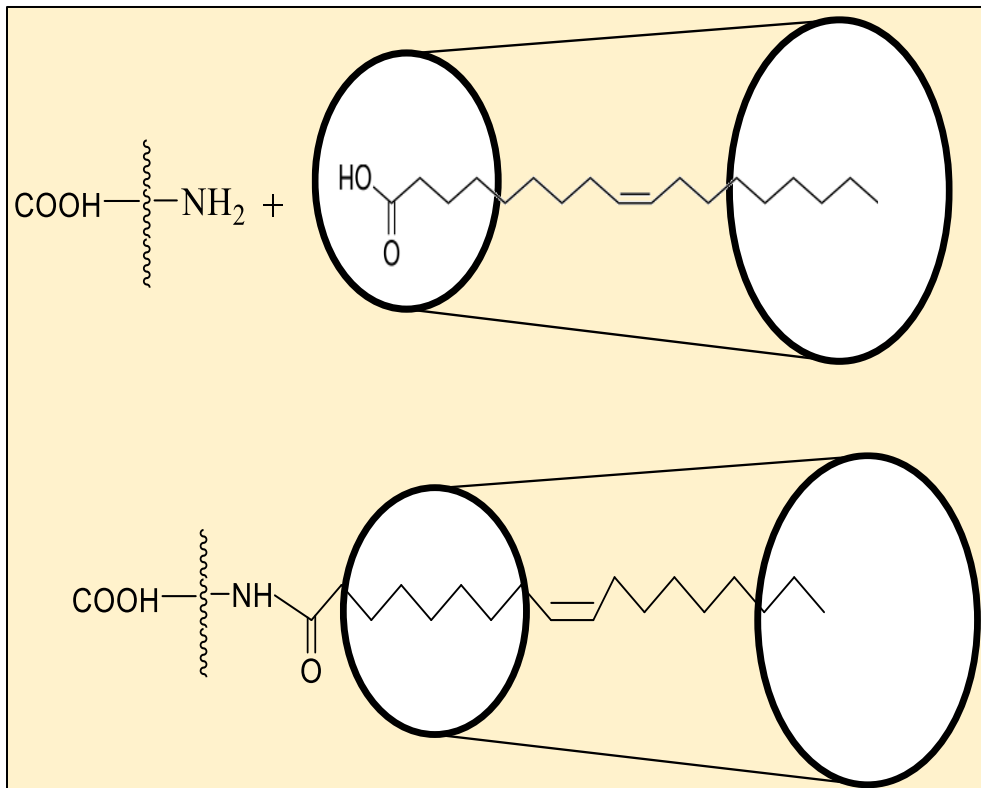
A stable Host Guest Assembly

- A cyclic oligosaccharide with a hydrophobic central cavity and hydrophilic exterior.
- Acts as a host to include lipophilic (fatty) molecules, forming a stable complex
- Fatty acids or fats are included inside the cyclodextrin cavity, reducing their direct interaction with other components.
- **Patent has been applied** – Application of oil and Cyclodextrin inclusion compound acted as retanning cum fatliquoring agent
- Applied 25 to 35 % of the product as replacement of the retanning and fatliquoring agent

Hydrophobic interactions



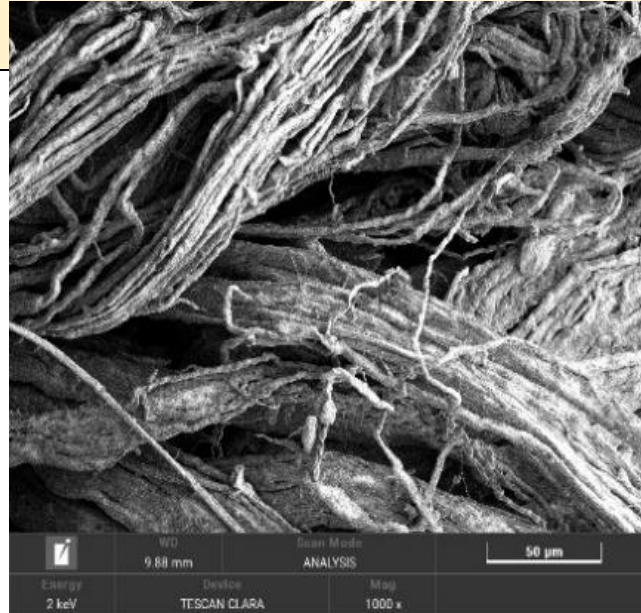
Castor oil inside the hydrophobic cavity



- **Oleic acid (OA)**-2853 and 2822 cm^{-1} (C-H) 1707 cm^{-1} (C=O), 1460 cm^{-1} (C-O)
- **β -CD**-3287 cm^{-1} (O-H) , 2923 cm^{-1} (C-H) , 1151 cm^{-1} (C-O), 1020 cm^{-1} (C-O)
- **OA/ β -CD inclusion complex (BCD A1)** characteristic peaks for OA at 2853, 1707 and 1460 cm^{-1} disappeared, suggesting that the carboxyl group of Oleic acid was probably entered into the cavity of β -CD and the vibrations of carboxyl group were restricted after the formation of inclusion complex.

Impact of fatliquoring

Fiber morphology-Clear lubricated and visible collagen



Experimental leather

Control Leather

Plant Regulatory effect



Post-tanning effluent
impact on plant growth

A stable Host Guest Assembly between Oleic acid and beta cyclodextrin

- The formulation provides lubrication without using traditional surfactants or emulsifiers.
- Benefits include reduced irritation, lower toxicity, and fewer environmental concerns.
- Enhanced stability of the active compounds.
- Improved bioavailability and controlled release.
- Plant regulatory effect
- Conductive crust leather

Physical testing parameters-

S. No	Sample	Tensile Strength (N/mm ²)	Elongation (%)	Tear Strength (N/mm)	Softness
1	Control	11.35±0.5	73±2	45.32±3	4/5
2	Experimental Leather	16.58±0.5	62±2	59.92±3	5/5

Team Member-



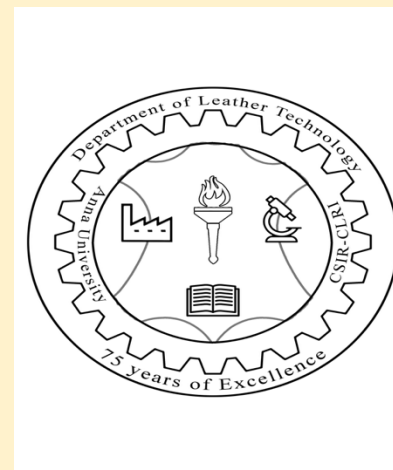
Acknowledgment –



(Specialty Chemicals Mission (MMP 035201))



Sustainable Manufacturing and
Environmental Pollution



Thank You