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# Effect of Surfactant–Keratin Hydrolysate Interactions on the Hydration Properties of a Stratum Corneum Substitute

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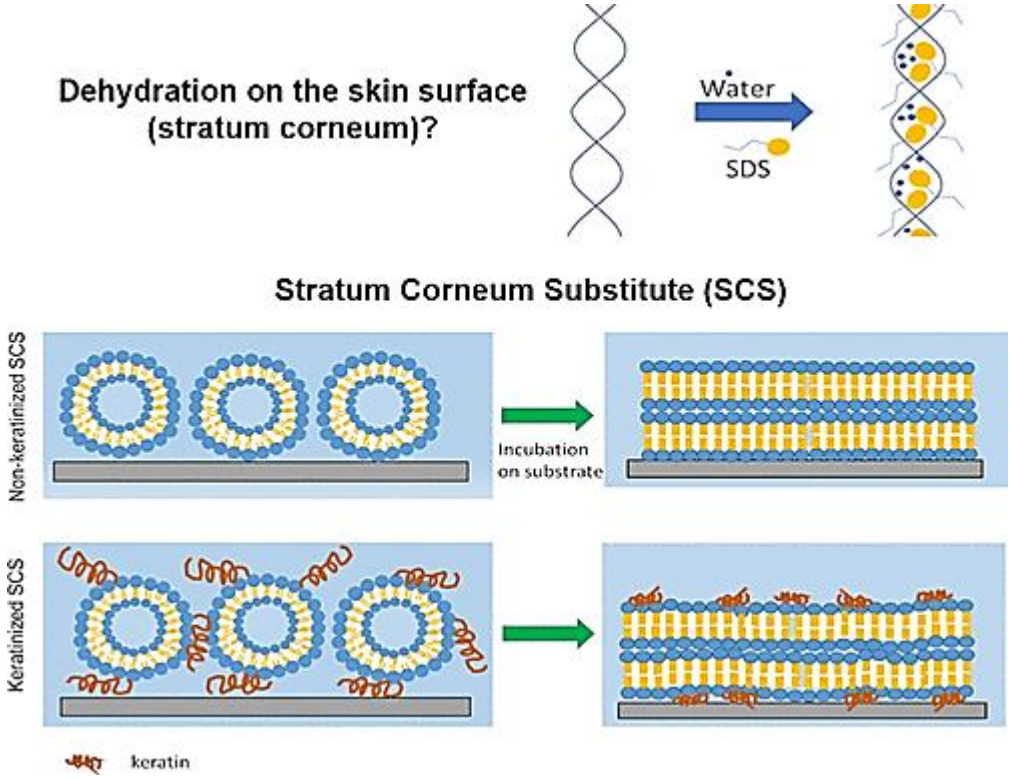
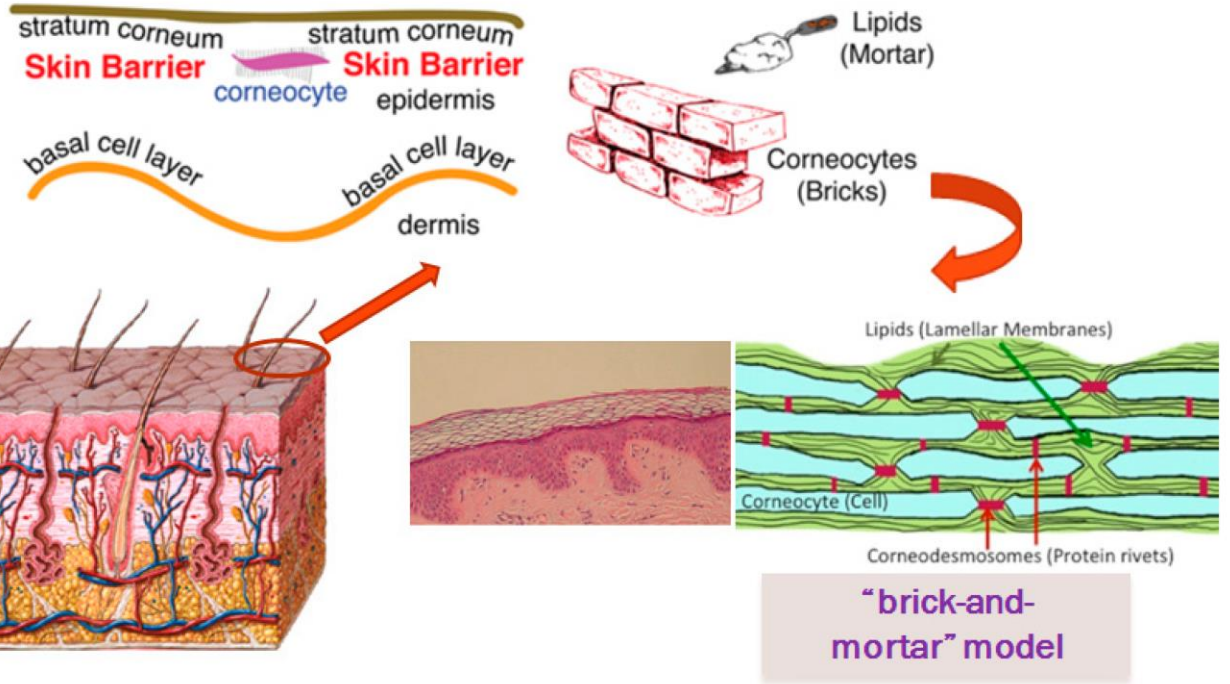



Tanvi Gupte

02.05.2020

# Why this paper?



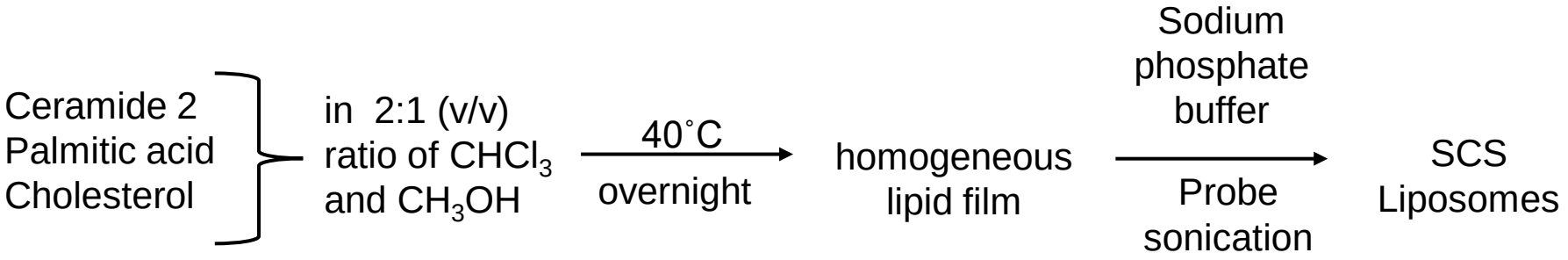

- Stratum corneum (SC): outermost skin layer, consisting of corneocytes and lipid bilayers.
- Corneocytes: keratinocytes cell organelles. Major constituents of corneocytes are keratin filaments.
- Stratum corneum substitute (SCS): skin model developed in this research.

# Introduction

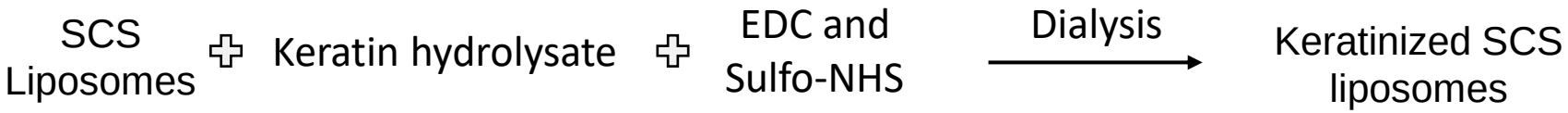
- A novel stratum corneum substitute (SCS) has been developed, to study the fundamental mechanism of the dehydration process.
- Changes in hydration of the SC are a suitable indicator to evaluate the irritation of surfactants on the skin.
- It is evident that both surfactant−protein and surfactant−lipid interactions can greatly influence the dehydration rate.
- **Significance of the paper**: an adequate skin model that helps in understanding the fundamentals of surfactant interactions with the SC at different time scales.

# Synthesis of SCS

**Liposomes**



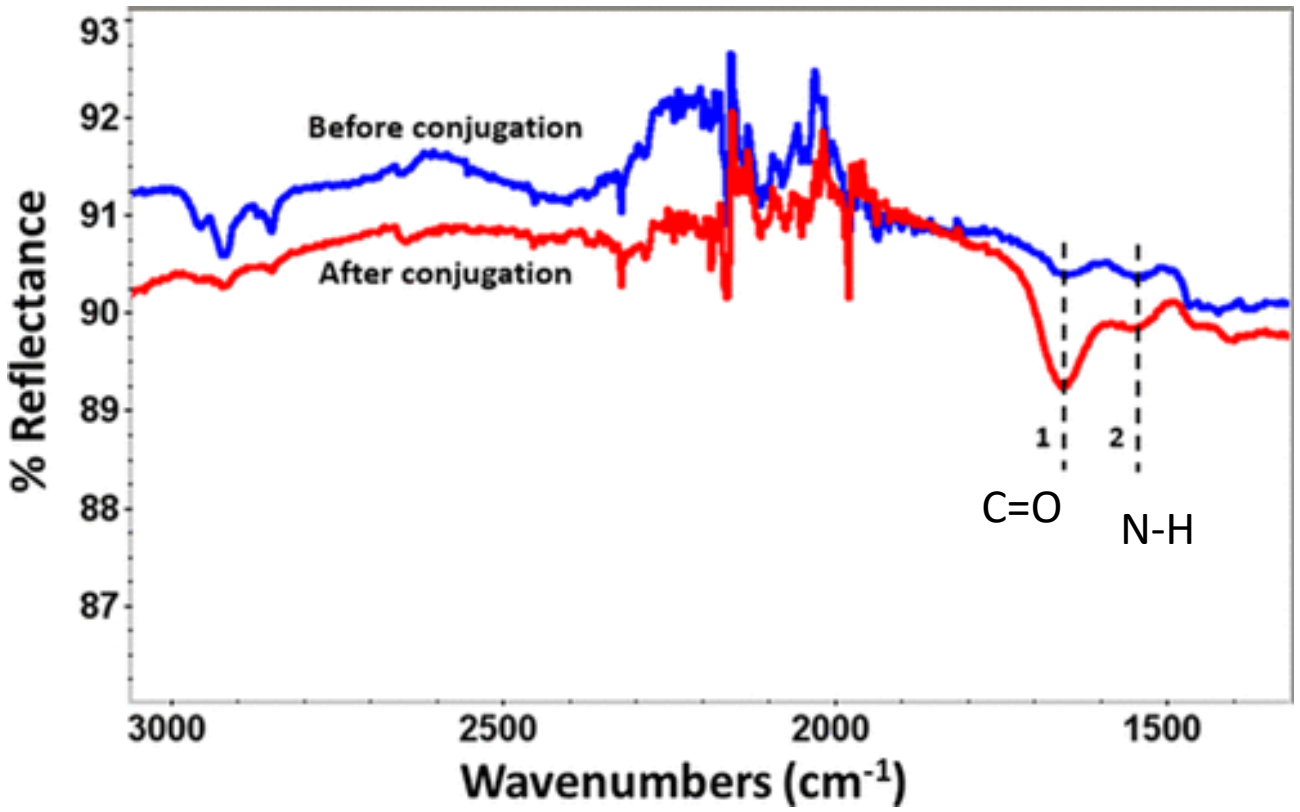

**Keratinized SCS liposomes**



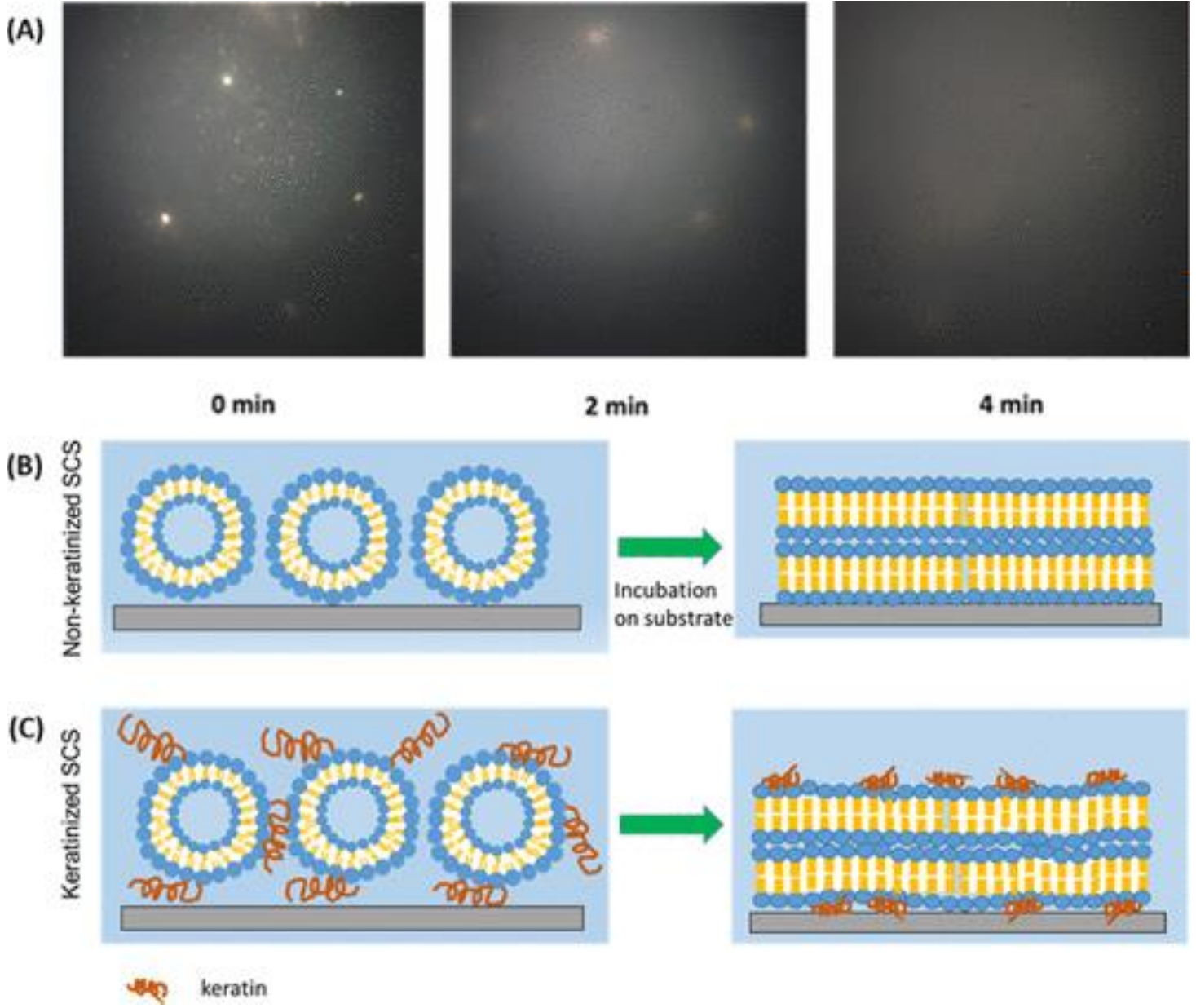

**Non-keratinized/keratinized SCS lipid bilayer**

Liposomes or Keratinized liposomes incubated on hydrophilic substrate

# Characterization of Non-Keratinized and Keratinized SCS Liposomes.

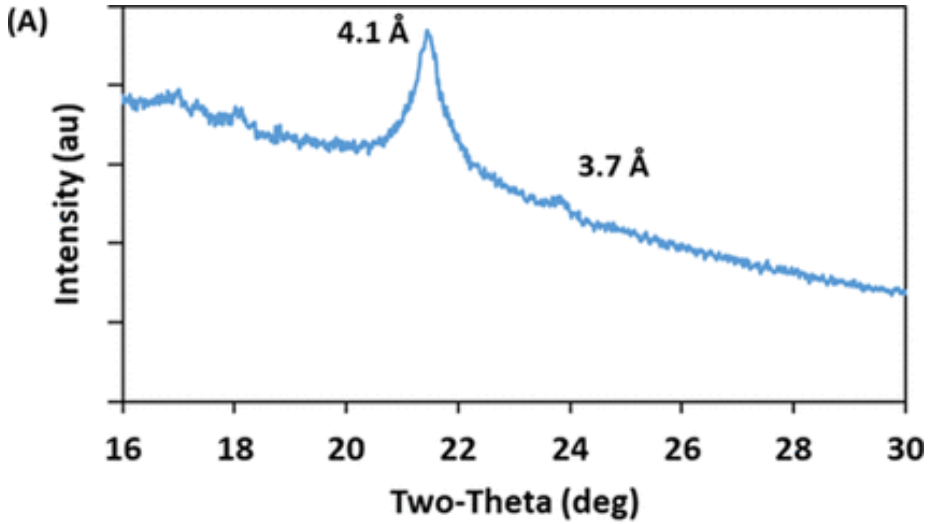


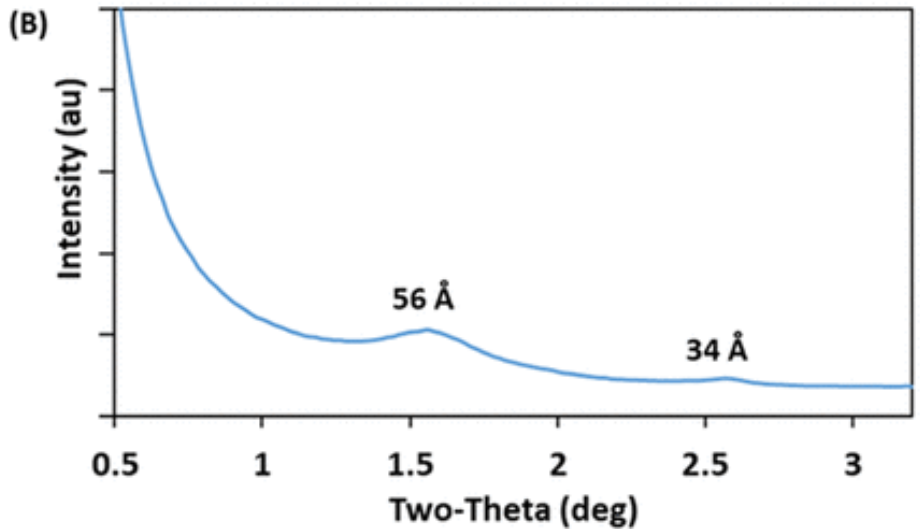

FT-IR data for non-keratinized SCS (blue) and keratinized SCS (red). The peak 1 near 1650 $cm^{-1}$ and peak 2 near 1547 $cm^{-1}$ correspond to amide bonds I and II, respectively.

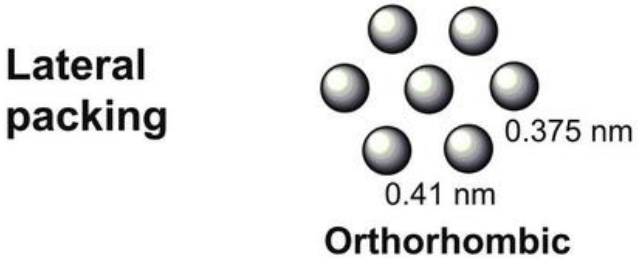


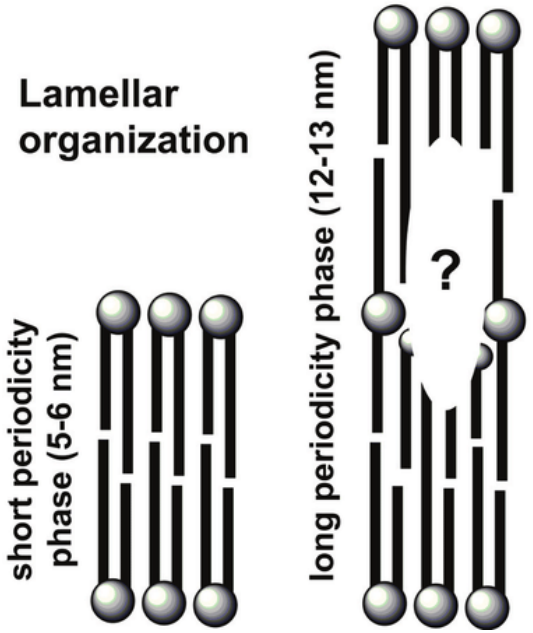

(A) Time-lapse dark-field images of SCS liposomes on a plasma-treated glass slide and schematics of the SCS layer formation for (B) non-keratinized SCS and (C) keratinized SCS on a hydrophilic substrate.

# Characterization of Non-Keratinized and Keratinized SCS Lipid Bilayers

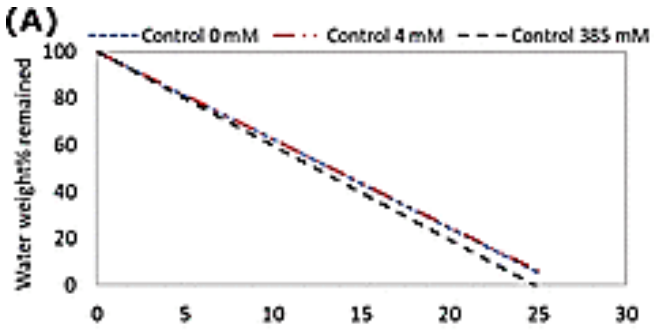


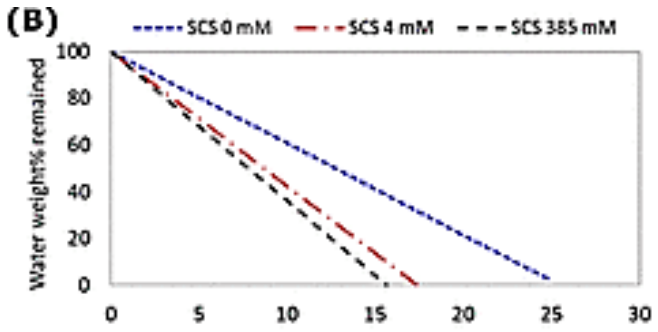



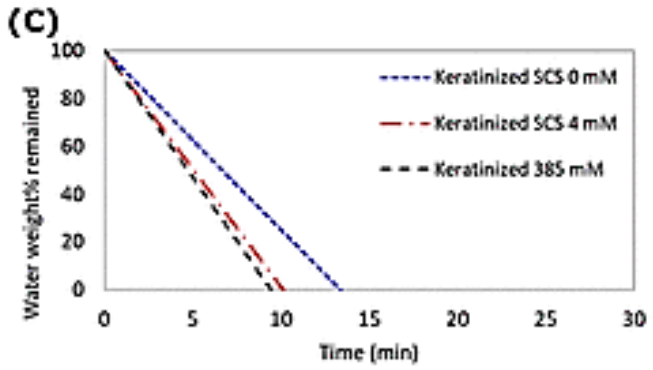



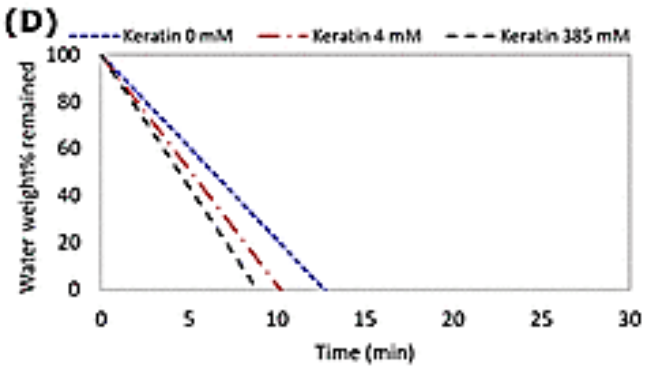



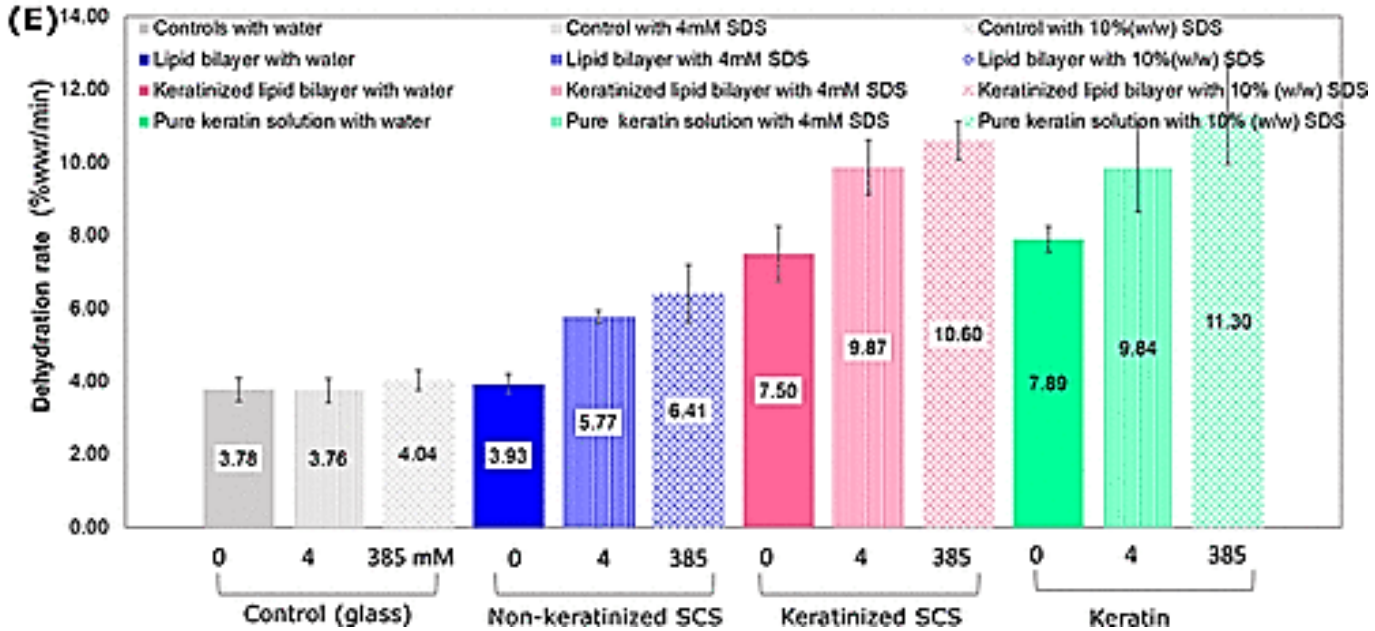

(A) Lateral packing: WAXS of non-keratinized SCS. (B) Lamellar phase: SAXS of non-keratinized SCS.



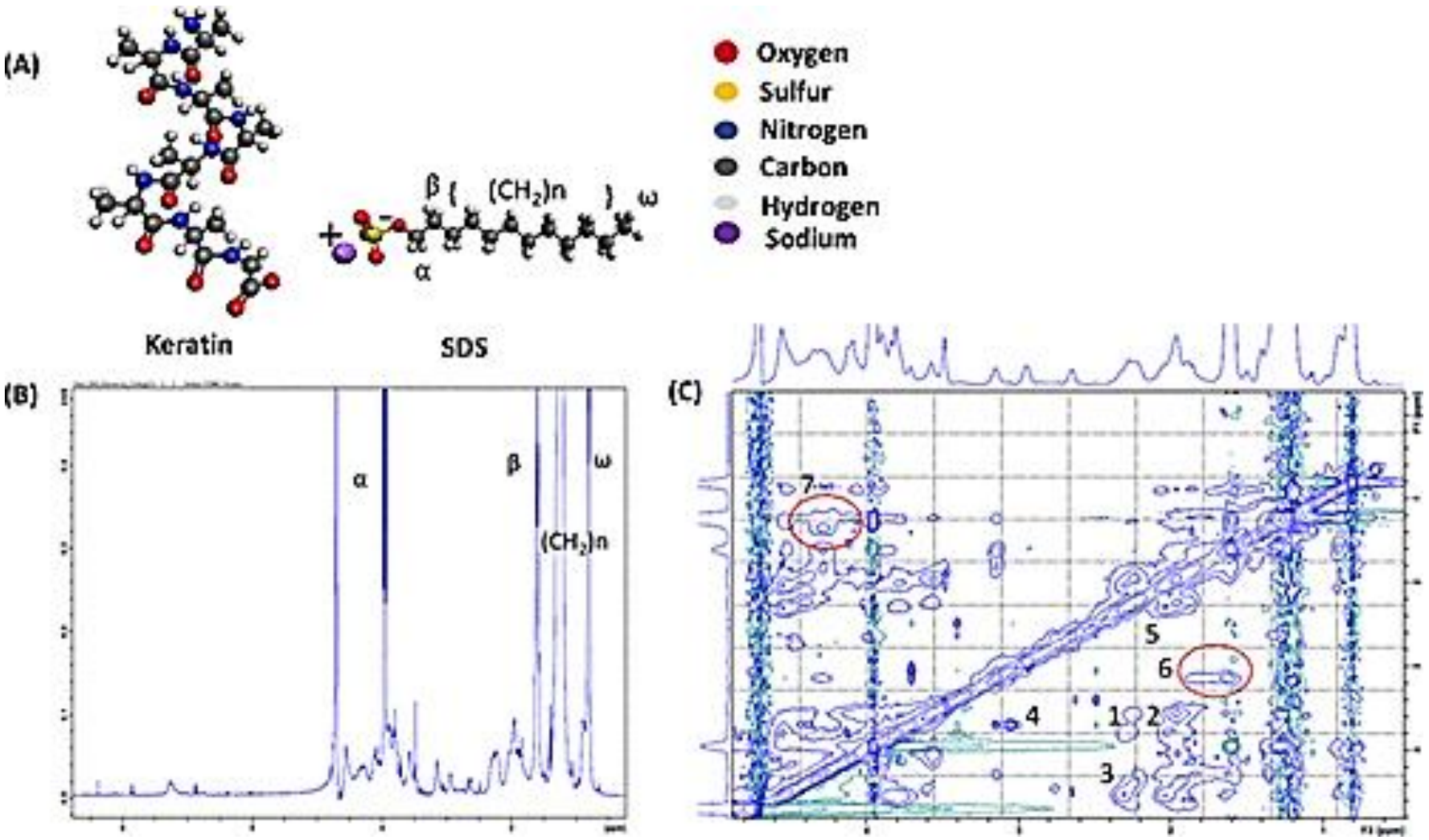




Dehydration rates (% wwr vs time) for (A) control,
(B) non-keratinized,
(C) keratinized lipid bilayer, and
(D) pure keratin hydrolysate samples and
(E) summary of the slope

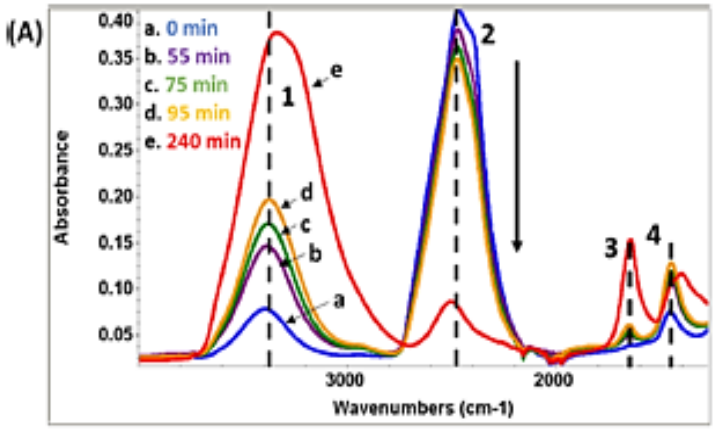
**Table 2. Contact Angle Data of Non-Keratinized SCS and Keratinized SCS with and without 10 wt % SDS**

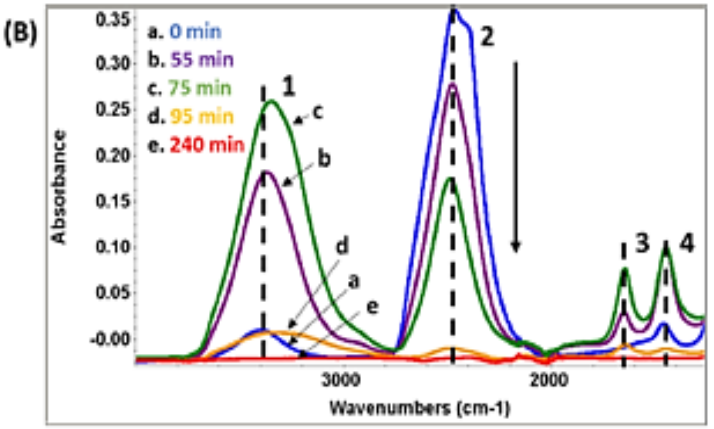
| | surfactant (SDS) | |
|---|---|---|
| | 0 mM (deg) | 385 mM (deg) |
| control (mica) | <1 | 17.8 |
| non-keratinized SCS layers | 12.9 | 19.2 |
| keratinized SCS layers | 22.3 | 32.4 |

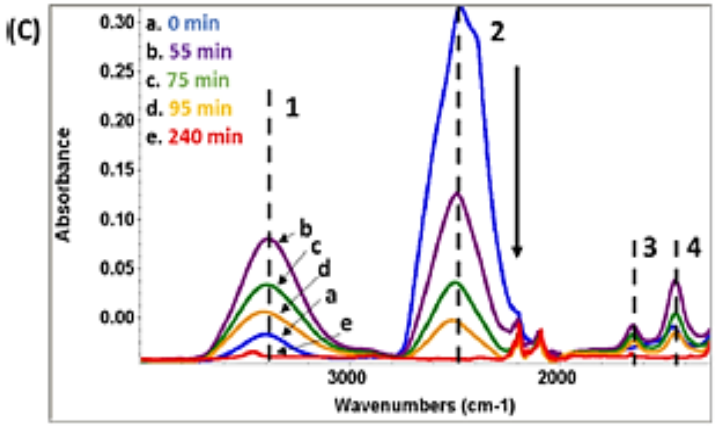
# Molecular Interactions between SCS and the Surfactant.

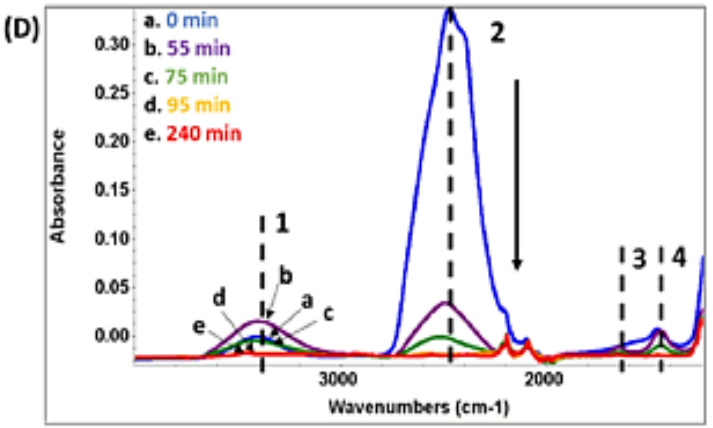


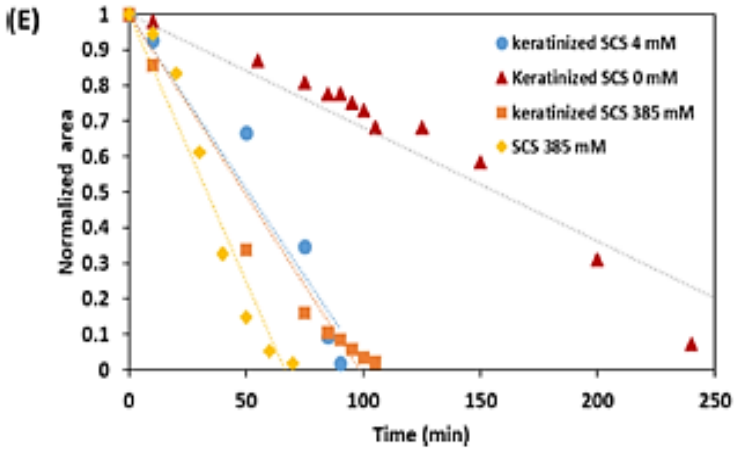

(A) Molecular structure, (B) $^{1}H$ proton, and (C) 2D NOESY spectra of the SDS/keratin hydrolysate mixture.



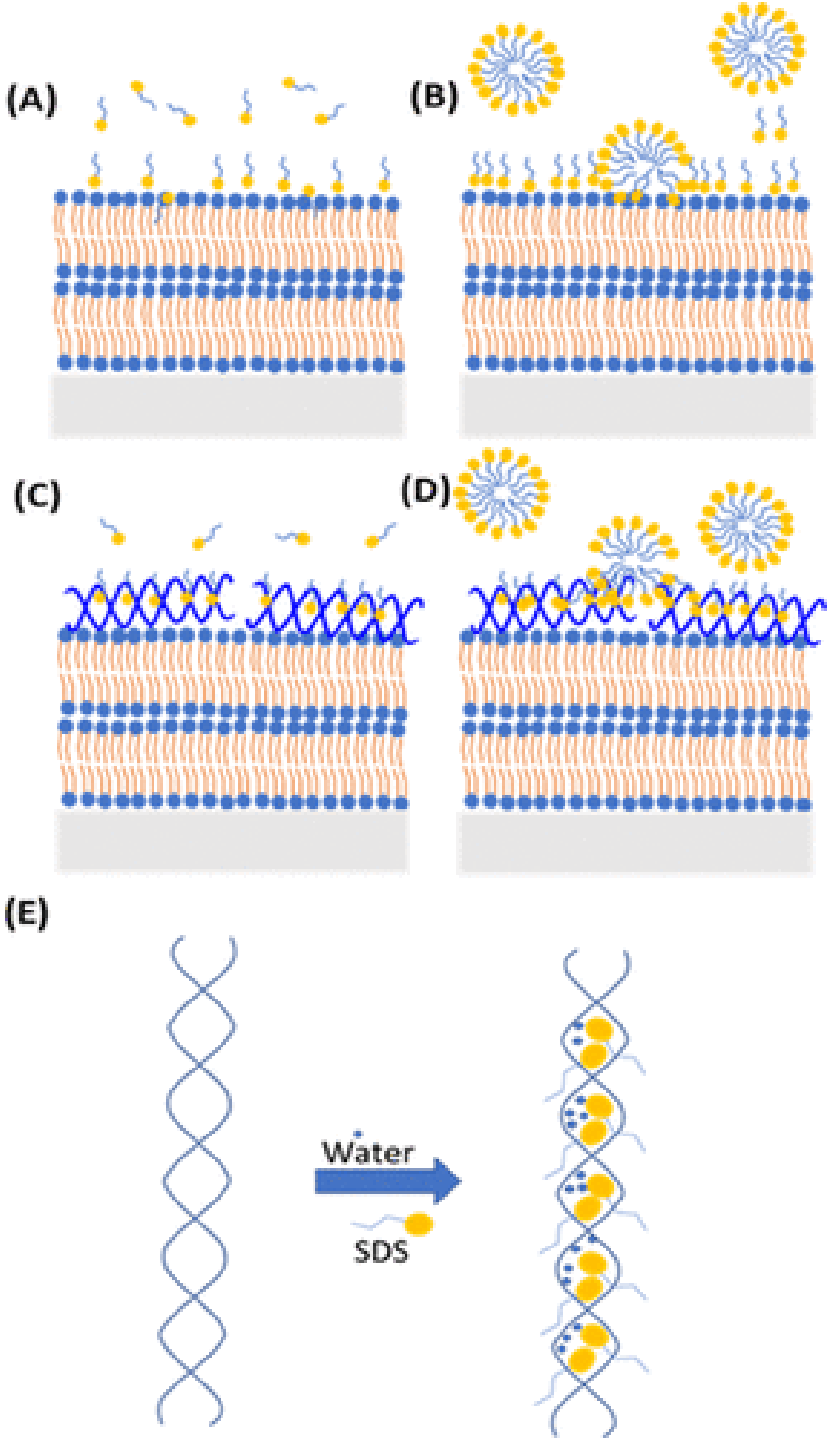




(1) Hydroxyl (3401 $cm^{-1}$) peak from the SCS sample,
(2) $D_2O$ (2466 $cm^{-1}$) peak,
(3) amide I (1648 $cm^{-1}$) peak, and
(4) $-CH_3$ (1458 $cm^{-1}$) peak

ATR–FTIR spectral evolution during evaporation of (A) keratinized SCS and $D_2O$; (B) keratinized SCS and 4 mM deuterated SDS (SDS-d25); (C) keratinized SCS and 385 mM SDS-d25; and (D) non-keratinized SCS and 385 mM SDS-d25, in $D_2O$. are denoted in all conditions. (E) Normalized area under the $D_2O$ peak as a function of time.




Schematics of (A) non-keratinized SCS/4 mM SDS interaction, (B) non-keratinized SCS/385 mM SDS interaction, (C) keratinized SCS/4 mM SDS interaction, (D) keratinized SCS/385 mM SDS interaction, and (E) keratin hydrolysates and SDS interaction in an enlarged view.

# Conclusion

- The keratinized SC model has shown the importance of keratin hydrolysates on regulating the dehydration process for both short term and long term.
- SDS interacts differently with keratin hydrolysates than with lipid bilayers.