Colonial Chemical

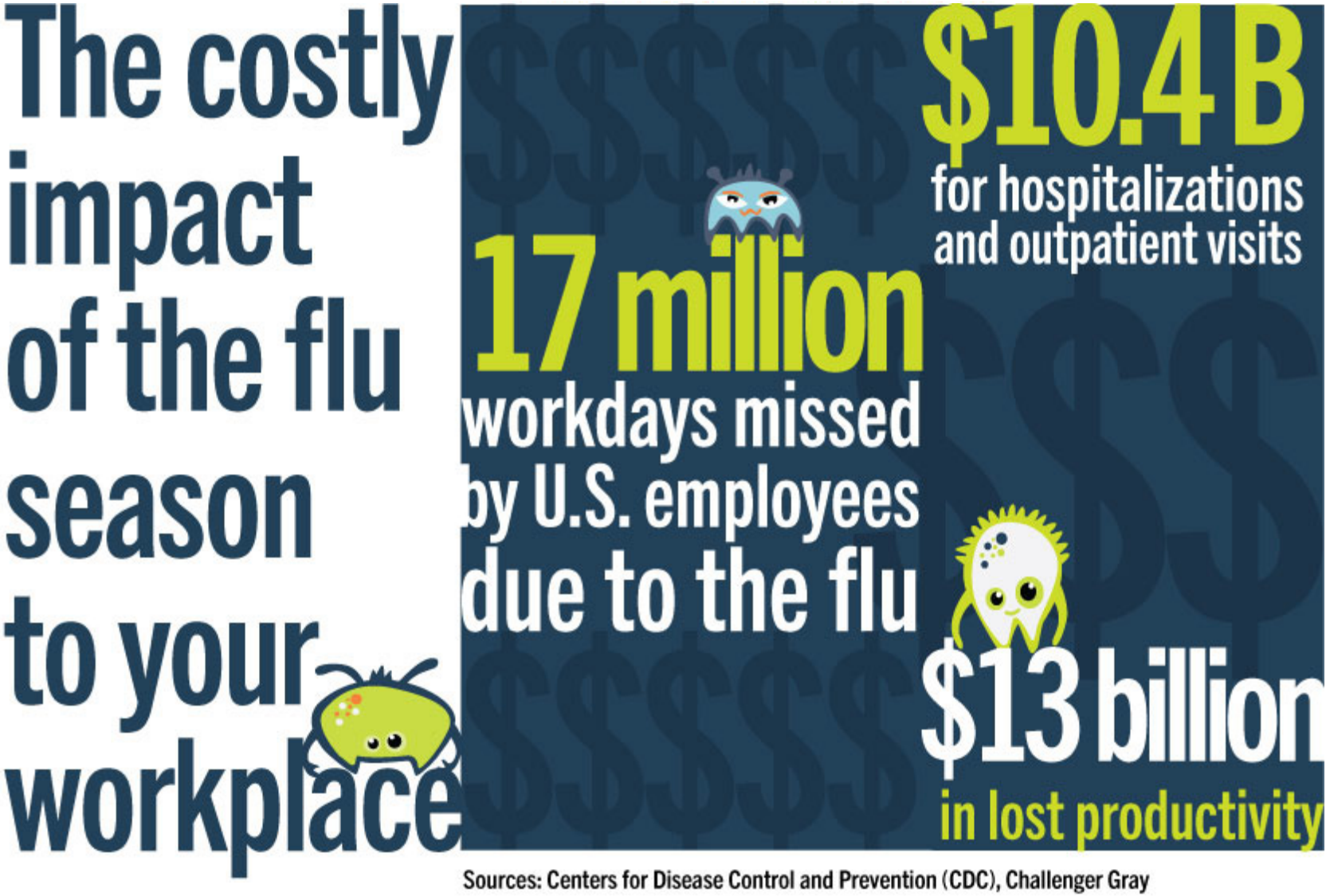
Surfactants: Myths and Mythconceptions

Dennis Abbeduto, Personal Care Business Manager



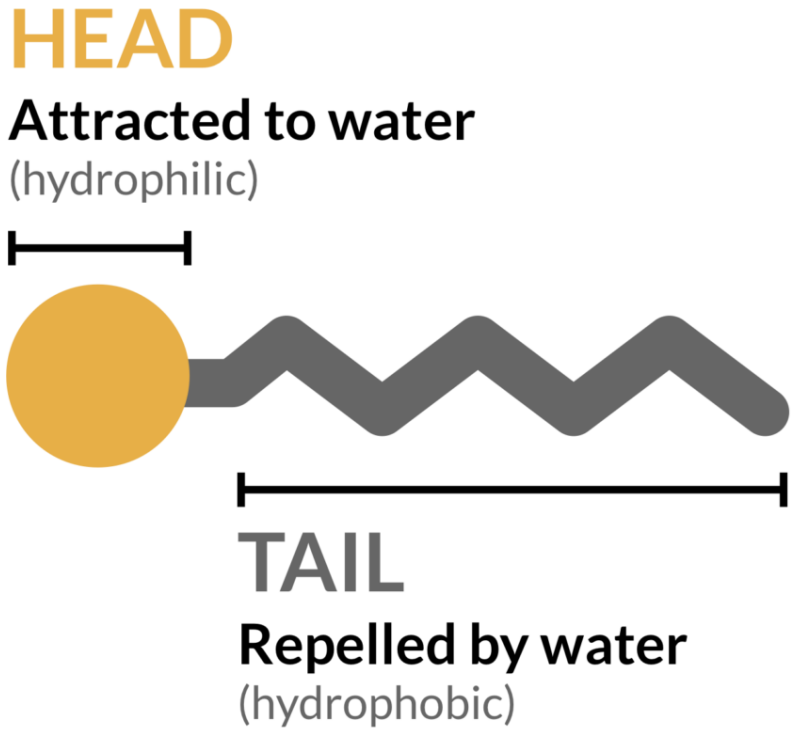



Flu Season is Here!



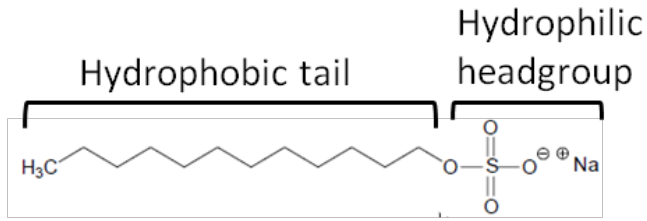
Wait a Second! What IS a Surfactant Anyway?

- Surfactant = SURFace ACTive AgeNT
- Surfactants decrease interfacial tension
  - Liquid/liquid
  - Liquid/solid
  - Liquid/gas
- Surfactants are usually amphiphilic (“both loving”)
  - One portion is usually hydrophilic (“water loving”)
  - One portion is usually hydrophobic (“water fearing”)



Variations in Surfactants – Nearly Infinite

- Where to even begin?
  - Head groups can be charged or neutral
  - Head groups vary greatly in shape and size
  - Head groups vary greatly in polarity
  - Tails vary greatly in shape and size
  - Multiple head characteristics
  - Multiple tail characteristics
  - Multiple charges
  - Many surfactants are decidedly NOT tadpoles!

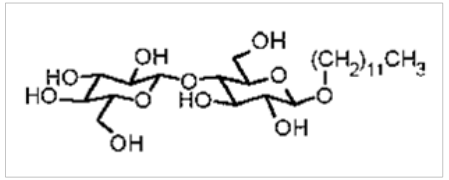


SDS

$C_{12}H_{25}NaO_4S$

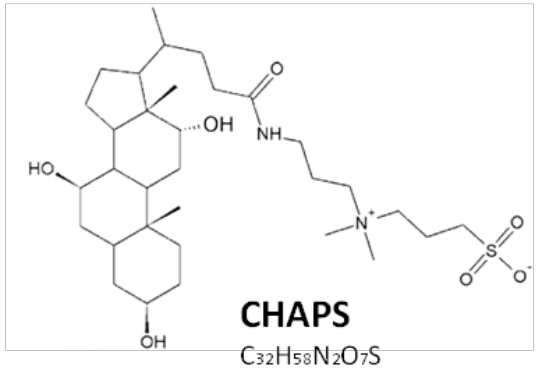
Triton X-100

$C_{34}H_{62}O_{11}$



n-dodecyl-β-D-maltoside

$C_{24}H_{46}O_{11}$

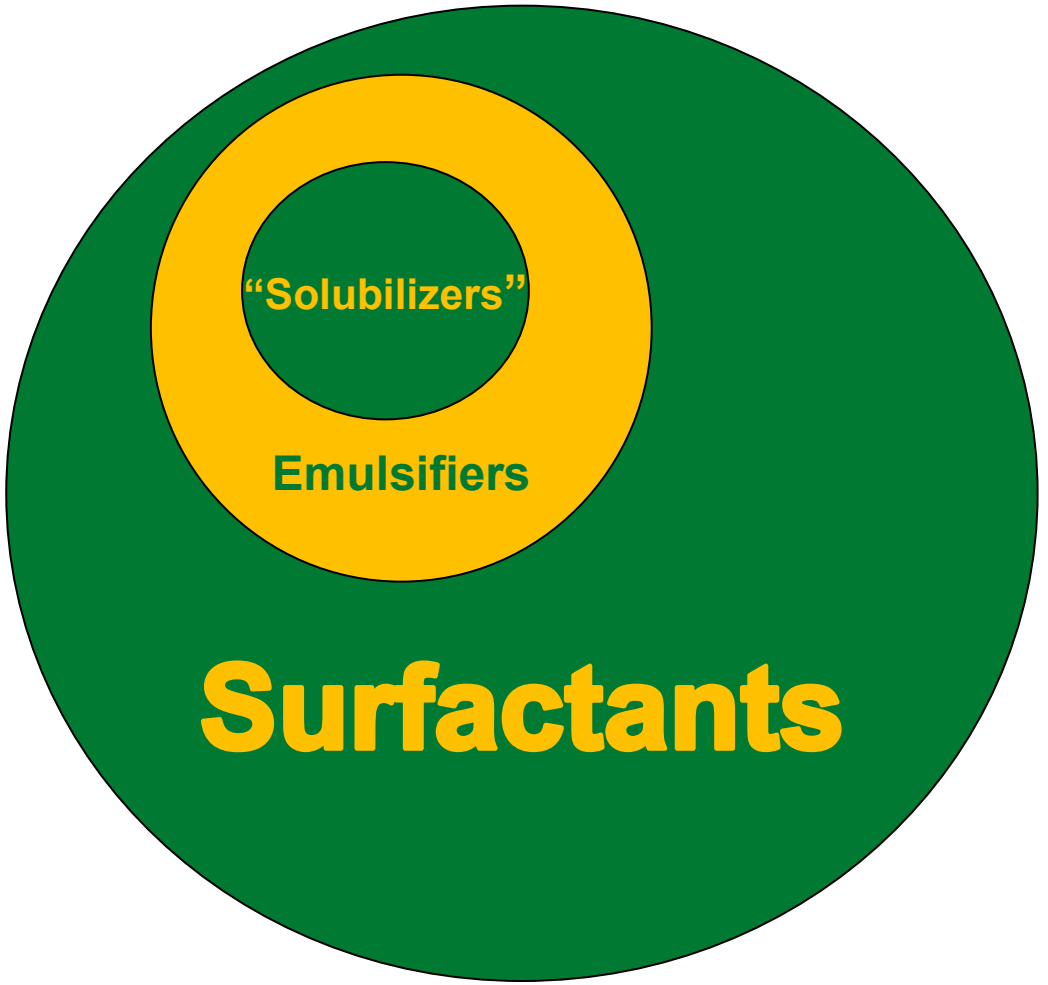


CHAPS

$C_{32}H_{58}N_2O_7S$

Is it a Surfactant or an Emulsifier?

- Emulsifiers ARE surfactants, just a subset
- Reduce interfacial tension between immiscible liquids
  - Oil and water
  - Silicone and water
- How do you pick one then?
  - HLB
  - HLD
- Multiple emulsifiers improve stability
- External phase rheology modifiers make things easier
- “Solubilizers” vs Emulsifiers
- Impact of emulsifiers on aesthetics

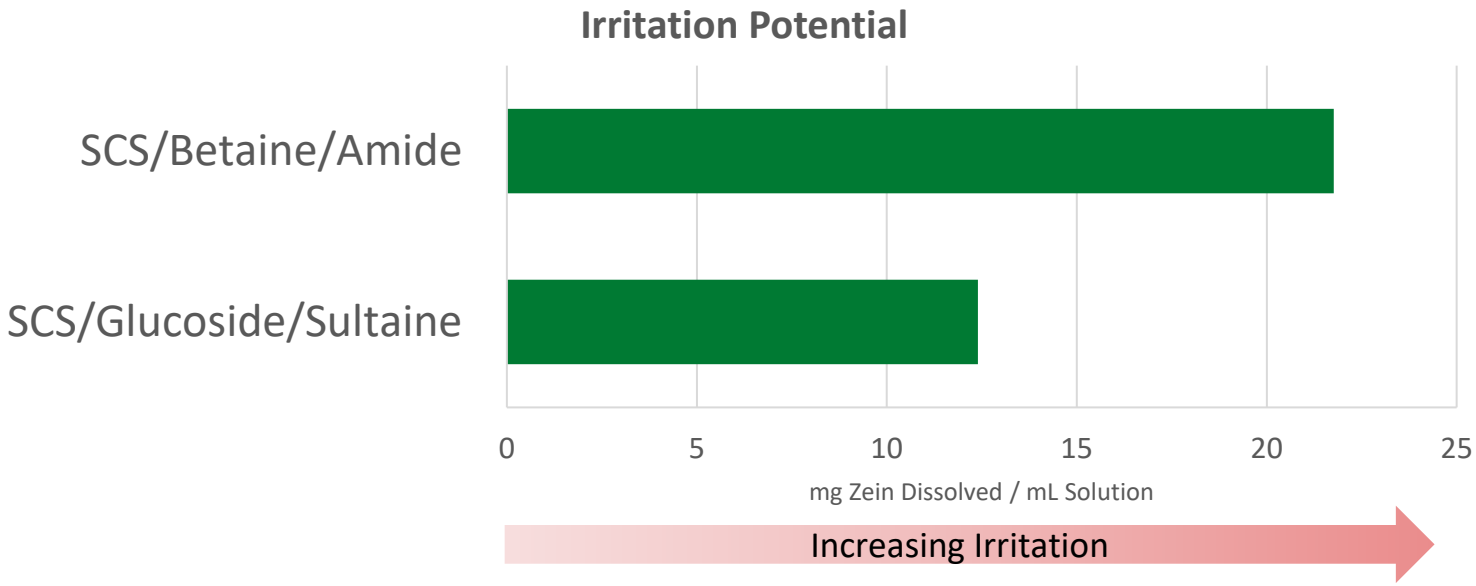


What Drives Irritation?

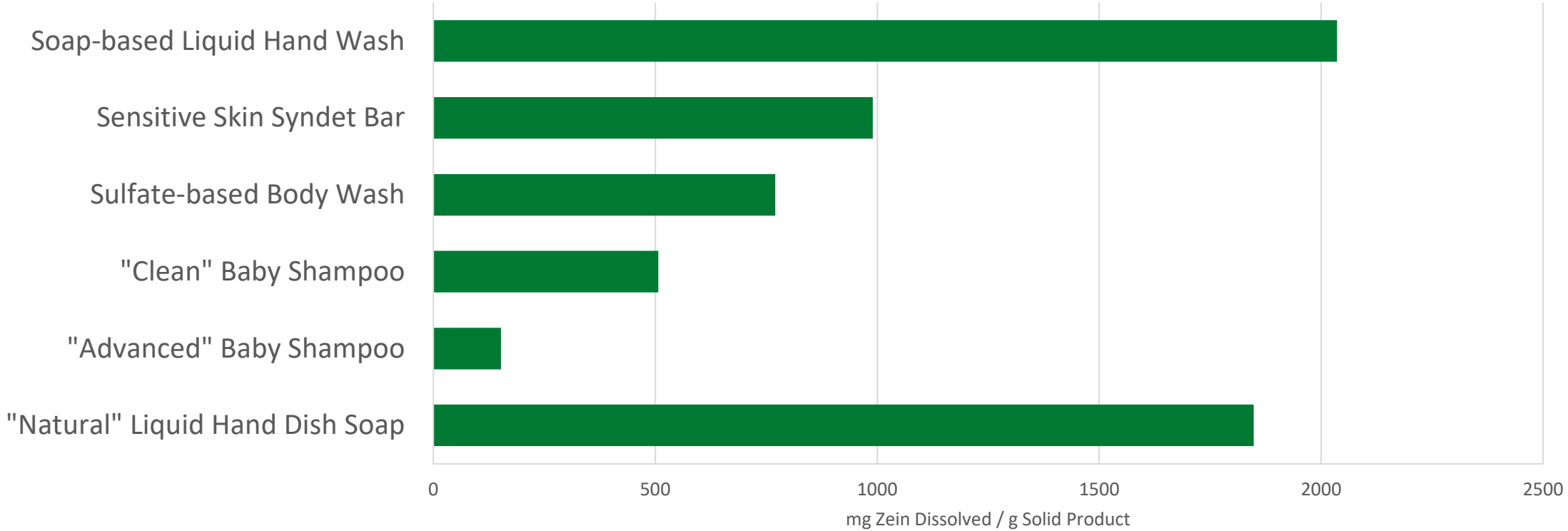
- Surfactants that induce irritation tend to do two things well
  - Denature protein
  - Emulsify lipids (at least temporarily)
- Worse actors have two common characteristics
  - Small, charged head group
  - C12-18 fatty chain
- Sound familiar?
  - Cetrimonium Chloride
  - Benzalkonium Chloride
  - Cocoate/Palmitate soaps
  - Sodium Lauryl Sulfate
  - C14-16 Olefin Sulfonate

Mixed Micelles To the Rescue!

- Combining surfactants DRASTICALLY lowers irritation potential
  - Anionic + amphoteric surfactants exhibit synergistic reduction in irritation potential
  - Significant reduction can also be observed combining anionic + nononic
  - Mixing anionic surfactants can also provide reduction
  - The whole is LESS irritating than the average of the parts
  - Surfactant selection matters!



Commercial Product Zein Data



Foam “Boosters”

- It seems everything promises to boost foam!
  - Cocamide MEA
  - Decyl Glucoside
  - Cocamidopropyl Betaine
  - Cetyl Betaine
  - Disodium Cocoamphodiacetate
  - Lauramine Oxide
  - Stearamine Oxide
  - Cetyl Alcohol
  - PEG-12 Dimethicone
  - HOW?!?

Boosting vs Stabilizing Foam

- The promise is boosting, but often the effect is stabilizing
  - Ingredients that increase solution viscosity tend to be great stabilizers
    - Alkanolamides
    - Alkyl Polyglucosides (longer chain)
    - Amine Oxides (longer chain)
    - Amphoterics (mid-chain)
- If initial foam is deficient, secondary surfactants may actually boost
  - Amphoterics (mid-chain)
  - Amine Oxides (mid-chain)
  - Especially useful in high sebum conditions (hair)
- The best boosting solution is typically increased primary surfactant

Controlling Viscosity

- "How do I thicken this formula"?
- "This formula doesn't thicken with salt"
- Some quick pointers:
  - Not all formulations will be salt responsive
  - Some formulations are extremely slow to respond
  - Formulations on the "right" side of the salt curve will not respond
  - New surfactants require new approaches
  - "Drop-in" replacements rarely are
  - Naturally derived options are improving constantly
  - How thick do you really need it?

Raw Material Sourcing

- Same INCI, same performance?
- Current INCI guideline – 80% pure substance
  - Variable alkyl distribution
  - Variable residuals
  - Variable byproducts
- Grandfathered INCI guideline – plurality substance
- Ethoxylates and other polymers
- Common substitutions
- Lies

Resources

- SCC Media Library & Resource Center
  - https://library.scconline.org/
  - Journal of Cosmetic Science

- Scientific Spectator
  - http://www.scientificspectator.com/book-service/
  - Surfactant Spectator
  - Surfactants: Strategic Personal Care Ingredients and Supplement

- Professor Steven Abbott – Science for the Real World
- Dr Steven Abbot's "Surfactant Science: Principles and Practice"

- AOCS Free Resources

Your Questions?

Thanks!

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https://colonialchem.com – Product Literature

https://apple.co/3dUq5fh - Formula Girls Podcast