Colonial Chemical

Personal Care Humectants

Dennis Abbeduto, Personal Care Product Manager






WASH YOUR HANDS

Outline

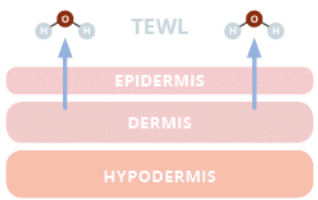
- Emollient vs Occlusive vs Humectant
- Humectant Examples
- Building a Better Humectant
  - Chemistry
  - Product Safety
- Moisturization Efficacy
  - In-vitro
  - In-vivo
    - Leave on
    - Rinse off
- Additional Application Data

Compound Interest – Andy Brunning @compoundchem

THE CHEMISTRY OF MOISTURISERS

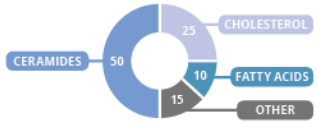
Whether you're suffering from sunburn in the summer, or dry skin in the winter, moisturisers are on hand to help. This graphic takes a look at some of the different compounds that moisturisers combine, and how each of the groups of compounds act to help produce a moisturising effect.

SKIN & WATER LOSS



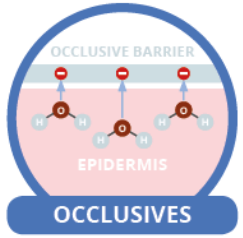
The skin has 3 main layers. The middle layer, the dermis, has several roles which include storing water. Transepidermal water loss (TEWL) is a normal process of water loss through the epidermis; moisturisers aim to reduce this water loss.

THE EPIDERMIS

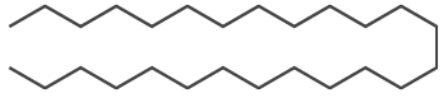


Approx. lipid composition of stratum corneum

The epidermis is composed of five sub-layers. The uppermost of these is the stratum corneum, which is made up of dead skin cells surrounded by proteins. Ceramides, fatty acids and cholesterol fill the gaps between cells, limiting transepidermal water loss.

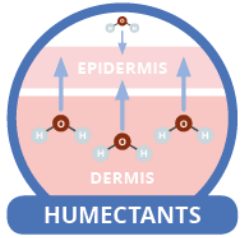


OCCLUSIVES

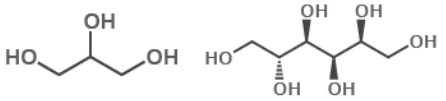


PETROLATUM — Mixture of hydrocarbons with 25+ carbon atoms. Other occlusives include lanolin & silicones

Occlusive agents prevent water loss by forming a hydrophobic barrier over the stratum corneum (the upper layer of the epidermis). Vaseline is an example of an occlusive moisturiser. Though effective, they make skin feel greasy.

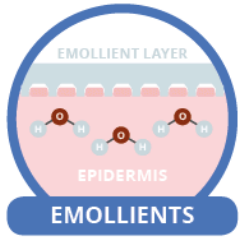


HUMECTANTS

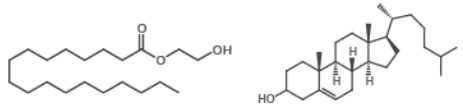


GLYCERIN (L) & SORBITOL (R) — Other humectants include urea, sodium lactate, & hyaluronic acid

Humectants are hydrophilic, and help draw water from the dermis to the epidermis. At humidity higher than 80%, they can also draw water from the atmosphere. Evaporation from skin as a result can also cause extra dryness, however.



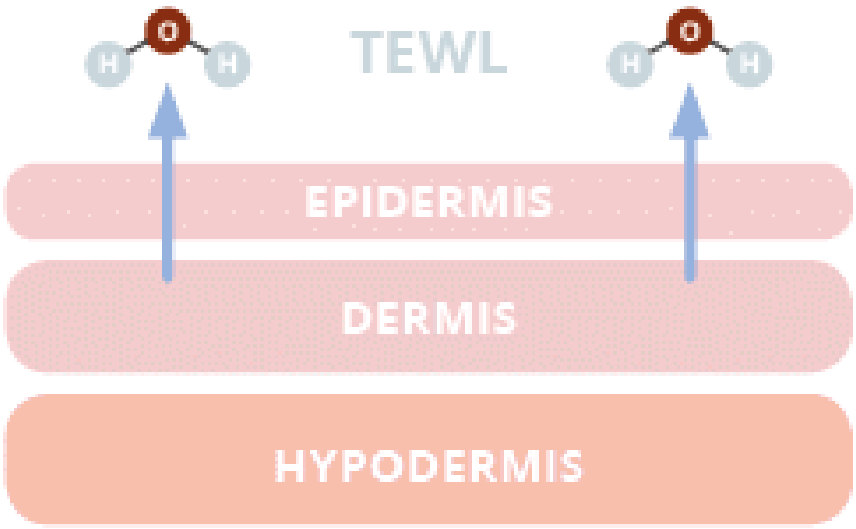
EMOLLIENTS



GLYCOL STEARATE (L) & CHOLESTEROL (R) — Others: ceramides, squalene, & fatty acids.

Like occlusives, emollients can form a barrier to TEWL when applied heavily. They can also reduce TEWL by helping 'plug' the gaps between corneocytes (dead skin cells), replacing absent natural skin lipids, and help smooth roughened skin.

Skin & Water Loss



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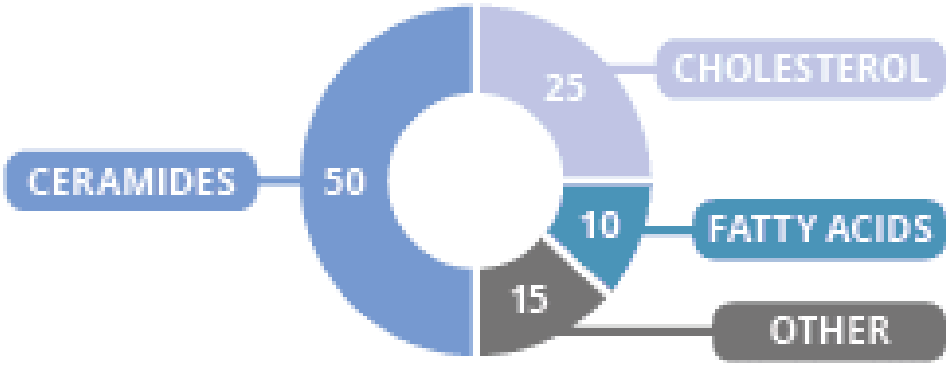

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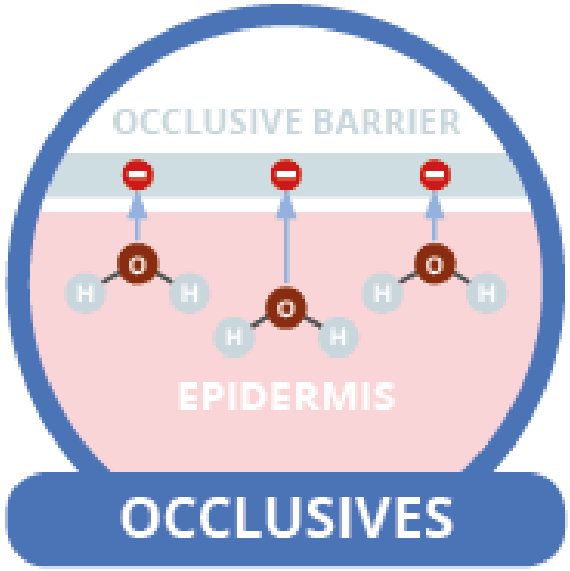
Occlusives



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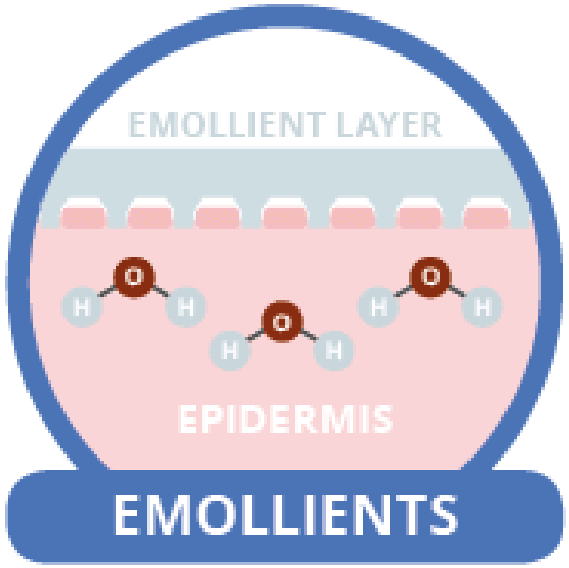
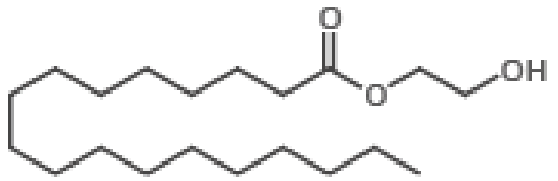
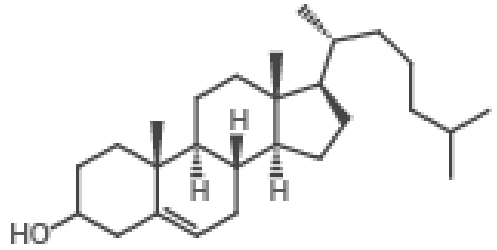
Emollients







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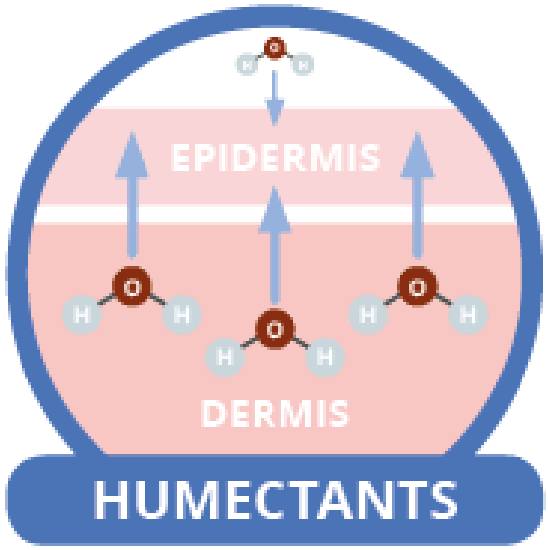
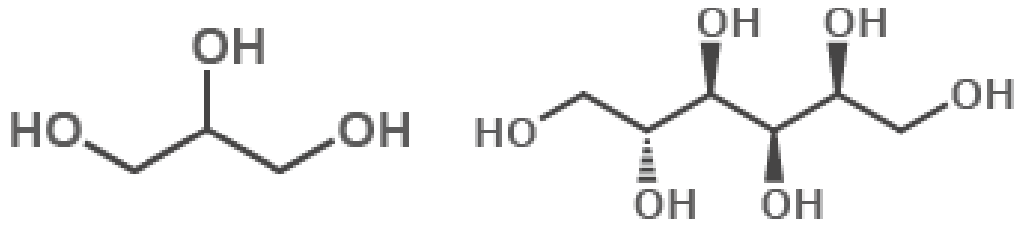
Humectants





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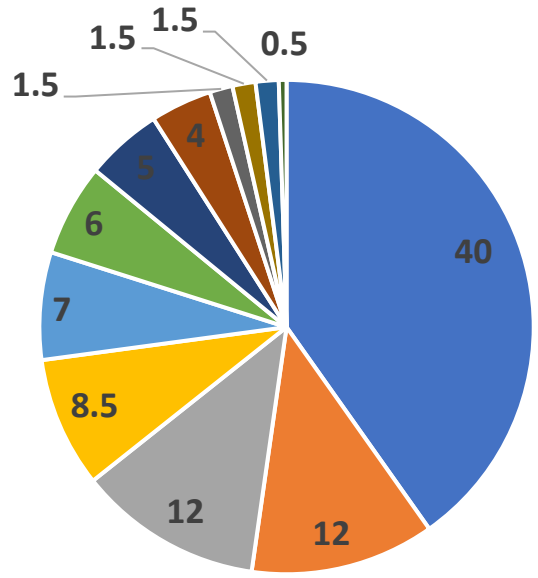
NMF Components

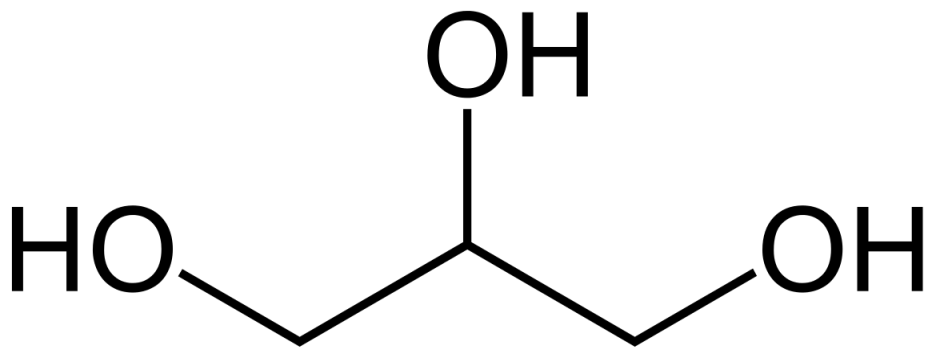


- Free amino acids and urocanic acid
- Pyrrolidone carboxylic acid (PCA)
- Lactate
- Sugars, organic acids, peptides, etc.
- Urea
- Chloride
- Sodium
- Potassium
- Calcium
- Magnesium
- Ammonia, creatine, uric acid, glucosamine
- Phosphate

The Workhorse - Glycerin

- Pros
  - Low Cost
  - Efficient water binding
  - High skin compatibility

- Cons
  - Tackiness
  - No substantivity

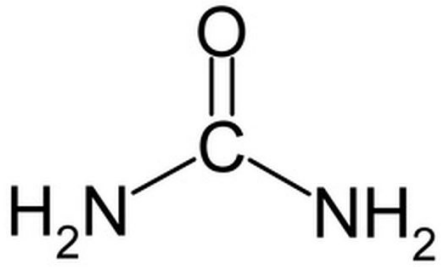


Other Common Humectants

- Glycols
  - Propylene Glycol
  - Dipropylene Glycol
  - Pentylene Glycol
- Sugar alcohols
  - Mannitol
  - Sorbitol
  - Xylitol
- Polyols/Polysaccharides
  - Maltitol
  - Cellulose
  - Galactoglucoarabinomannan
- Hydroxy acids
  - Lactic Acid
  - Glycolic Acid
  - Tartaric Acid

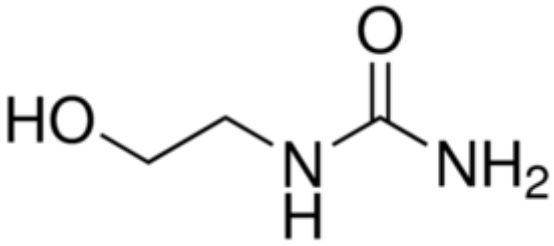
Nature-Inspired Improvements

- Urea
  - An important endogenous NMF component
  - Has limited water binding efficiency



- Potential to improve by adding more water binding sites

- Urea + MEA = Hydroxyethyl Urea ($+NH_3$)



- Improved moisturization but…
  - pH instability
  - Trace DEA

Other Nature-Inspired Chemistry

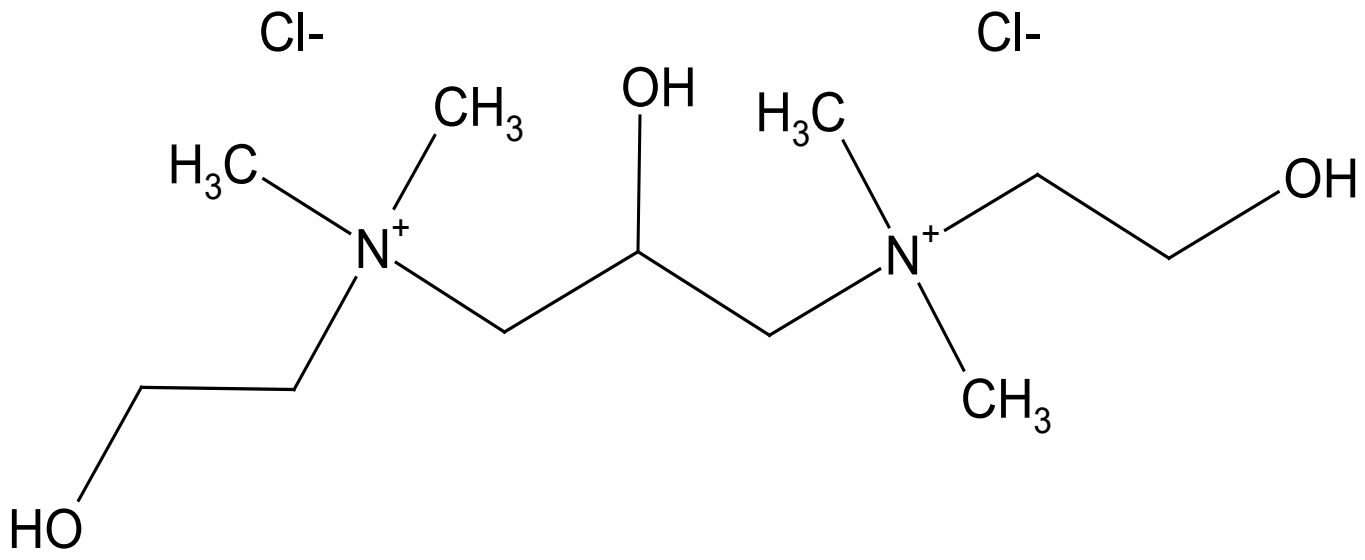
- Small molecules
  - Acetamide MEA
  - Lactamide MEA

- Hybrid Emollient/Emulsifier/Humectants
  - Sorbitan Oleate
  - Polyglyceryl-3 Oleate

- Ethoxylates
  - Methyl Gluceth-20
  - Sorbeth Tetraoleate

New Chemistry – Cola®Moist 200

INCI NAME Hydroxypropyl Bis-Hydroxyethyldimonium Chloride
CAS NO. 110528-94-4
LISTINGS TSCA, NDSL, REACH, IECIC



Cola®Moist 200 Toxicity Testing

- Eye irritation
  - HET-CAM testing
    - 5% solid solution – Score 2.5 (Non-irritating)
  - MatTek EpiOcular
    - 2% solid solution – ET-50 >256min (Non-irritating)

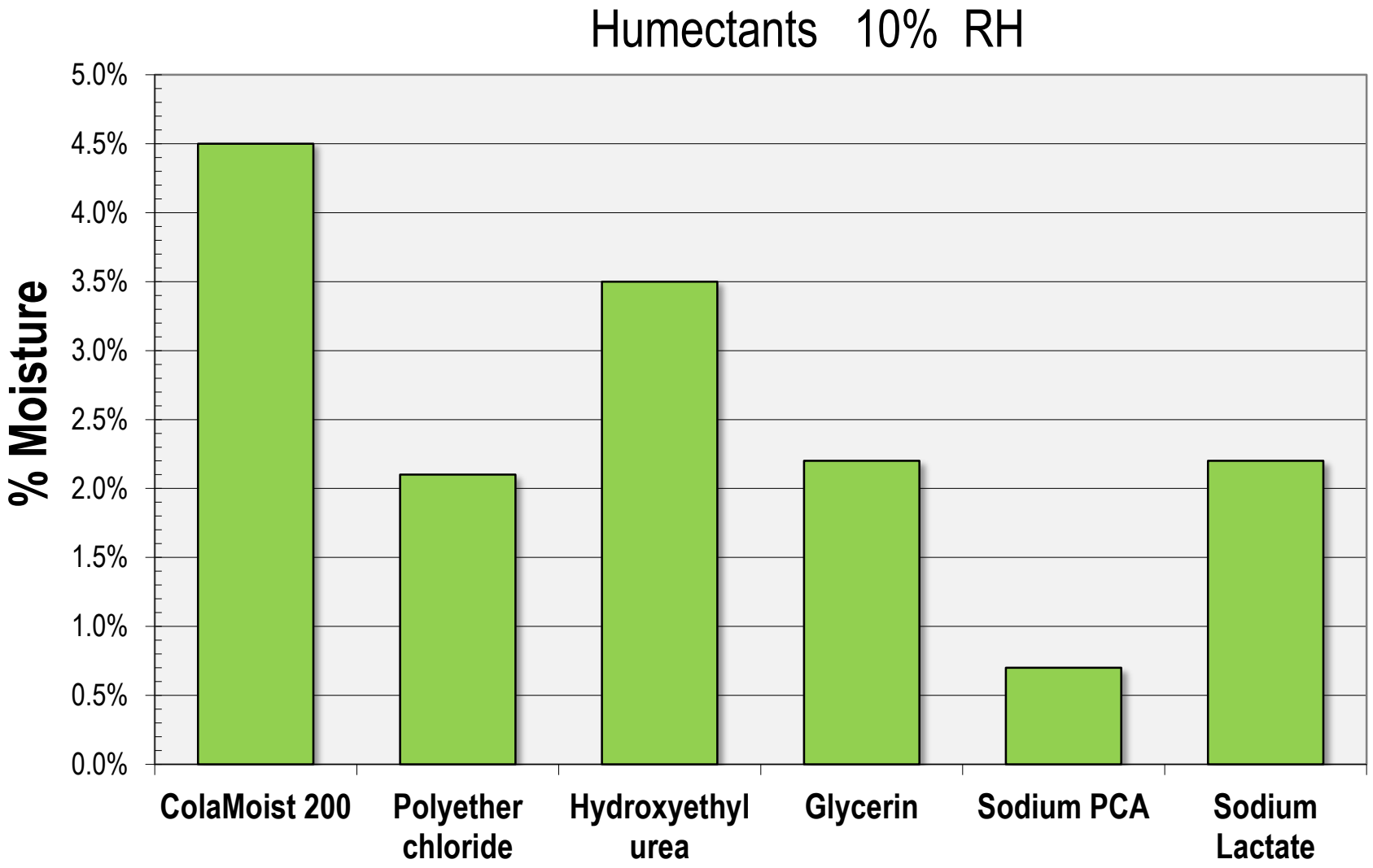
- Skin irritation
  - 48 hour patch test
    - 5% solid solution – No irritation
  - HRIPT
    - 5% solid solution – No sensitization

- Mutagenicity
  - Ames assay
    - 5% solid - No genotoxic activity

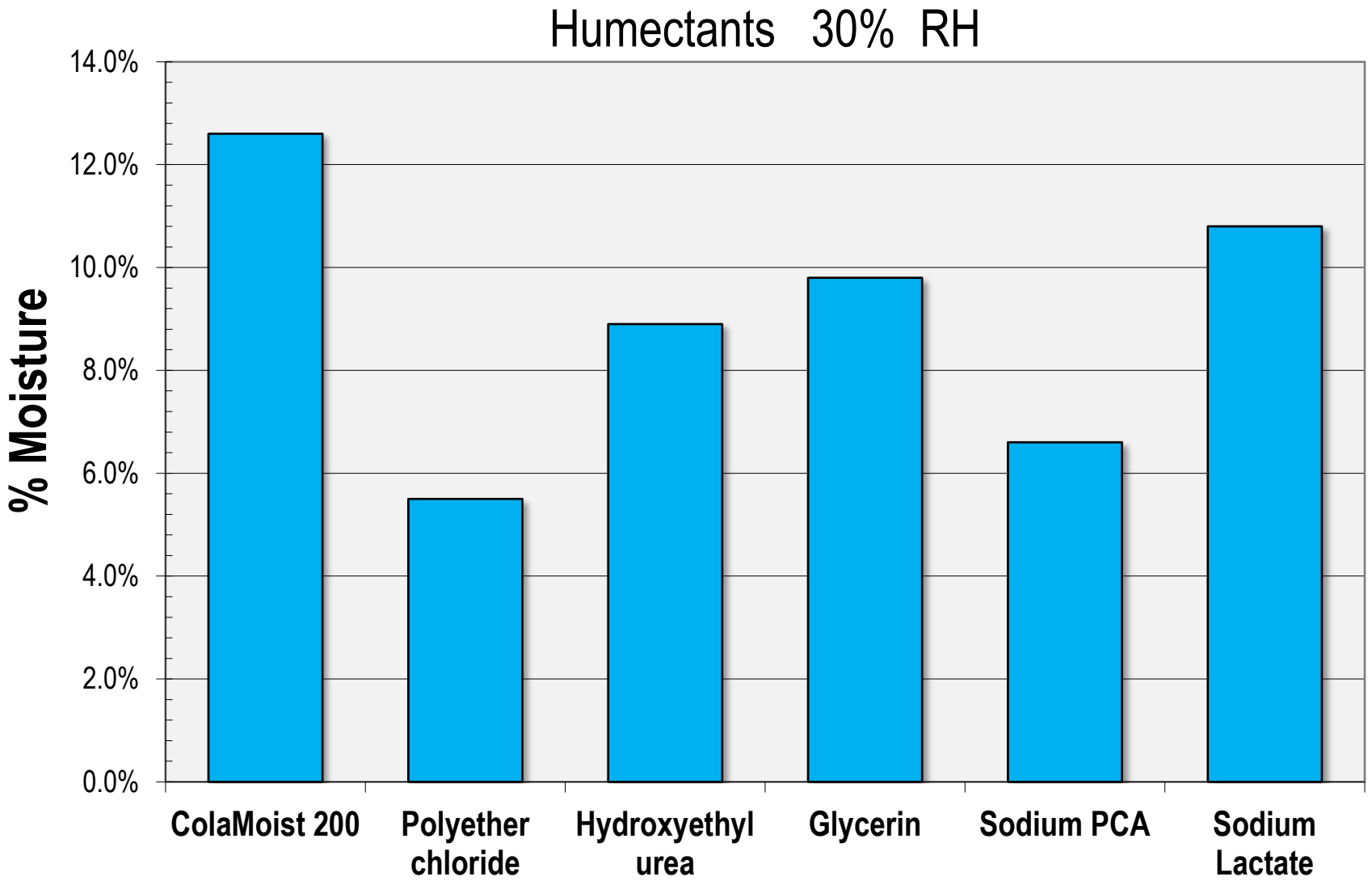
Cola®Moist 200 Moisturization Efficacy

- Water binding test
- Rubine dye test
- Lotion efficacy
- Rinse off efficacy

Cola®Moist 200 Water Binding – Very low humidity



Cola®Moist 200 Water Binding – Low humidity



Rubine Dye Test

- Background
  - Rubine dye is anionic and adheres strongly to substrates with free cationic charge at the surface
  - Increased dye intensity under identical treatment conditions indicates higher substantivity cationic molecules to the substrate

- Cola®Moist 200 Test
  - 2% solution of Cola®Moist 200 was applied to non-mercerized cotton skein
  - Negative control skein treated with water
  - Skeins were rinsed thoroughly with water before applying rubine dye solution
  - After 30 seconds, the rubine dye solution was rinsed from the skeins with water

- Results
  - Cola®Moist 200 displayed strong dye retention compared to indicating the retention of Cola®Moist 200 on the test substrate.
  - Skeins treated with surfactant solution containing Cola®Moist 200 demonstrated similar substantivity

Rubine Dye Test

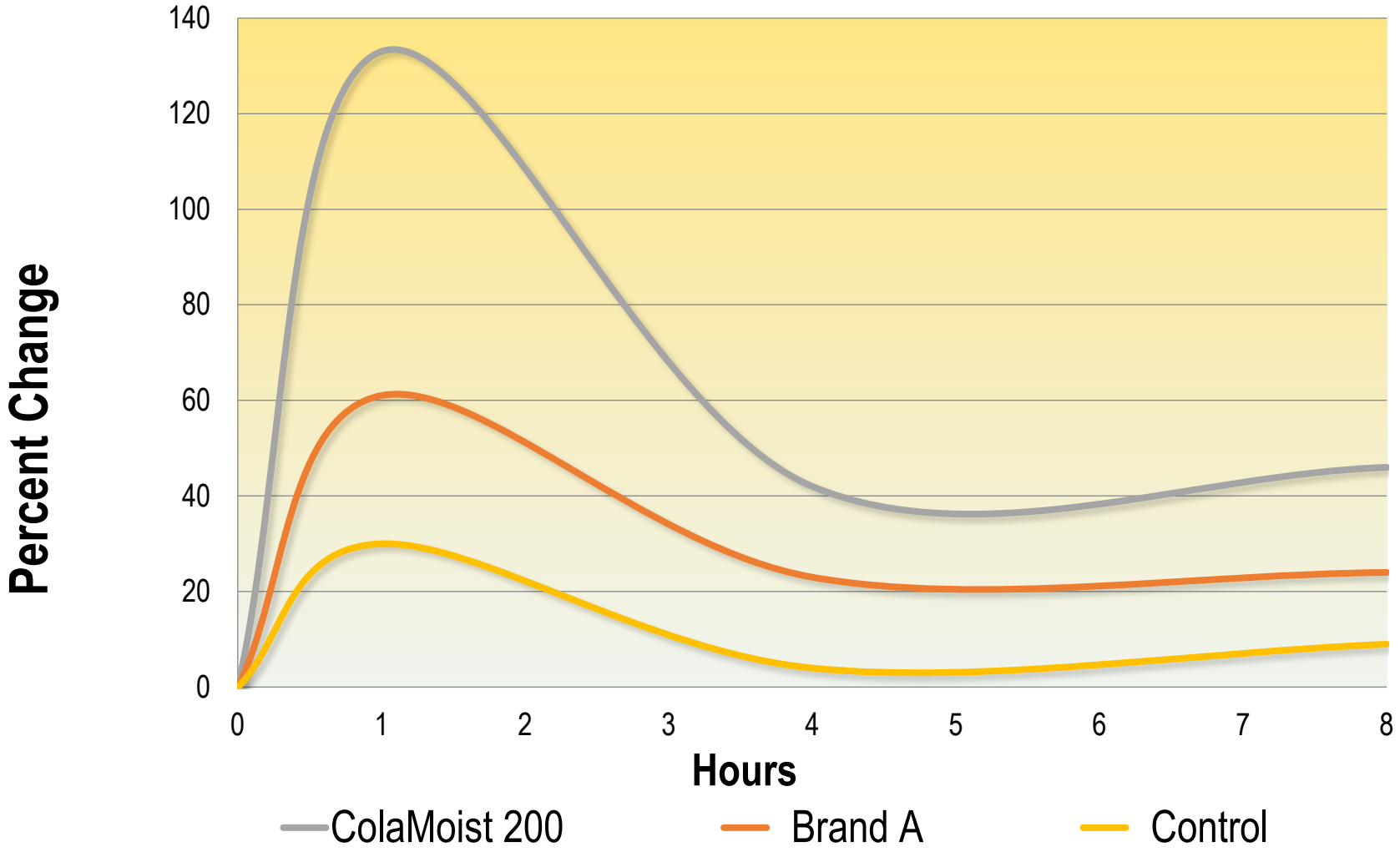
Negative Control

Cola®Moist 200 – 2%

Skin Moisturization Study – Leave On

- Background
  - Cola®Moist 200 was compared to a leading glycerin replacement
- Study Design
  - Each test article was added at 5% as supplied to a neutral lotion base
  - 10 healthy skin volunteers
  - Lotion base and lotions containing test articles were applied to each volunteer on volar forearm
  - Skin moisturization measured with Nova DPM 9003 at baseline and 2, 4, 6, 8 hours after application
- Results
  - Cola®Moist 200 significantly improved moisturization over the base lotion and the competitive material throughout the 8-hour study

Skin Moisturization Study – Leave On



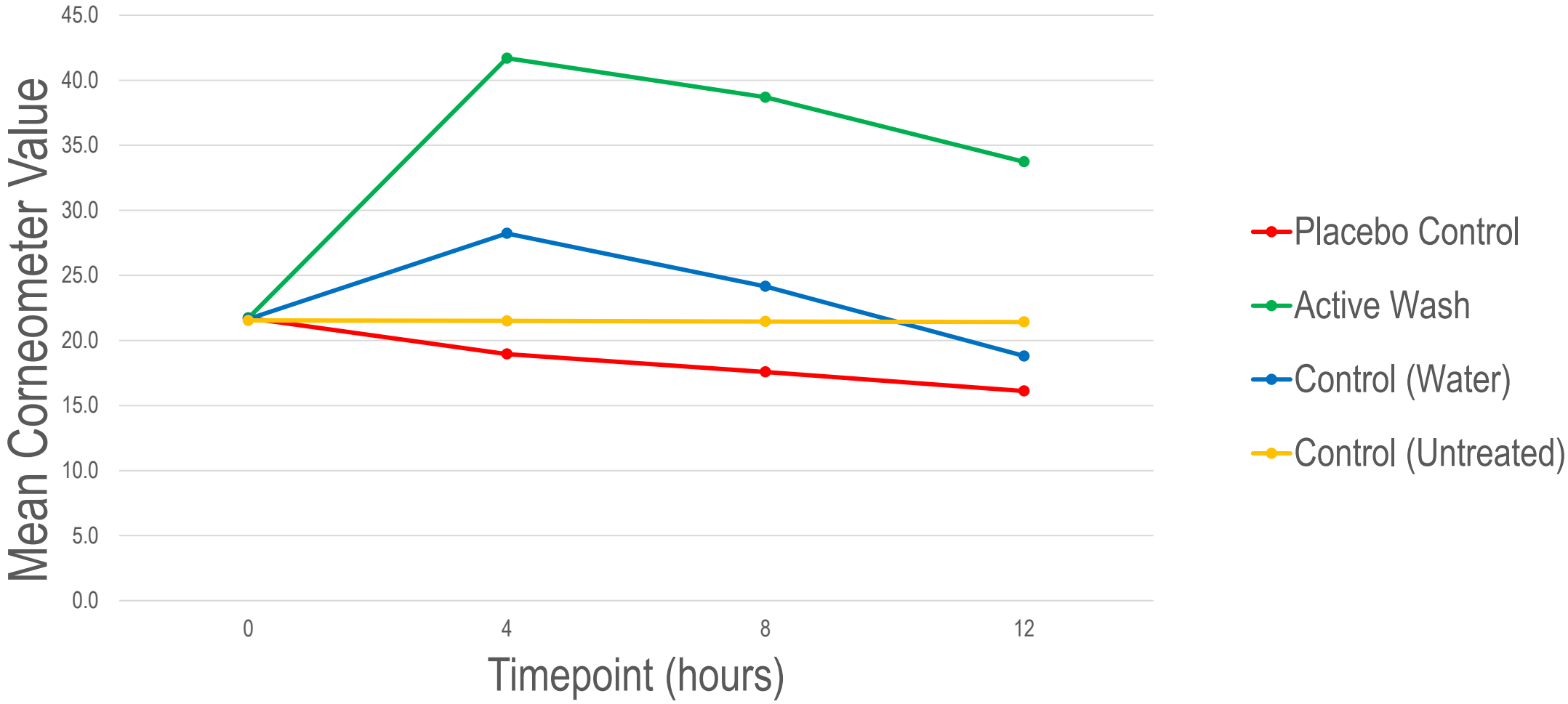
Skin Moisturization Study – Rinse Off

- Background
  - A sulfate-free body wash was compared to the same body wash containing 3% Cola®Moist 200 (as supplied)

- Study Design
  - 26 healthy, dry skin volunteers (Dryness Score 1.5 – 3.0)
  - LCAT (Lower Leg Controlled Application Test) Design
  - 4 test sites: Placebo control wash, active wash, water control, untreated control
  - Skin moisturization was measured with visual grading and Corneometer® at baseline and 4, 8, 12 hours after application

- Results
  - The sulfate-free body wash with Cola®Moist 200 significantly improved moisturization over all other conditions throughout the 12-hour study

Skin Moisturization Study – Rinse Off



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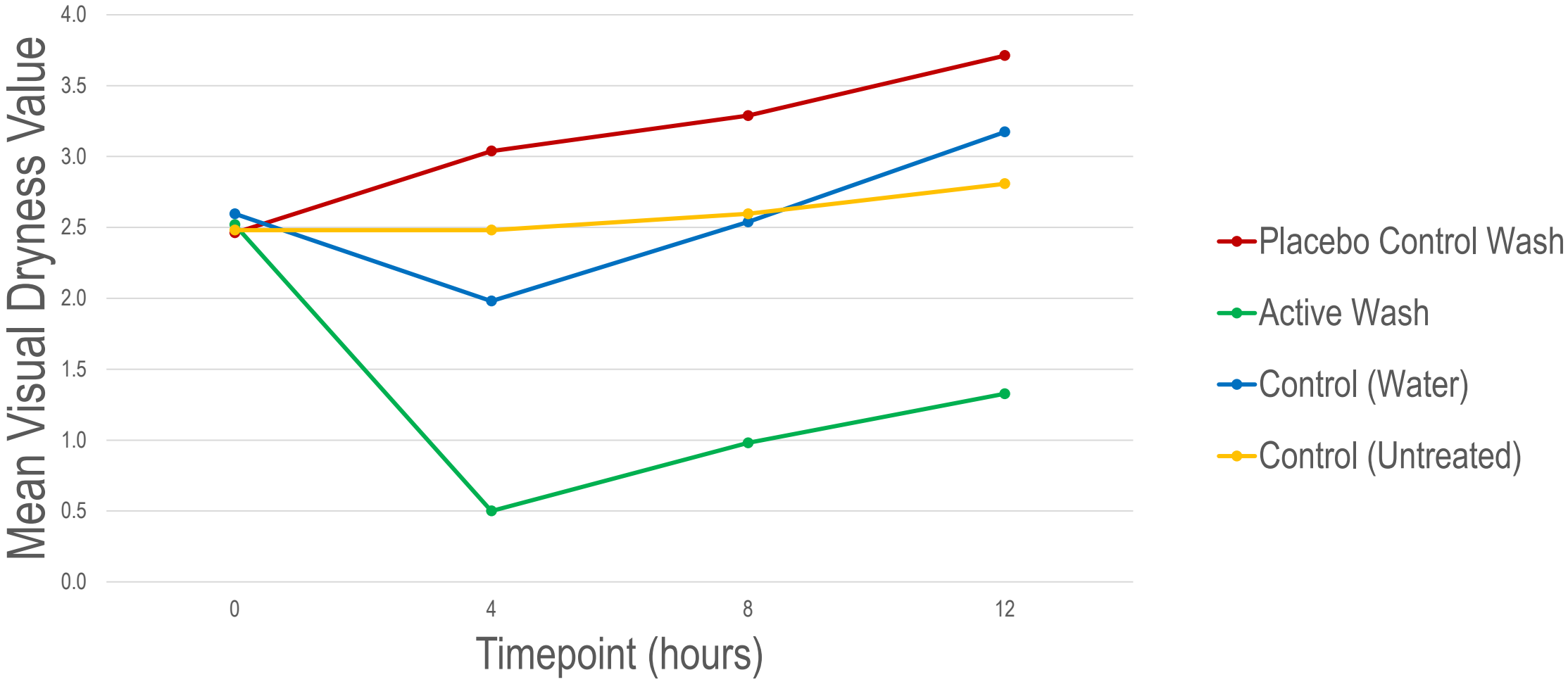


Cola®Moist 200 Applications

- Hair Care
  - Shampoos
  - Conditioning creams and rinses
  - Frizz/flyaway control
  - Volumizing products
- Personal Care
  - Soap bars
  - Liquid soaps
  - Facial cleansers
- Skin Care
  - Dry skin lotions and creams
  - Daily wear moisturizers
- Baby and Sensitive Skin Care

Effect on Emulsion Stability

Base Formulation

Ingredient	%
Isopropyl Palmitate	5
Glyceryl Stearate & PEG-100 Stearate	3
Coconut Oil	3
Coco-Caprylate	2
Cetyl Alcohol	1
Water to 100	
Citric Acid to pH 6	

Emulsion Stabilizers

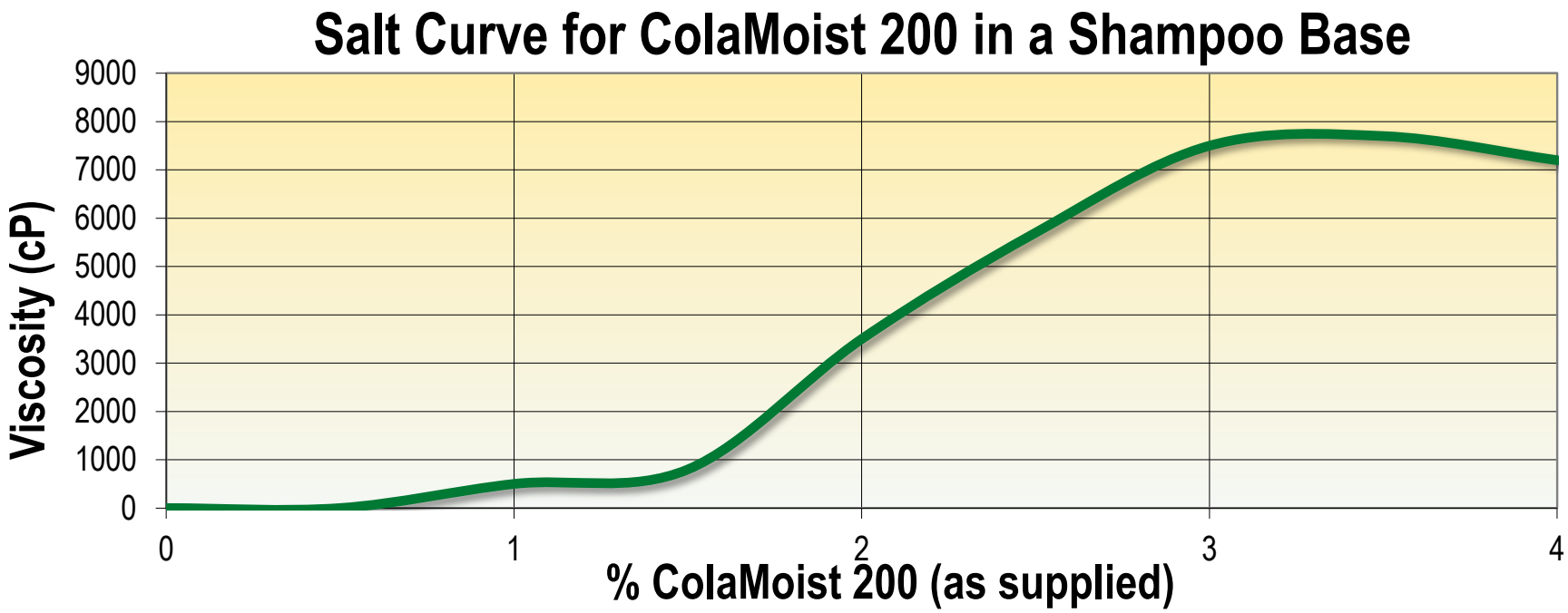
Ingredient	%
Cetyl HEC	0.3
Guar Gum	0.8
Xanthan Gum	0.6
Carbomer	0.2
High CD Guar Quat	0.5

Results with 3% Cola®Moist 200

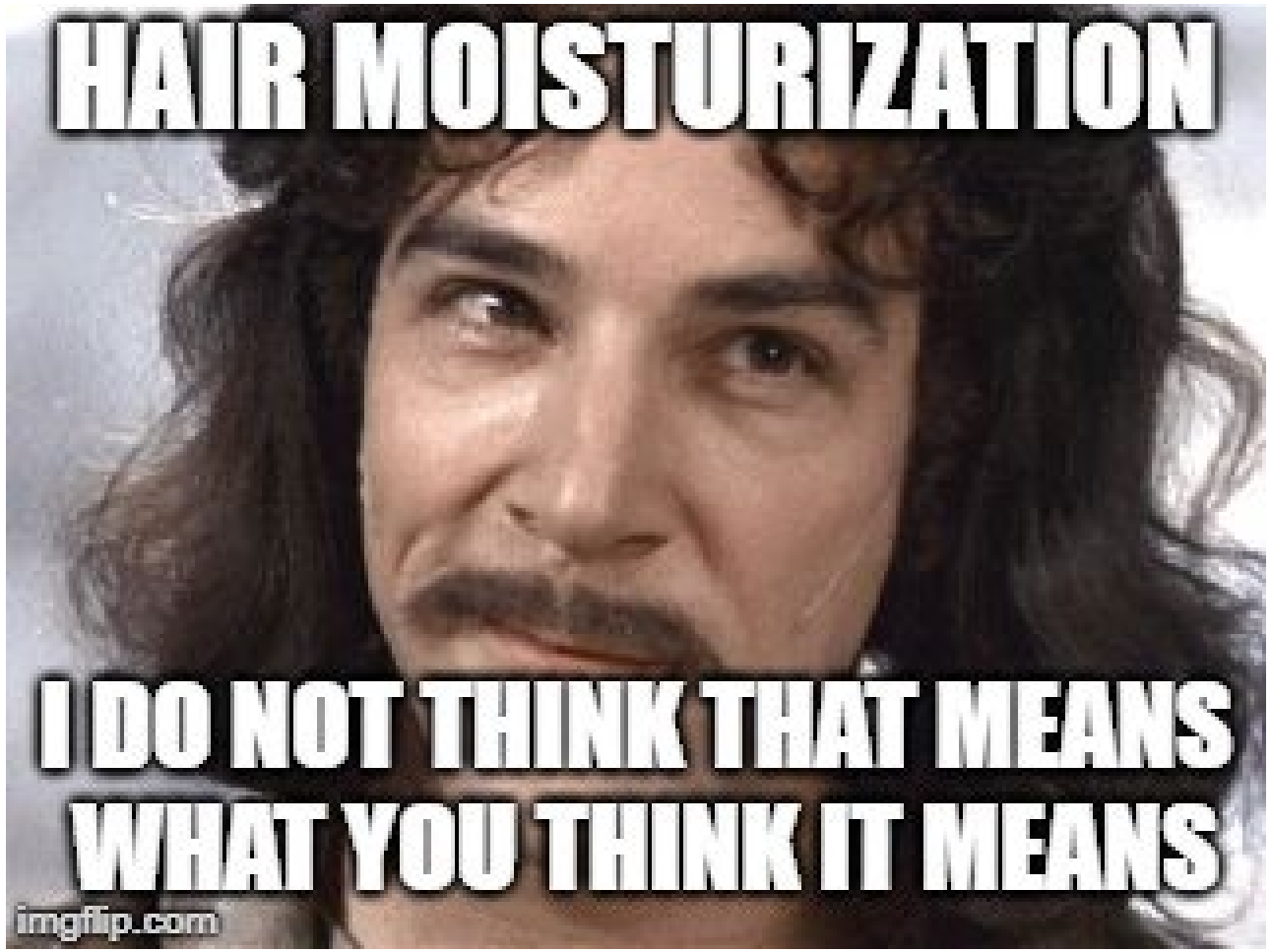
Ingredient	P/F
Cetyl HEC	Pass
Guar Gum	Pass
Xanthan Gum	Pass
Carbomer	Fail
High CD Guar Quat	Fail

Viscosity Response Curve in Shampoo Base

- Additions of nominal amounts of Cola®Moist 200 will promote a salting effect in traditional surfactant cleansing systems.
- Formulators may be able to completely avoid adding sodium chloride to a system with Cola®Moist 200.

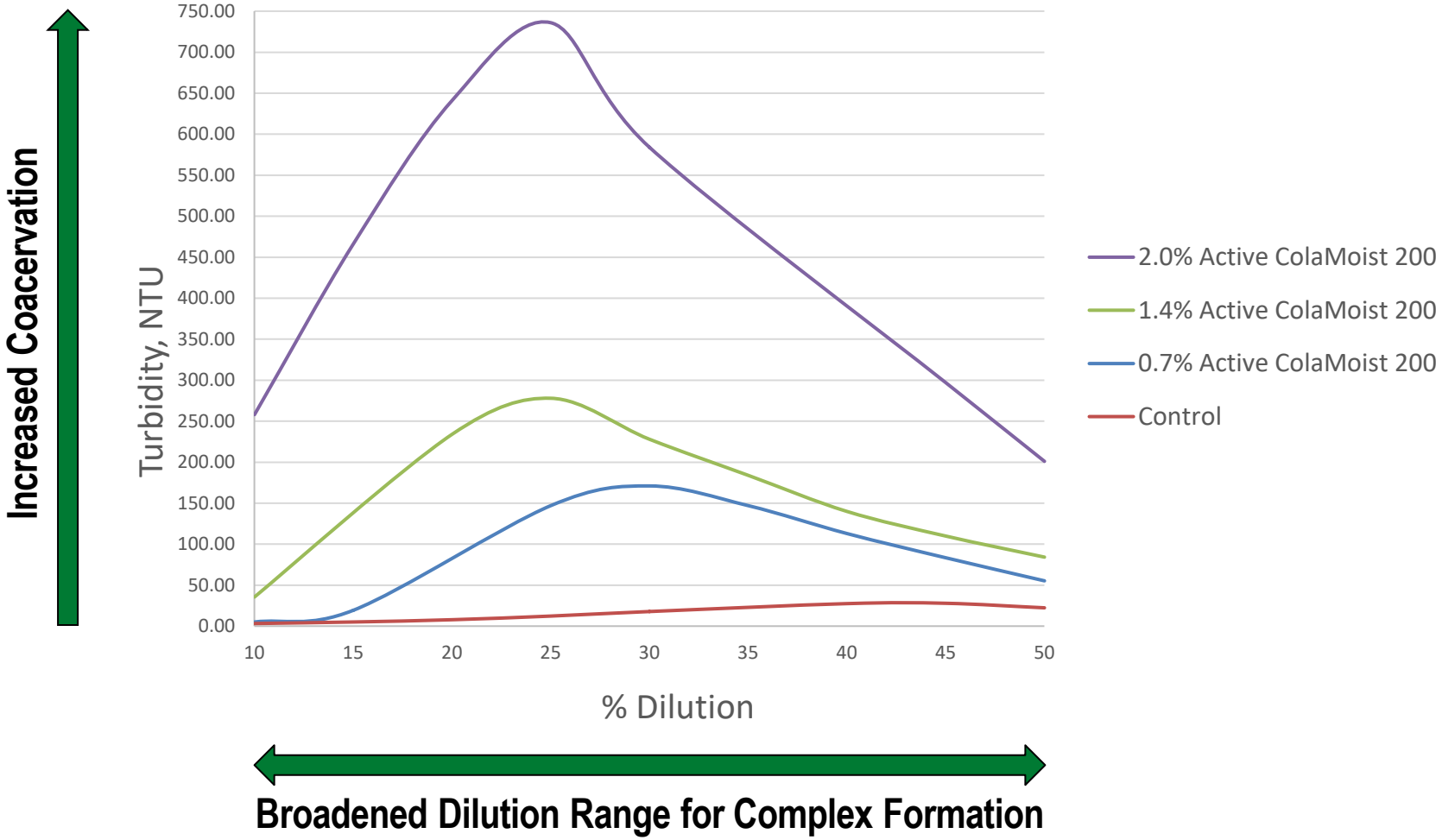


Hair Moisturization



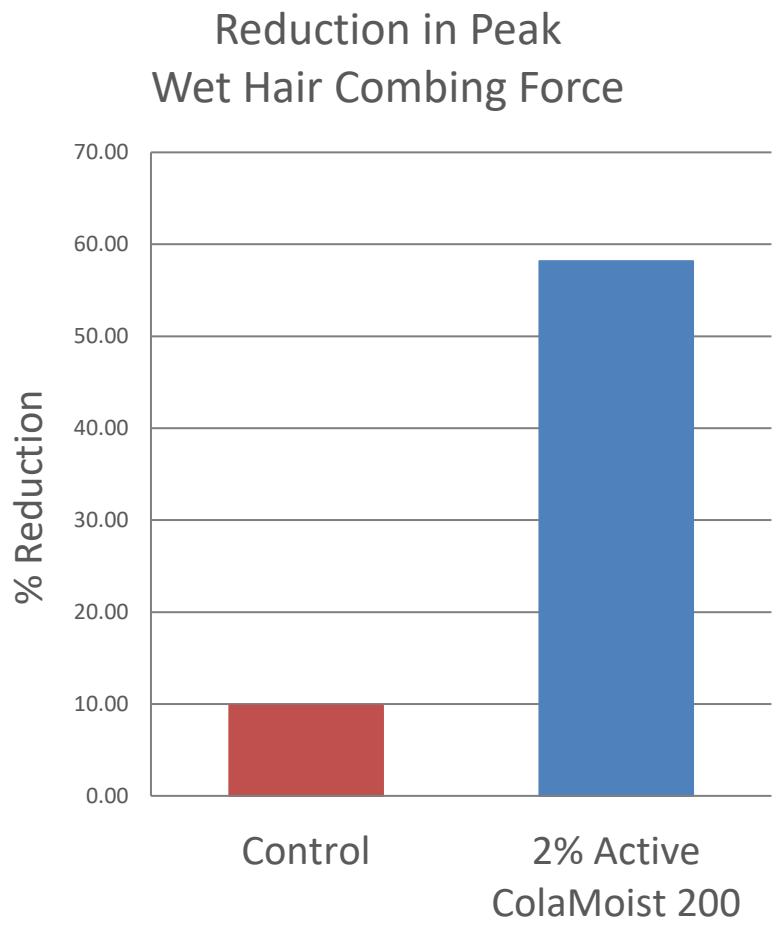
Cola®Moist 200 Promotes Coacervation

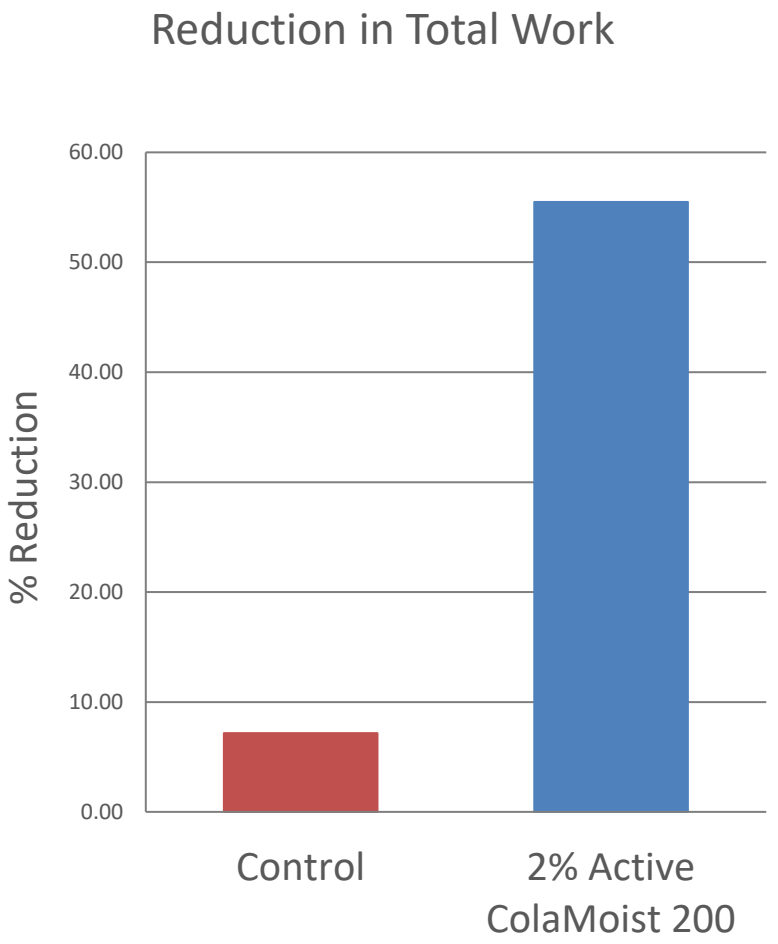
Turbidity Results for Dilutions of Base Formula (11.5% SLES-2, 2.6% DSCADA, 0.5% PQ-10) in DI Water



Cola®Moist 200

Dia-Stron Wet Combing Results for Base Formula (11.5% SLES-2, 2.6% DSCADA, 0.5% PQ-10) on bleached brown hair





Cola®Moist 200 in Formulation

Nourishing Hand Wash (Sulfate-Free, Betaine-Free) # 4040

INCI Name	*Trade Name*	*%*
Water	Water	qs to 100.00
Water, Sodium C14-16 Olefin Sulfonate, Cocamidopropyl Hydroxysultaine, Cocamide MIPA	***Cola®Det DEF-61***	35.00
Hydroxypropyl Bis-Hydroxyethyldimonium Chloride	***Cola®Moist 200***	3.00
Water and Glycol Distearate and Sodium Hydroxypropylphosphate Decylglucoside Crosspolymer and Cocamidopropyl Hydroxysultaine and Sodium Stearoyl Lactylate	***Suga®Det EcoPearl***	3.00
Sodium Benzoate *and* Potassium Sorbate	Euxyl® K712 [1]	1.00
Fragrance	Oud Fragrance [2]	0.20
Citric Acid	Citric Acid, 50%	qs to pH 5.5 – 6.0

TYPICAL PROPERTIES

Appearance	**Pearled, Viscous Liquid**
pH	5.5 – 6.0
Viscosity	4,000 – 6,000 cP
% Solids	**15.8 – 17.4**

Time Lapse Demo

- Click here for video on Vimeo

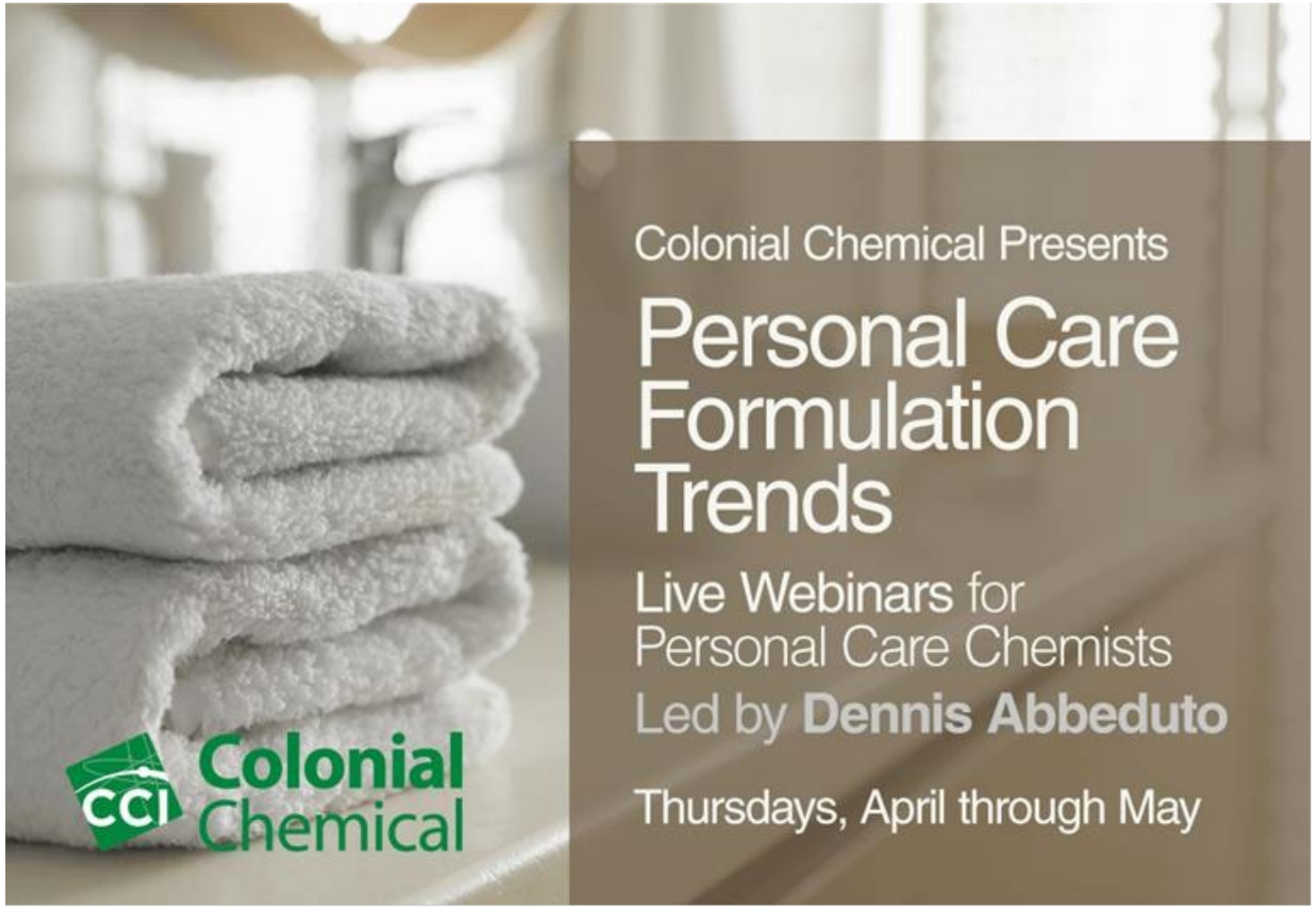
Wrap Up

- Humectants are important tools for skin moisturization
- Nature-inspired synthetic products can offer new benefits
- Formulators need to conduct a rational approach to demonstrating efficacy
- Improved moisturization from rinse-off products is possible

Webinar Series – Coming Events

- April 30 – Surfactants 101
- May 7 – Salt-free Surfactants
- May 14 – Alternate Preservation
- May 21 – Dioxane-Free Formulas
- May 28 – Sulfate-Free Formulas

- https://bit.ly/2XXTbEO



Thank you!

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Product TDS/SDS/Formulations: https://www.colonialchem.com
Formula Girls Podcast: https://apple.co/3dUq5fh