Alternative Preservation Technologies

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WASH YOUR HANDS

Outline

- The Importance of Preservation
- Alternative to What?
- When the Cure is Worse Than the Disease
- Surfactants as Preservatives
- Product Solutions
  - Cationic
  - Nonionic
  - Amphoteric
- Wrap-up.

The Importance of Preservation

- The majority (and increasing) of personal care ingredients are food for microbes
- Generally, this is what people want
  - Readily biodegradeable
  - High biobased carbon content
  - Natural or nature-identical
- Increasing water activity increases susceptibility to microbial growth
- Anhydrous formulations can adsorb water at the surface to sustain mold or bacteria
- Anhydrous raw materials may not desiccate microbes quickly enough to ensure zero contamination
- Mold spores can be particularly tenacious.

Alternative to What?

- Over the years, a variety of preservatives have come under scrutiny
- Carcinogenic potential
  - Formaldehyde and donors
  - Polyaminopropyl Biguanide (PHMB)
  - Salicylic Acid
  - Parabens
- Contact allergen
  - Isothiazolinones
  - Bronopol
  - Iodopropynyl Butylcarbamate (IPBC)
- Environmental issues
  - Ethylenediaminetetraacetic Acid (EDTA).

When the Cure is Worse Than the Disease

- Elimination of traditional preservatives with long history of safe use has serious consequences
  - Increased reliance on products without extensive use history
  - Increased incidence of contact sensitization
  - Insufficient testing to ensure stability
  - Lack of consideration for preservative effect on formulation and vice versa

- As preservatives continue to come under attack, industry is moving increasingly towards multifunctional additives, stacking together to increase “hurdles”.

Feature Products for Personal Care

Poly Suga®Quats	*APG quats with multiple advantages*
Colonial Monolaurin	*Multifunctional nonionic with proven efficacy*
Cola®Teric CHGL	*Betaine replacement with added benefits*
Cola®Lipid C	*Multifunctional amphoteric*

Poly Suga®Quats

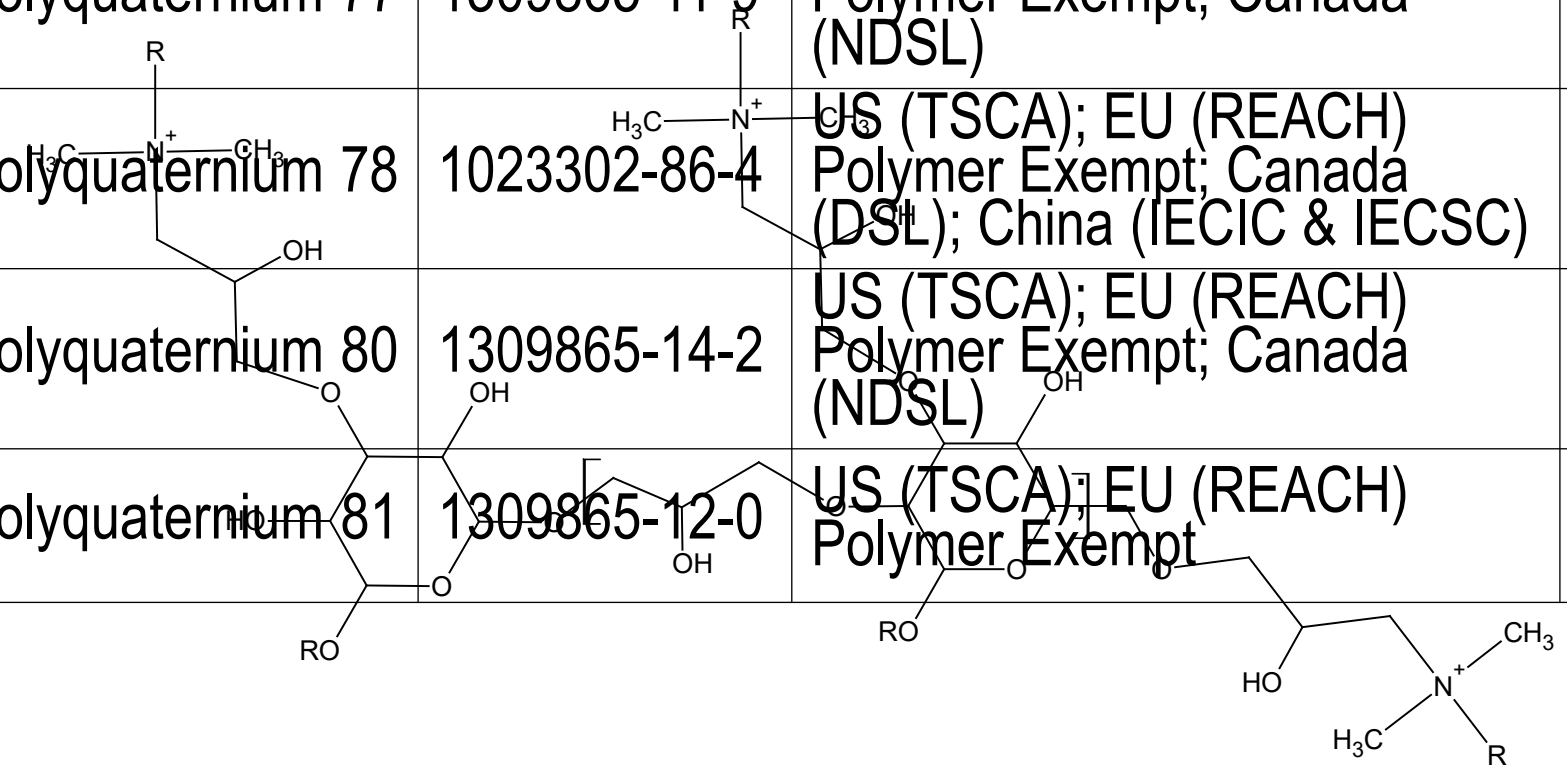
Quaternized Polymeric Alkylpolyglucosides

Poly Suga®Quat

Chemistry

Poly Suga®Quat Chemistry

Product	INCI Name	CAS No.	Listings	ISO 16128
TM-8610P	Polyquaternium 77	1309865-11-9	US (TSCA); EU (REACH) Polymer Exempt; Canada (NDSL)	0.95
L-1010P	Polyquaternium 78	1023302-86-4	US (TSCA); EU (REACH) Polymer Exempt; Canada (DSL); China (IECIC & IECSC)	0.96
L-1210P	Polyquaternium 80	1309865-14-2	US (TSCA); EU (REACH) Polymer Exempt; Canada (NDSL)	0.96
S-1210P	Polyquaternium 81	1309865-12-0	US (TSCA); EU (REACH) Polymer Exempt	0.965



Poly Suga®Quat

Benefits and Applications

Poly Suga®Quat Benefits

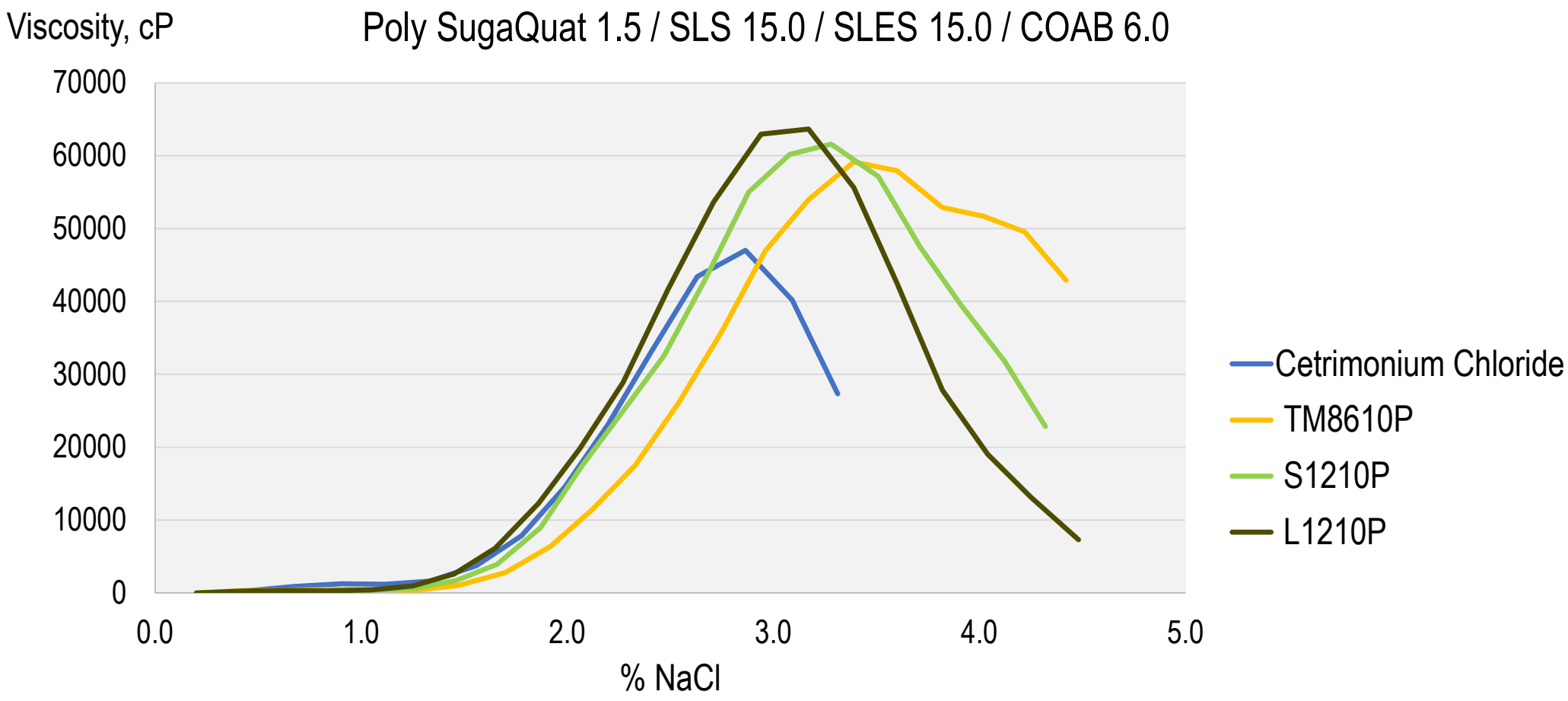
- Lower irritation when compared to many traditional quaternaries
- Excellent replacement for wide variety of quaternary ingredients
- Excellent formulation compatibility with anionic surfactants
- Made from naturally derived, renewable resources
- Exhibit varying degrees of antimicrobial activity
- Do not contain preservatives when shipped
- PEG-free, toxic monomer-free

Antimicrobial Testing

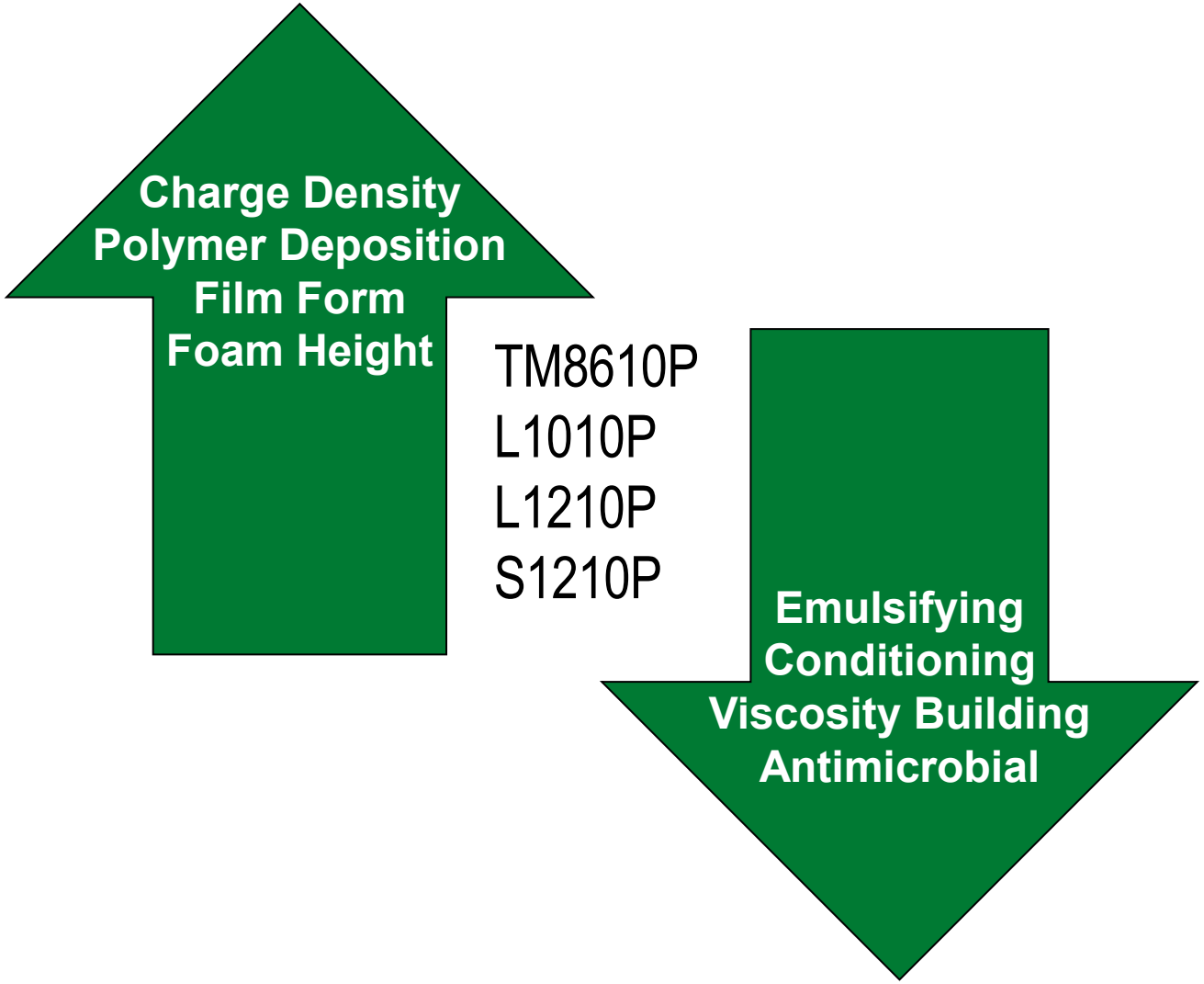
Organism	% solid ingredient	L1210P	S1210P
P. aeruginosa	0.5	0.0	8.3
	1.0	0.0	11.7
	2.0	0.0	14.7
S. aureus	0.5	0.0	9.7
	1.0	9.7	11.0
	2.0	14.3	15.7
E. coli	0.5	0.0	11.0
	1.0	0.0	12.3
	2.0	0.0	15.0
C. albicans	0.5	10.0	9.7
	1.0	12.3	12.3
	2.0	16.7	15.0
A. brasiliensis	0.5	0.0	0.0
	1.0	10.3	10.0
	2.0	12.3	13.3

» Zone of inhibition is measured in mm from the center of the site

Viscosity Development



Which Poly Suga®Quat Should I Use?



Poly Suga®Quat

Toxicological Properties

Ocular Irritation Potential

- Poly Suga®Quat L1010P **13.25**
  - Only moderate ocular irritation potential
- Poly Suga®Quat S1210P **12.50**
  - Only moderate ocular irritation potential
- Poly Suga®Quat TM8610P **14.50**
  - Only moderate ocular irritation potential

- By comparison, common quaternaries like Cetrimonium Chloride and Stearalkonium Chloride at similar concentration would score the maximum **32.00**

Dermal Irritation Potential

48-Hour Patch Test – 53 subjects:

- Poly Suga®Quat L1010P
  - 53/53 No potential for dermal irritation
- Poly Suga®Quat S1210P
  - 53/53 No potential for dermal irritation
- Poly Suga®Quat TM8610P
  - 53/53 No potential for dermal irritation

Colonial Monolaurin (MB)

Glyceryl Laurate

Colonial Monolaurin (MB)

Chemistry

Colonial Monolaurin (MB)

- **INCI:** **Glyceryl Laurate**
- **CAS:** 142-18-7
- **Listings:** USA (TSCA); Canada (DSL); EU (REACH); Australia (AICS); Japan (ENCS); Korea (KECI); China (IECSC & IECIC); Philippines (PICCS); New Zealand (NZIOC); Taiwan (TCSI)

GRAS	21 CFR 184.1505 Mono- and diglycerides
NATRUE	Annex 3
ISO 16128	Derived Natural with a Natural Origin Index of 1.00
NSF®/ANSI	305-2012

Colonial Monolaurin (MB)

- Colonial Monolaurin (MB) is a distilled monoglyceride made from fractionated fatty acids

Typical Properties	**Colonial Monolaurin**
Monoester content	90% Minimum
Fatty acid composition	Capric: 2% max., Lauric: 90% min., Myristic: 8% max
Iodine value	1 Maximum
Saponification value	200-210
Free glycerol	4% Maximum
Free fatty acid	1.5% Maximum
Melting point	59°C - 60°C
Appearance	White pastilles
HLB Value	5.2

Colonial Monolaurin (MB)

Benefits and Applications

Colonial Monolaurin (MB) Benefits

- High purity product
- Low odor and color
- Excellent emollient
- Antimicrobial activity
- Virtually no skin irritation
- Enhanced efficacy of cosmeceutical formulations
- **Ecocert/COSMOS**

Antimicrobial Efficacy

- The efficacy of glyceryl laurate has been well established in patents and peer-reviewed literature
  - Broad spectrum efficacy (Gram +, Gram -, yeasts, molds)
  - Safe use in a variety of applications (GRAS)
  - Compatibility with routine ingredients
  - Low MIC values *in vitro*

- https://en.wikipedia.org/wiki/Monolaurin
- https://patents.google.com/?q=monolaurin+antimicrobial
- https://www.ncbi.nlm.nih.gov/pubmed/?term=monolaurin+antimicrobial

Cola®Teric CHGL

Sultaine Amphoteric with Enhanced Properties

Cola®Teric CHGL

Chemistry

Cola®Teric CHGL

- **INCI:** **Cocamidopropyl Hydroxysultaine** *and* **Glyceryl Laurate**
- **CAS:** 68139-30-0 and 142-18-7
- **Listings***:* USA (TSCA), Canada (DSL), EU (REACH Registered), Australia (AICS); China (IECIC/IECSC); Philippines (PICCS); New Zealand (NZIOC)

Cola®Teric CHGL is **"Derived Natural"** with a **Natural Origin Index of 0.82** in accordance with **ISO 16128** guideline.

Cola®Teric CHGL

Benefits and Applications

Cola®Teric CHGL

Processing Benefits

- Disperses readily into surfactant mixtures without heating or special mixing equipment
- Easily soluble in surfactant solutions
  - Clear formulations are obtained in combination with other surfactants (e.g. anionic and/or amphoteric)
- Can be added during every step of production

Formulation Benefits

- Delivers Glyceryl Laurate in rinse-off cleansing formulations
- Extremely efficient foam booster, stabilizer, and thickener
- Reduces the prevalence of “long” or “stringy” appearance in low-solid surfactant formulations.
- Useful in reducing the amount of salt needed to achieve optimum viscosity, especially in difficult-to-build sulfate-free formulations

Cola®Lipid C

Coconut-Derived Biomimetic Phospholipid

Cola®Lipid C Chemistry

INCI: **Cocamidopropyl PG-Dimonium Chloride Phosphate**
CAS: 83682-78-4
LISTINGS: USA (TSCA); EU (REACH); Canada (DSL); Australia (AICS); Philippines (PICCS); Korea (ECL); China (IECSC); New Zealand (NZIoC); Japan (ENCS)

Cola®Lipid C is **"Derived Natural"** with a **Natural Origin Index of 0.80** in accordance with **ISO 16128** guideline.

Cola®Lipid C

Benefits and Applications

Cola®Lipid C Benefits

- Compatible with wide range of ingredients
- Broad spectrum antimicrobial activity
- Consumer-perceivable silky feel
- Sustainable, naturally-derived
- Mimics natural phospholipids
- Multi-functional ingredient
- Broad global approval

Cola®Lipid C

Test Organism	ATCC	Type Number	Minimum Inhibitory Concentration (active ppm)
Staphylococcus aureus	6538	Gram +	141
Staphylococcus epidermidis	14409	Gram +	141
Streptococcus faecalis	6569	Gram +	141
Bacillis subtilis	6633	Gram +	71
Bacillis cereus	11778	Gram +	71
Micrococcus luteus	4698	Gram +	141
Escherichia coli	8739	Gram -	24
Proteus mirabilis	9921	Gram -	24
Pseudomonas aeruginosa	15442	Gram -	141
Pseudomonas cepacia	25608	Gram -	71
Pseudomonas stutzeri	17591	Gram -	71
Salmonella choleraesuis	10708	Gram -	588
Enterobacter aerogenes	13048	Gram -	588
Klebsiella pneumoniae	13883	Gram -	588
Aeromonas hydrophila	9071	Gram -	24
Candida albicans	10259	Yeast	376
Aspergillus niger	6275	Mold	294
P. Expansum	1117	Mold	36
Aspergillus oryzae	10196	Mold	2350
Cephalosporium species	12285	Mold	71

Cola®Lipid C

- **TEST RESULTS FOR SUSTAINED ANTIMICROBIAL ACTIVITY ON FIBER***
  - Procedure: Swatches of an air-laid cellulosic / cotton blend were exposed to the test material by dipping into the test solution and blotting to remove excess moisture. Imprints were then made on seeded agar plates (inoculated with S. Epidermidis). The swatches were then rinsed and blotted to remove excess moisture. A series of four rinsings and imprints were made, including the initial exposure and imprint. The degree of residual activity / fiber substantivity was determined by the clarity of the zone of inhibition to microbe growth surrounding the imprints and the seeded agar plates as compared to the untreated controls. The grading system used to record the data obtained is as follows:

Grade	**Antimicrobial activity**
0	No control of microbial growth
1	Slight
2	Moderate
3	Good
4	Excellent control of microbial growth

Swatch (2x2 cm)	**1% test material as supplied**	**3% test material as supplied**
Initial exposure	4.0	4.0
Rinse 1	4.0	4.0
Rinse 2	3.0	3.3
Rinse 3	2.7	2.8
Untreated control	0.3	0.3

*** As reported in Cosmetics and Toiletries Manufacture Worldwide, 1994**

Cola®Lipid C

- **TEST RESULTS FOR SUSTAINED ANTIMICROBIAL ACTIVITY ON SKIN***
  - Procedure: Individual fingers of selected panelists were washed twice, blotted to remove excess moisture, and exposed to the test material. Finger imprints were then made on seeded agar plates (inoculated with S. Epidermidis), after which the individual fingers were rinsed and blotted. A series of three rinsings and four imprints were made, including the initial exposure and imprint. The degree of residual antimicrobial activity on the skin was determined by the clarity of the zone of inhibition to microbial growth surrounding the imprints on the seeded agar plates. The grading system used to record the data is identical with that described above.

Grade	Antimicrobial activity
0	No control of microbial growth
1	Slight
2	Moderate
3	Good
4	Excellent control of microbial growth

	Control Soap only	3% test material as supplied	5% test material as supplied
Initial exposure	2.0	4.0	4.0
Rinse 1	1.6	2.6	3.0
Rinse 2	1.0	2.0	2.3
Rinse 3	1.3	1.3	2.0
Untreated	1.3	1.3	1.3

*** As reported in Cosmetics and Toiletries Manufacture Worldwide, 1994**

Cola®Lipid C: Preservative Challenge Test

PROCEDURE BRIEF

Test material was diluted to a final test concentration of 1.0% in phosphate buffered saline. Representative aliquots of test preparation were inoculated with separate mixed cultures of bacteria and fungi. Plate counts to determine survivors were performed at 0 time and after 1, 3, 7 and 14 after inoculation. Sample was inoculated at both 0 time and 7 days. Results are presented as the number of surviving organisms present at each time interval per gram of material tested. Inoculum levels were ~10^6 per gm for the mixed bacteria and ~10^5 per gm for the mixed fungi.

INOCULUM

a) Mixed Bacteria: Pseud. aeruginosa (ATCC 15442); B. cepacia (ATCC 25416); E.coli (ATCC 8739 or 11229); S. aureus (ATCC 6538).

b) Mixed fungi: A. brasilienis (niger) (ATCC 16404); C. albicans (ATCC 10231); Penicillium luteum (ATCC 9644) or Penicillium levitum (ATCC 10464)

MICROBIAL CHALLENGE TEST RESULTS

	0 Hours	24 Hr.	72 Hrs	1 Week*	2 Weeks
Bacteria	1,200,000	<10	<10	<10	<10
Fungi	380,000	<10	<10	<10	<10

Sample was reinoculated at day seven (*) for a total of two (2) challenges. Bacterial and fungal counts are presented as organisms recovered. Test day is the number of days after inoculation of the test sample.

ColaLipid C Human Tox Properties

- Dermal (5% in water)
  - 48 Hour Occluded Human Patch - 53 Test Subjects
    - 53/53 ***Completely Non-Irritating***

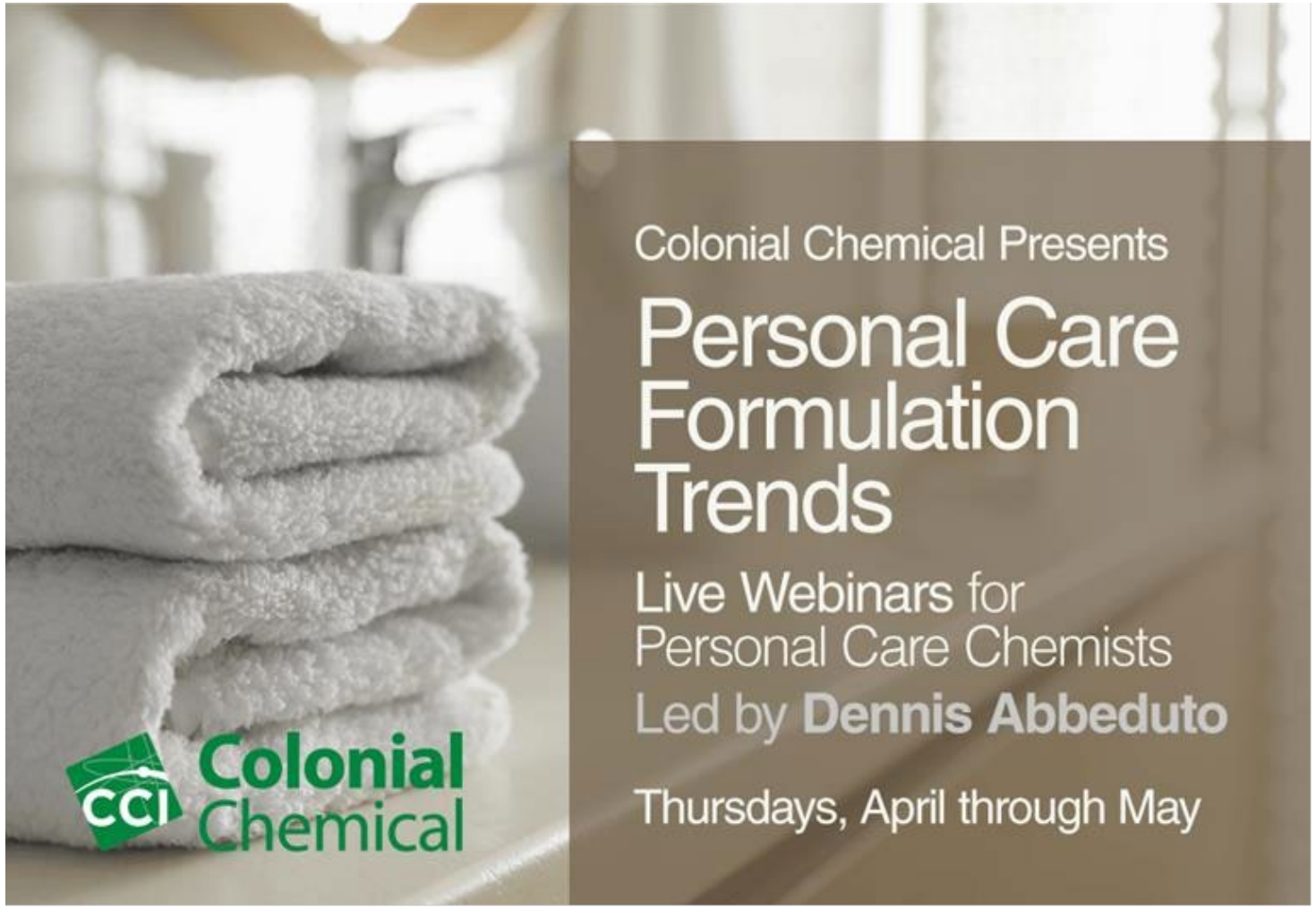
- Ocular (5% in water)
  - HET-CAM: Hen's Egg Test Chorioallantoic Membrane
    - **6.25** *Classification:* ***Minimal/Mild***
  - MatTek EpiOcular Irritation Test
    - **78.5** (ET-50) *Classification:* ***Minimal***

- Sensitization
  - Repeated Insult Occluded Patch (5% in water) - 50 Test Subjects
    - **No evidence** of induced allergic contact dermatitis in humans
  - Method OECD Test Guideline 442C - Direct Peptide Reactivity Assay (DPRA) and Method 442D - the KeratinoSens test method (47% active)
    - Newly approved in-vitro studies for skin sensitization
    - *Classification:* ***Non-sensitizer*** *with no or minimal reactivity*

Webinar Series – Coming Events

- May 21 – Dioxane-Free Formulas
- May 28 – Sulfate-Free Formulas

- **https://bit.ly/2XXTbEO**



Thank you!

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