Quick Facts

• 30-year-old specialty chemical manufacturing company

• Global supplier to over 420 manufacturers of finished goods for personal care, household, and industrial use

• Portfolio is represented through Colonial sales people and regional distributors worldwide

• Employs over 88 staff in manufacturing and administration
Colonial Chemical Products

- Meet customer demands for options, features, quick order fulfillment, and fast delivery for broad surfactant requirements
- Marketed through comprehensive branding program that differentiates the qualities of the product to the customer
- Competitively priced
- Emphasis on emerging green chemistry market, i.e. safe, innovative, naturally-derived surfactants alongside traditional chemistry
  - 12 Principles of Green Chemistry
- Offering the mildest chemistry found in the marketplace for Personal Care and HI&I applications
At Colonial Chemical, we bring "Green" chemistry to practice:

- The major raw materials and components in the surfactant are from natural, plant-derived sources.
- The surfactants are readily biodegradable – causing no harm to the environment.
- The surfactants are produced using safe, mild process methods which minimize waste and harmful by-products.
- The surfactants have comparable performance to current products.
- The surfactants meet or exceed regulatory requirements and NGO mandates.
Colonial Chemical “Green” chemistries help customers to improve:
- Meeting demanding and changing regulatory requirements
- Using Non-GMO and GMO-Free alternatives
- CARB / VOC Reduction
- Environmental safety
- Human safety
- Food safety
- Energy conservation
- Water conservation
- Materials and labor efficiency
Benefits of APG Derivatized Products

- Naturally-derived, renewable feedstock source
- Biodegradable and safe for the environment
- Superior to traditional sulfates, ether sulfates, sulfonates or AOS for toxicity and irritation
- EO free (1,4-Dioxane free)
- Non-irritating to eyes and skin
- High foaming
- Builds a wet, dense, stable foam
- Stable over a broad pH range
- Broad regulatory and NGO acceptance
Suga®Nate 160NC
Next Generation Surfactant
Reliable but Ancient Technologies

- Alkyl Sulfates – Sodium lauryl sulfate and sodium lauryl ether sulfate
  - SLS and SLES are proven products and widely used.
  - They are also 60+ year-old technologies.
There are new options!

- **Formulators need to move into the 21st Century**
- New technologies offer:
  - Sulfate-free formulations
  - Improved safety data
  - Eco-friendly
  - Lower irritation
  - Sustainable raw materials
  - Safer processes to manufacture
    - 12 principles of Green Chemistry
Our starting point

- Alkyl Polyglycosides

- They are derived from sugars, usually glucose derivatives, and fatty alcohols
  - Raw materials for industrial manufacture are typically starch and fat, and the final products are typically complex mixtures of compounds with different sugars comprising the hydrophilic end and alkyl groups of variable length comprising the hydrophobic end
- When derived from glucose, they are known as alkyl polyglucosides
Alkyl Polyglucosides

• APG surfactants: Fischer synthesis
  - Corn starch glucose and coconut oil-derived alcohol
  - Originally from Staley, Henkel, Cognis (now BASF), and other suppliers

• APGs
  - Nonionic, nitrogen-free, EO free and 1,4-dioxane free

• APGs
  - A natural choice for personal care products because of the level of detergency, low color, and no nitrosamine issues
Alkyl Polyglucosides

- However, there are deficiencies
  - Solubility issues
  - Handling
  - Foaming is moderate
  - Irritation can be high
Alkyl Polyglucosides

- Blending approach
  - Mitigate some of the deficiencies
  - Still contains SLES, SLS

- Derivatized approach
  - Gives greater functionality and application in formulations
  - Improves the Irritation scores in most cases
  - Easier to formulate
  - Generally has more desirable properties
  - Broader range of application
APG Derivative Synthesis

Sodium Laurylglucosides Hydroxypropylsulfonate
Benefits

• Sodium Laurylglucosides Hydroxypropylsulfonate
  - Naturally-derived, renewable feedstock source
  - Biodegradable and safe for the environment
  - Superior to traditional sulfates, ether sulfates, sulfonates or AOS for toxicity and irritation
  - EO free (1,4-Dioxane free)
  - Non-irritating to eyes and skin
  - High foaming
  - Builds a wet, dense, stable foam
  - Stable over a broad pH range
• The development of Suga®Nate 160NC represents a breakthrough in formulation technology.
  - In the past, a formulator started with irritating materials and built the formulation to mitigate irritation.
  - Suga®Nate 160NC allows a formulator to start formulating with a non-irritating product and build consumer desired aesthetic properties knowing irritation to eyes and skin will not be a problem.
  - This breakthrough allows the formulation of non-irritating, shampoos, body washes, bath gels, and personal cleansing products.
### Typical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Suga®Nate 160NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Clear liquid</td>
</tr>
<tr>
<td>Color, Gardner</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Solids %</td>
<td>39.0 – 41.0</td>
</tr>
<tr>
<td>Viscosity (cps), 25°C</td>
<td>7,500</td>
</tr>
<tr>
<td>Odor</td>
<td>mild, fatty alcohol</td>
</tr>
<tr>
<td>pH (10% aq)</td>
<td>6.0 – 8.0</td>
</tr>
</tbody>
</table>

**Ross Miles Foam Height** *(1%, 25°C, tap water), mm*

<table>
<thead>
<tr>
<th>Time</th>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate</td>
<td>155</td>
</tr>
<tr>
<td>1 min.</td>
<td>152</td>
</tr>
<tr>
<td>5 min.</td>
<td>150</td>
</tr>
</tbody>
</table>

**Draves Wetting** *(1% active), sec.*

<table>
<thead>
<tr>
<th>Time</th>
<th>Wetting (sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.2</td>
</tr>
</tbody>
</table>
Toxicological Properties

Eye Irritation

• HET-CAM: Hen's Egg Test Chorioallantoic Membrane
  - Practically no ocular irritation potential in vivo, score of Zero

• MatTek Epi-Ocular: In vitro epidermal keratinocytes
  - Results indicate Suga®Nate 160NC has a 'non-irritating' classification, equivalent Draize score of Zero
HET-CAM Irritation Results

- Sodium Lauryl Sulfate: 30
- Sodium Laureth-2 Sulfate: 25.5
- Sodium Lauroyl Methyl Isethionate: 23.5
- Sodium C14-16 Olefin Sulfonate: 21
- Sodium Lauroyl Sarcosinate: 18.5
- Sodium Cocoyl Isethionate: 18.5
- Sodium Cocoyl Glutamate: 17.75
- Sodium Lauryl Sulfoacetate: 17.25
- Sodium Methyl Cocoyl Taurate: 13.75
- Disodium Laureth Sulfosuccinate: 12
- Poly Suga®Nate 160P: 4.5
- Suga®Nate 160NC: 0

10% solids, pH 5.5 - 6.5

CONFIDENTIAL USE ONLY
Clean Label

GHS Warning Labels

Suga®Nate 160NC
SODIUM LAURYLGLUCOSIDES
HYDROXYPROPYLSULFONATE
LOT# 56015C17

PUREACT I-85EC
Warning
Causes serious eye irritation.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.
Toxicological Properties

Acute Skin Irritation
• 48 Hour Occlusive skin patch test on human volunteers - 53 Test Subjects
  - 53/53 showed no visible skin reaction
  - No potential for dermal irritation

Skin Sensitization
• Repeat Insult Patch testing (HRIPT)
  - Suga®Nate 160NC does not indicate a potential for dermal irritation or allergic contact sensitization
Toxicological Properties

Biodegradability

- OECD 301 Ready Biodegradability Test (301E)
  - 80-82% biodegradable in 28 days
  - Exceeds 70% biodegradability requirement
- OECD 311 Anaerobic Biodegradability Test
  - 76% biodegradable in 60 days

Bacteria Reverse Mutation Assay

- Ames test, OECD 471
  - No detectable genotoxic activity at the non-cytotoxic concentrations of Suga® Nate160NC, neither in the absence nor in the presence of the S9 enzyme activation
Personal Care Applications

- Sulfate-free shampoos
- Low and high-pH shampoos
- Bath gels
- Body washes
- Facial cleansers
- Baby cleansing products
- Personal care wipes
- Make-up removers
- Pet shampoos
• Building viscosity in sulfate-free formulations has been a challenge for formulators.

• Simple combination of Suga® Nate 160NC with a wide variety of secondary surfactants will give high viscosity formulations at solids levels that are achievable in all types of formulations.

• Sodium Stearoyl Lactylate also improves viscosity
Viscosity Performance

Viscosity of Suga®Nate 160NC with Cola®Teric blends

- CBS
- COAB
- LMB
- CBS-HP
Sodium Stearoyl Lactylate

Viscosity of Suga®Nate 160NC Shampoo Concentrate
30% dilution w/ Sodium Stearoyl Lactylate
Foaming comparison

• Our Suga®Nate 160NC formulation vs. popular sulfate-free shampoos currently on the market

L’Oreal® EverStrong Shampoo  JASON® Aloe Vera Shampoo  Nature’s Gate® Shampoo

• Suga®Nate 160NC foams well – and better than some of the leading brands!
Other Considerations for Formulating

- Amphoteric and pH
- Rheology modifiers
- Viscosity boosting
- Optimizing foam
- Preservation
- Fragrance
- Skin feel
Suga®Nate 160NC Regulatory Status

- USA (TSCA)
- EU (REACH)
- Canada (NDSL)
- Australia (AICS)
- New Zealand (NZIoC)
- Japan (ENCS)
Suga®Nate 160NC NGO Listings

- NPA Certified Ingredient
- NSF/ANSI 305-2012
- Approved for EPA’s Safer Choice
- Whole Foods Market® list of premium body care products
- USDA Biopreferred Product
- Halal Certified
# Natural Body Wash

## Clarifying Shampoo (Sulfate-Free)

<table>
<thead>
<tr>
<th>INCI Name</th>
<th>Trade Name</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td></td>
<td>qs to 100.00</td>
</tr>
<tr>
<td>Lauramidopropyl Betaine</td>
<td>Cola® Teric LMB</td>
<td>15.00</td>
</tr>
<tr>
<td>Sodium Laurylglucosides Hydroxypropylsulfonate</td>
<td>Suga® Nate 160NC</td>
<td>25.00</td>
</tr>
<tr>
<td>Cocamide MIPA</td>
<td>Cola® Mid CMPA</td>
<td>0.50</td>
</tr>
<tr>
<td>Glycol Distearate</td>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td>Polyquaternium-81</td>
<td>Poly Suga® Quat S1210P</td>
<td>0.50</td>
</tr>
<tr>
<td>Disodium Laureth Sulfosuccinate</td>
<td>Cola® Mate DSLS</td>
<td>10.00</td>
</tr>
<tr>
<td>Fragrance</td>
<td>Green Tea</td>
<td>0.20</td>
</tr>
<tr>
<td>Preservative</td>
<td>Glydant</td>
<td>0.40</td>
</tr>
</tbody>
</table>

### TYPICAL PROPERTIES

- **Appearance**: Clear Liquid
- **pH**: 6.5
- **Viscosity**: 10,000 cP
## Natural Body Wash (Betaine-Free)

<table>
<thead>
<tr>
<th>INCI Name</th>
<th>Trade Name</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>qs to 100.00</td>
<td></td>
</tr>
<tr>
<td>Sodium Laurylglucosides Hydroxypropylsulfonate</td>
<td>Suga® Nate 160NC</td>
<td>19.20</td>
</tr>
<tr>
<td>Disodium Lauryl Sulfosuccinate</td>
<td>Cola® Mate LA-40</td>
<td>4.00</td>
</tr>
<tr>
<td>Cocamidopropyl Hydroxysultaine (Fatty Acid)</td>
<td>Cola® Teric CBS-HP</td>
<td>9.60</td>
</tr>
<tr>
<td>Fragrance</td>
<td>Island Luau</td>
<td>0.20</td>
</tr>
<tr>
<td>Preservative</td>
<td>qs</td>
<td></td>
</tr>
<tr>
<td>Citric Acid</td>
<td>qs</td>
<td></td>
</tr>
</tbody>
</table>

### Typical Properties

- **Appearance**: Clear Liquid
- **pH**: 5.5
- **Viscosity**: 8,000 cP
Where has it taken us so far?

Forecast for 2017 is 5,000,000 pounds + 2,200,000 kgs +
Suga®Nate 160NC Recent Successes
Suga®Nate 160NC Recent Successes
Colonial Chemical’s green surfactants Poly Suga®Nate 160P and Suga®Nate 160NC are both clearly less damaging to these flowers than the traditional surfactants used in the experiment.

When synthetically-derived chemicals such as Sodium Lauryl Sulfate, Sodium Laureth Sulfate and Alpha Olefin Sulfonate meet nature, they have a devastating effect on nature’s plant life such as roses.

What are they doing to your skin and hair?
Time Lapse Video of Test
Things to Remember About Suga®Nate 160NC:

- Superior to other popular sulfate-free surfactants when referring to toxicity and irritation
- EO free (1,4-Dioxane free)
- Nothing is as mild to eyes and skin
- Nothing is as safe for the environment
- Cost-effective when compared to newest technology surfactants
- Shipped preservative-free!
- *The Natural Choice for Sulfate-Free Formulations!*
Suga® Fax
APG Phosphate
Suga®Fax Chemistry

• **Suga®Fax** Products
  - **Suga®Fax D04**
    • Sodium Dibutylglucosides Hydroxypropyl Phosphate
  - **Suga®Fax D08**
    • Sodium Dioctylglucosides Hydroxypropyl Phosphate
  - **Suga®Fax D10NC – 100% Natural**
    • Sodium Didecylglucosides Hydroxypropyl Phosphate
  - **Suga®Fax D12 – 100% Natural**
    • Sodium Dilaurylglucosides Hydroxypropyl Phosphate
  - **Suga®Fax D86 – 100% Natural**
    • Sodium Dicocoglucosides Hydroxypropyl Phosphate
Focus on one product: Suga®Fax D-10NC

- **Multi-function**
  - Wetting agent
  - Foaming agent
  - Hydrotrope

- **This is real green chemistry**
  - One ingredient taking the place of many
  - 100% natural based carbon
Suga®Fax D10NC

• Ideal starting point for formulators of greener, milder and safer properties
  - Household cleaners and oilfield cleaners
  - High-performance industrial cleaners
  - May be used in household cleaners such as hard surface cleaning, oven cleaners, and extreme clean-up products for pots and pans
INCI NAME  Sodium Decylglucosides Hydroxypropyl Phosphate
CAS NO.       740817-98-5
LISTINGS     USA (TSCA); EU (REACH); Canada (NDSL)
Suga®Fax D10NC Chemistry

- 100% Naturally Derived and nonpetroleum based
- EO/PO Free- 1,4 dioxane free
- Mild to eyes and very mild characteristics for skin contact
- Meets regulatory approvals
- Organic phosphorus level of 1.3%
- Safe for release in the environment
  - Readily biodegradable (OECD 301B) and presents no damage to aquatic life
- Effective detergent and hydrotrope – better than SXS or SCS
- Rapid wetting
- Broad spectrum of pH usage
## Typical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Suga®Fax D10NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color, Gardner</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Activity, %</td>
<td>40</td>
</tr>
<tr>
<td>pH (10% aqueous)</td>
<td>7.5</td>
</tr>
<tr>
<td>Appearance, 10% aq.</td>
<td>Clear</td>
</tr>
</tbody>
</table>

## Ross-Miles Foam Height (1%, 25C, tap water), mm

<table>
<thead>
<tr>
<th>Time</th>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate</td>
<td>155</td>
</tr>
<tr>
<td>1 minute</td>
<td>145</td>
</tr>
<tr>
<td>5 minutes</td>
<td>140</td>
</tr>
</tbody>
</table>

## Draves Wetting (1% active), seconds

<table>
<thead>
<tr>
<th>Solubility (10% active)</th>
<th>Immediate</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% NaOH</td>
<td>Soluble</td>
</tr>
<tr>
<td>25% H₂SO₄</td>
<td>Soluble</td>
</tr>
</tbody>
</table>
Suga®Fax D10NC – 100% Natural

- Approved for EPA’s Safer Choice
- USDA Listed – **100**
- GreenStar™ - **10**

**Listings**
- USA (TSCA)
- EU (REACH)
- Canada (NDSL)
Suga®Fax D10NC Chemistry

- Suga®Fax D10NC shows good hydrotroping capabilities in 10% KOH solution.
  - Graph gives an indication of the relative ability to hydrotrope a nonionic material, compared to Sodium Xylene Sulfonate (SXS).
Suga®Fax D10NC Hydrotroping Tests

- Amounts needed to clear 100g of 1% Cola®Dol 91-6 in 10% KOH solution

Suga®Fax D10NC

4 Grams

5 Grams
Surface Tension Reduction

- 50% caustic has a surface tension of 126 dyne/cm; with the addition of 10% Suga®Fax D10NC, surface tension of the mixture was reduced to 45 dyne/cm.

- The graph shows the surface tension of Suga®Fax D10NC in 25% caustic going from 84 dyne/cm to 42 dyne.cm with just 1%
# All-Purpose Cleaner (Environmentally Friendly) # 5006

<table>
<thead>
<tr>
<th>Order</th>
<th>INCI Name</th>
<th>Trade Name</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water</td>
<td>qs to 100.00</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sodium Decylglucosides Hydroxypropyl Phosphate</td>
<td><em>Suga®Fax D10NC</em></td>
<td>5.00</td>
</tr>
<tr>
<td>3</td>
<td>Diethylene Glycol Monobutyl Ether</td>
<td>Butyl Carbitol</td>
<td>3.00</td>
</tr>
</tbody>
</table>

**TYPICAL PROPERTIES**

- Appearance: Clear liquid
- pH: 7.0
- Viscosity: 20 cP
Suga® Fax D10NC Facts To Remember

- 100% Naturally-derived and non-petroleum based
- EO/PO Free
- Mild to eyes and very mild characteristics for skin contact
- Safe for release in the environment
- Effective detergent and hydrotrope – better than SXS and SCS
We continue to expand the product line.
Poly Suga® Mulse Chemistry

- Sorbitan Oleate Decylglucoside Crosspolymer
- REACH Polymer Exempt
- GreenStar rating of 10.0
- HLB Value: 12-14 (D9)

D series – Decyl Glucoside
Colonial Chemical APG Chemistry Products

Alkyl Poly Glucoside

Suga®
- Suga®Nate • APG Sulfonates
- Suga®Fax • APG Phosphate Esters
- Suga®Det • Sulfate-Free PC Concentrates

Poly Suga®
- Poly Suga®Glycinate • Poly APG Amphoterics
- Poly Suga®Mulse • EO-Free Poly APG Emulsifiers
- Poly Suga®Nate • Poly APG Sulfonates
- Poly Suga®Phos • Poly APG Phosphates
- Poly Suga®Quat • Poly APG Quats
- Poly Suga®Sil • Dimethicone-APG Surfactants
Thank you!
Any questions?