WEBINAR

Sustainable Surfactants

For Emulsion Polymerization

Kathie Hacek
Market Manager,
EP/CASE

Dr. Andy Sun
Business Manager,
HI&I, Vehicle Care,
Oil & Gas, EP/CASE

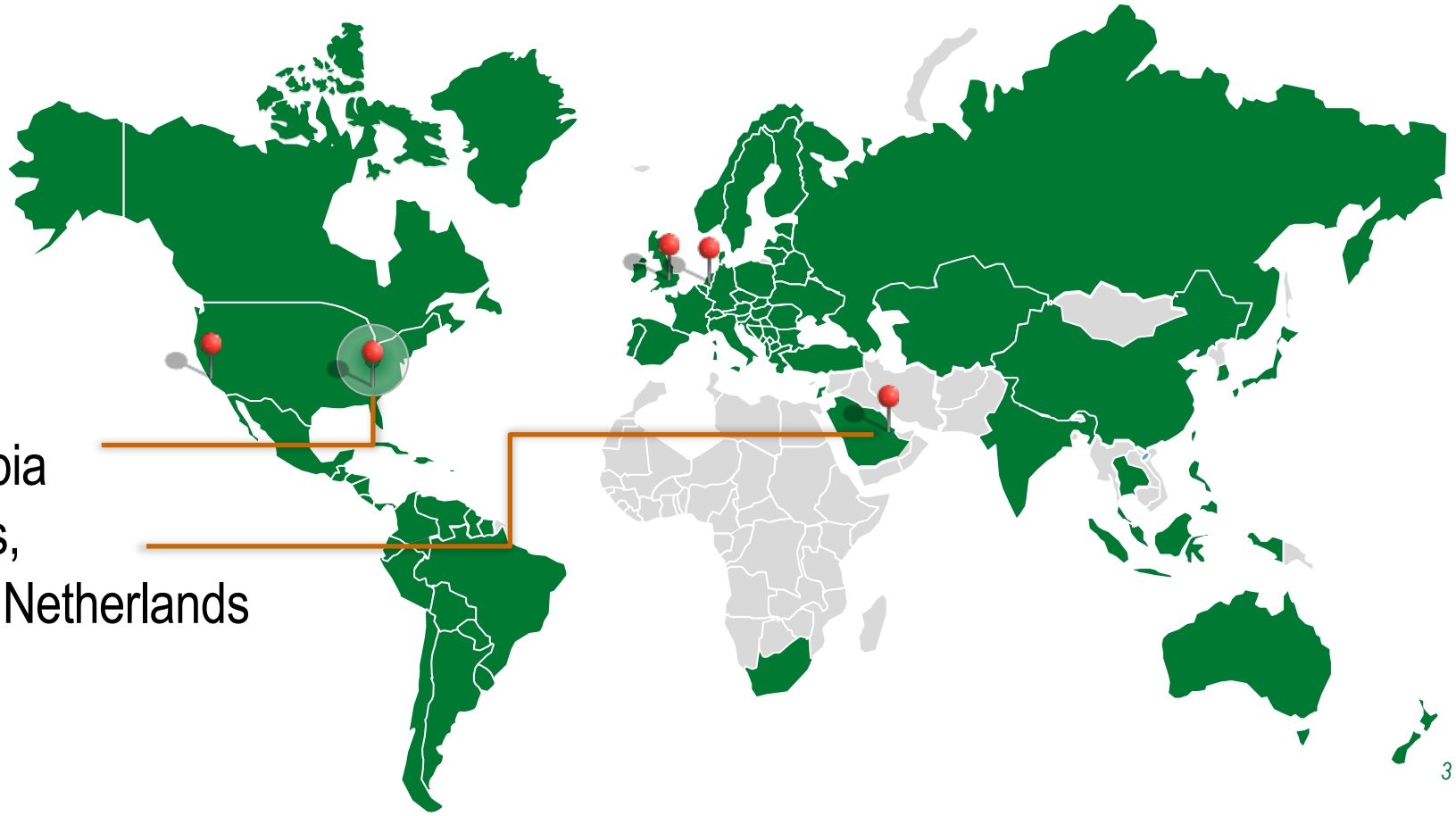
Colonial Chemical

Outline

- A Brief Introduction of Colonial Chemical, Inc.
- Sustainable Technology Platform
- EP Product Portfolio

Quick Facts

- 35-year-old specialty chemical manufacturing company
- Global supplier to over 930 manufacturers in personal care, HI&I markets
- Represented through Colonial sales personnel, distributors worldwide
- Almost 200 employees in manufacturing and administration in Tennessee and other locations
- Colonial Chemical M.E. Arabia
- Warehousing in Los Angeles, Birmingham UK, Rotterdam Netherlands



Quick Facts

- Over 100,000 sq. ft. (9300 m^2) of manufacturing and administrative offices
  - *and growing, additional 25,000 sq. ft in completion*
- Access to major SE distribution arteries and rail spur construction almost complete
- Optimum climate conditions for manufacturing
- Significant capital reinvestment of profits into assets for growth
  - Company will more than double in size in the next five years

Colonial Chemical M.E. Arabia

- Joint venture established for Saudi Arabia and Middle East operations
- Nine-acre manufacturing plant under construction
- General Manager on site
- Operations anticipated to commence Q3 2022

Colonial Chemical M.E. ARABIA

Industries Served

Personal Care, Cosmetics

- Hair Care
- Body Wash
- Baby Products
- Creams and Lotions
- Conditioners
- Pharmaceuticals
- OTC Products

Industrial Chemicals

- Household, Industrial and Institutional Cleaners
- Spray, High Pressure Cleaning
- Agricultural Emulsifiers
- Water Treatment
- Transportation Cleaners
- Dairy Cleaners
- Asphalt Products
- De-icing Fluids
- Intermediates

Vehicle Care

- Vehicle cleaning, drying, protection
- Competitive on pricing and cost-in-use
- Innovator in vehicle care products and applications
- Environment friendly and certified surfactants
- Nonionic, amphoteric surfactants and cationic emulsifiers

Industrial Lubrication

- Corrosion Inhibitors
  - Oil soluble
  - Water soluble
  - Aerosol can
- Metalworking Lubricants
  - Soluble oil emulsifiers
  - Anti-wear additives
  - Extreme pressure additives (EP Additives)

Industries Served cont.

CASE and EP

- Emulsifying
- Stabilizing
- Wetting
- Dispersing

- Specialty monomers
- Epoxy diluents

Oilfield Operations

- Drilling and well-bore additives
- Corrosion Inhibitors & Lubricants
- Production Chemicals
- Cleaning and Remediation

Other industries

- Medical
- Pet Products and Animal Health
- Plastics Lubricants
- Electronics Cleaning
- Mining
- Fire Fighting Foams
- Agriculture

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

Regulatory and NGO Approvals

- Worldwide regulatory approvals on most products
  - TSCA, DSL, **REACH**, ENCS, NZIoC, IECSC, and others
- CleanGredients
- USDA BioBased Approved
- Whole Foods Market® Premium Body Care
- NSF/ANSI 305-2012
- EcoCert Certified
- Kosher Certified
- Halal Certified Facility
- RSPO
- USDA NOP Organic Certified Facility

EPA Green Chemistry Challenge Award Winner

- **Suga®Boost 030** and **050** were awarded the 2021 EPA Green Chemistry Challenge For Designing Greener Chemicals
  - Consume less energy to create
  - Biodegradable
  - Derived from plant-based materials
  - Performance that demonstrates potential to replace EO-containing surfactants such as SLES and APEs.
- Additional chemistries have been recognized with the P2 (Pollution Prevention) Award previously

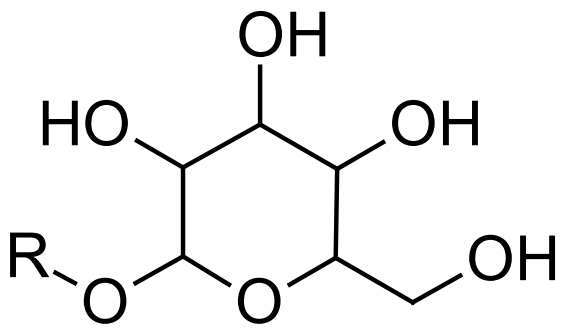
EPA United States Environmental Protection Agency

GREEN CHEMISTRY CHALLENGE

Functionalized APG Surfactants Provide Solutions

- **Increasingly Stringent Regulation**
  - Alkyl phenol ethoxylates (APE/NPE, reproduction issue and 1,4-dioxane)
  - Alcohol Alkoxylates (1,4-dioxane)
  - DEA in amides
  - Dichloro acetic acid (DCA) in betaines
- **Public Safety Concerns**
  - Carcinogenic (1,4-dioxane, DEA, NPE, DCA, SLES, etc.)
  - Irritators and sensitizers (sulfate, ethoxylates, etc.)
- **Environment Concerns**
  - Soil, water, air contamination
  - Aqua toxicity
  - VOC
  - Toxic residuals in degradation
  - Reclamation of resources and green cycle
- **Performance in Green Surfactants**

Functionalized APG Chemistry (patented)



Alkyl Poly Glucoside

Suga®

Suga®Nate • APG Sulfonates
Suga®Fax • APG Phosphate Esters
Suga®Citrate • APG Citrate

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

Suga®Boost

High Performance Boosting Blends

Suga® and Poly Suga®

- 100% or close to 100% naturally-derived
- Very mild to eyes and skin contact, over harsh sulfates, alkoxylates, coco DEA
- No GHS warning labels for some products
- Free of Prop 65 components (1,4-Dioxane, DEA, DCA, etc.)
- Stable in wide range of pH
- Stable in hard water and electrolyte solution without hydrotropes
- Great environmental profiles (readily biodegradable, low aqua toxicity, VOC-free, direct release)
- Broad regulation approval (EPA Safer Choice, USDA Biobased, EU Detergent Directive)
- Compatible with majority of surfactants
- Variety of chemistries that meet different formulation and performance demands
- ***Superior Performance Over Traditional Surfactants***

Colonial Chemical

Surfactants for Emulsion Polymerization

Overview of EP

- Emulsion Polymerization
  - The process of synthesizing hydrophobic polymers while emulsified in water using monomer and surfactant
- Uses Include:
  - Architectural Paints
  - Adhesives
  - Sealers and Waterproofing Systems
  - Cement Additives
  - Paper Binders
  - Textile Coatings

Industry Trends

- Diminishing use of alkylphenol ethoxylates (APEOs)
- VOC reduction and non-fugitive
- Increasing consumer preference for environmentally friendly products to provide safe and healthy environment (water-based)
- Demand for improved quality of biobased and renewable raw materials

Colonial Product Lines for EP/CASE

Green Product Lines

Cola®Tex	Green Emulsifiers
Poly Suga®Sperse	Green Dispersants
Suga®Fax	APG Phosphate
Suga®Nate	APG Sulfonates
Poly Suga®Nate	Poly APG Sulfonate
Poly Suga®Phos	Poly APG Phosphate
Poly Suga®Mulse	Poly APG Oleate
Poly Suga®Glycinate	Poly APG Amphoteric
Cola®Dil MOD 8	Green Reactive Diluent

Others

Cola®Mer	Specialty Reactive Additives
Cola®Dil	Epoxy Reactive Diluents
Cola®Fax	Phosphate Esters
Cola®Carb	Alcohol Ether Carboxylate
Cola®Wet	Sulfosuccinates
Cola®Cor	Corrosion Inhibitors
Cola®Zoline	Imidazolines

Cola®Tex 127

- Proprietary Blend of Functionalized Alkyl polyglucoside with anionic surfactant.
- Nonionic/Anionic
- Effective Primary Surfactant for Acrylic, Styrene Acrylic, Vinyl Acrylic, and Styrene Butadiene Formulations ≥55%TSC
- Made from 69% plant-based materials by weight.
- 100% Biodegradable
- Single product to make acrylic latex formulations for excellent cost/performance
- No EO-1,4 Dioxane or other components of Prop 65 concern
- No Alkyl Phenol Ethoxylate (APE)
- No Sulfates
- Small particle size and low coagulation formation
- Predominately derived from vegetable sources
- Outstanding human and environmental safety
- Simplifies and speeds the manufacturing process
- Anionic and nonionic compatible
- Easy to handle
- Stable at high and low pH
- Patent pending

Cola®Tex 127 – Starting Formulations

Acrylic Formulation		
	MASS (g)	Percent
REACTOR:		
Water	165	22.210556
ColaTex 127	0.2	0.0269219
Sodium Persulfate	0.37	0.0498055
PRE-EMULSION:		
Water	47	6.3266432
ColaTex 127	14.6	1.9652977
Methyl Methacrylate	177.95	23.953748
Butyl Acrylate	210.52	28.337977
Acrylic Acid	15	2.0191415
INITIATOR:		
Water	110	14.807037
Sodium Persulfate	2.25	0.3028712

							CaCL2 STABILITY		
LATEX	g/L COAGULUM	SOLIDS	VISCOSITY	SURFACE TENSION	NH3 ADJUSTED PH	FREEZE/THAW STABILITY	10%	20%	30%
COLATEX 127 ACRYLIC	0.51	54.85	345	37	7.21	3 CYCLES	PASS	PASS	PASS

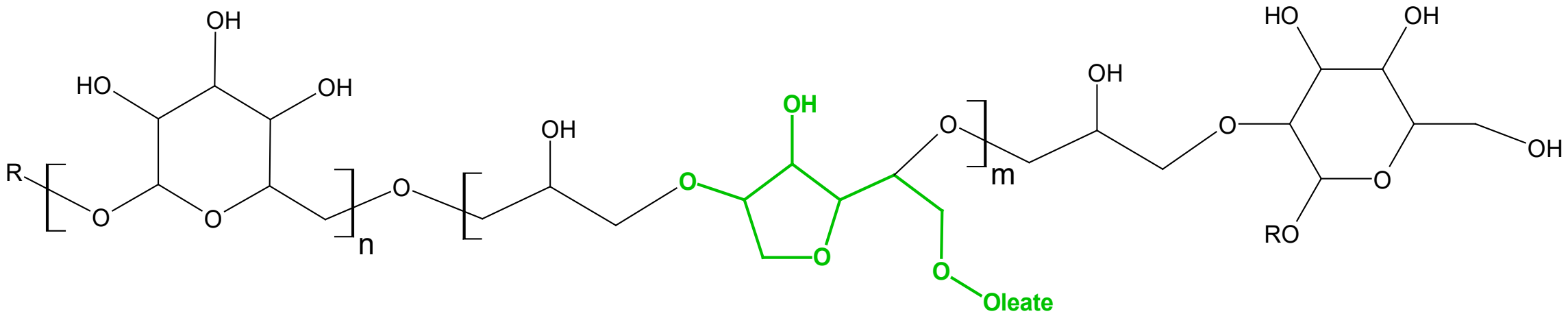
Cola®Tex 127 – Starting Formulations

Styrene Acrylic Formulation		
	MASS (g)	Percent
REACTOR:		
Water	165	22.312072
ColaTex 127	0.2	0.0270449
Sodium Persulfate	0.37	0.0500331
PRE-EMULSION:		
Water	47	6.3555598
ColaTex 127	14.6	1.9742803
Sytrene	185.52	25.086882
Butyl Acrylate	202.95	27.443848
Acrylic Acid	10.12	1.3684737
INITIATOR:		
Water	110	14.874714
Sodium Persulfate	3.75	0.5070925

							CaCL2 STABILITY		
LATEX	g/L COAGULUM	SOLIDS	VISCOSITY	SURFACE TENSION	NH3 ADJUSTED PH	FREEZE/THAW STABILITY	10%	20%	30%
COLATEX127 STYRENE ACYLIC	<0.1	55	980	41.15	6.95	3 CYLCES	FAIL	FAIL	FAIL

Poly Suga®Mulse D9

- Sorbitan Oleate Decylglucoside Crosspolymer
  - 100% Bio-Based
  - US Patent 8,268,766



Poly Suga®Mulse D9 EO-Free Emulsifier

- Sorbitan Oleate Decylglucoside Crosspolymer *(Patent Pending)*
- Nonionic
- 100% Biobased
- Environmentally safe
- Alkyl phenol ethoxylate (APE) free
- Easy to handle
- Blended with anionic surfactants, the product will work well with both acrylic and styrene acrylic formulations as a co-surfactant.
- **EO Free and 1,4-Dioxane Free alternative for Alkyl Phenol Ethoxylates and Fatty alcohol ethoxylates.**

Poly Suga®Mulse D9

Typical Properties	Poly Suga®Mulse D9
Appearance	Clear viscous liquid
pH *(10% aqueous)*	6.0 – 8.0
Solids, %	65 - 68
Color, Gardner	4 Maximum

Ross-Miles Foam Height (1% active solution Poly Suga®Mulse D9), mm

Immediate	185
1 minute	170
5 minutes	165
Draves Wetting *(1 % active), seconds*	2.1
HLB *(estimated)*	13
HET-CAM *(2.5% solution)*	2.25

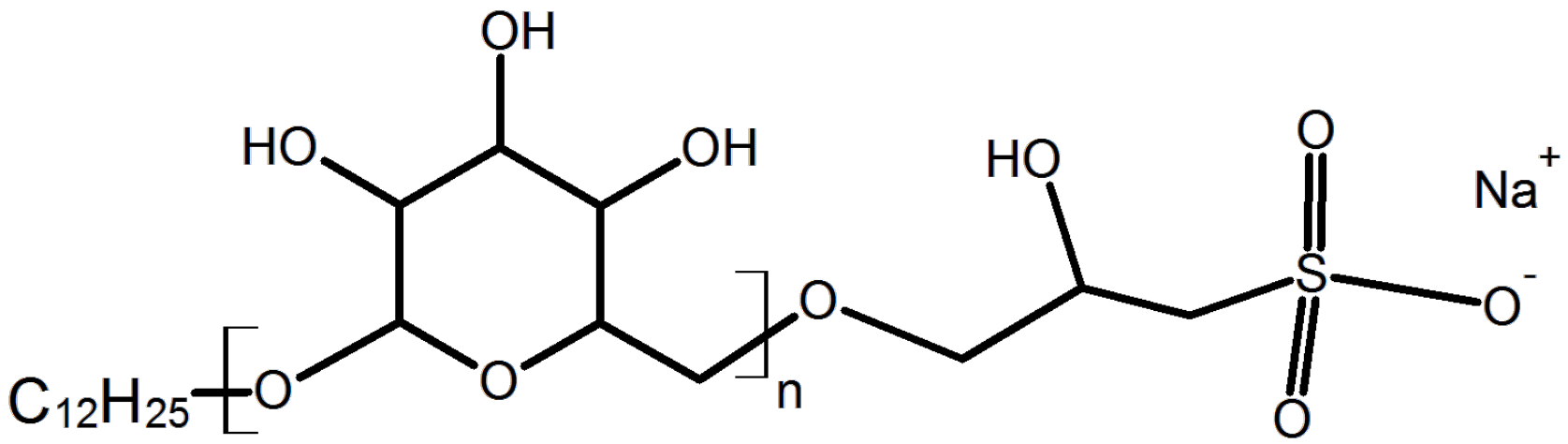
Starting Formulation

Example 6: Styrene-Acrylic Emulsion Polymerization utilizing Poly Suga®Mulse D9 as co-surfactant

	INGREDIENT	Wt. %	Wt. gm
Reactor Charge			
1	Water	34.28	617.04
2	***Cola®Fax 3397*** / Alcohol Ethoxylate Phosphate Ester	0.04	0.72
Pre-emulsion			
1	Butyl Acrylate	15.50	279.00
2	Styrene	21.68	390.24
3	Dodecyl Mercaptan	0.22	3.96
4	Acrylic Acid	1.18	21.24
5	Water	7.75	139.50
6	***Cola®Fax 3397*** / Alcohol Ethoxylate Phosphate Ester	1.49	26.82
7	***Poly Suga®Mulse D9*** / Sorbitan Oleate Decylglucoside Crosspolymer	0.50	9.00
8	Sodium Hydroxide	0.11	1.98
Initiator			
1	Water	5.83	104.94
2	Sodium Persulfate	0.46	8.28
	TOTAL	**100.00**	**1800.00**

Suga®Nate 160NC

- Sodium Laurylglucosides Hydroxypropylsulfonate
  - 100% Bio-Based



Suga®Nate 160NC APG Sulfonate

- Sodium Laurylglucosides Hydroxypropylsulfonate *(Patent Pending)*
- Anionic
- 100% Biobased, Environmentally safe with low aquatic toxicity
- Alkyl phenol ethoxylate (APE) free
- Easy to handle
- **Use alone in low solids styrene acrylic formulations, or as a secondary surfactant in higher solids formulations.**
- **Creates binomial particle size distribution.**

Suga®Nate 160NC

Typical Properties	**Suga®Nate 160NC**
Appearance	Clear liquid
Color, Gardner	< 1
Solids %	39.0 – 41.0
Viscosity (cps), 25°C	7,500
Odor	mild, fatty alcohol
pH (10% aq)	6.0 – 8.0
Ross Miles Foam Height *(1%, 25C, tap water), mm*	
Immediate	155
1 min.	152
5 min.	150
Draves Wetting (1% active), sec.	7.2

GHS Warning Labels

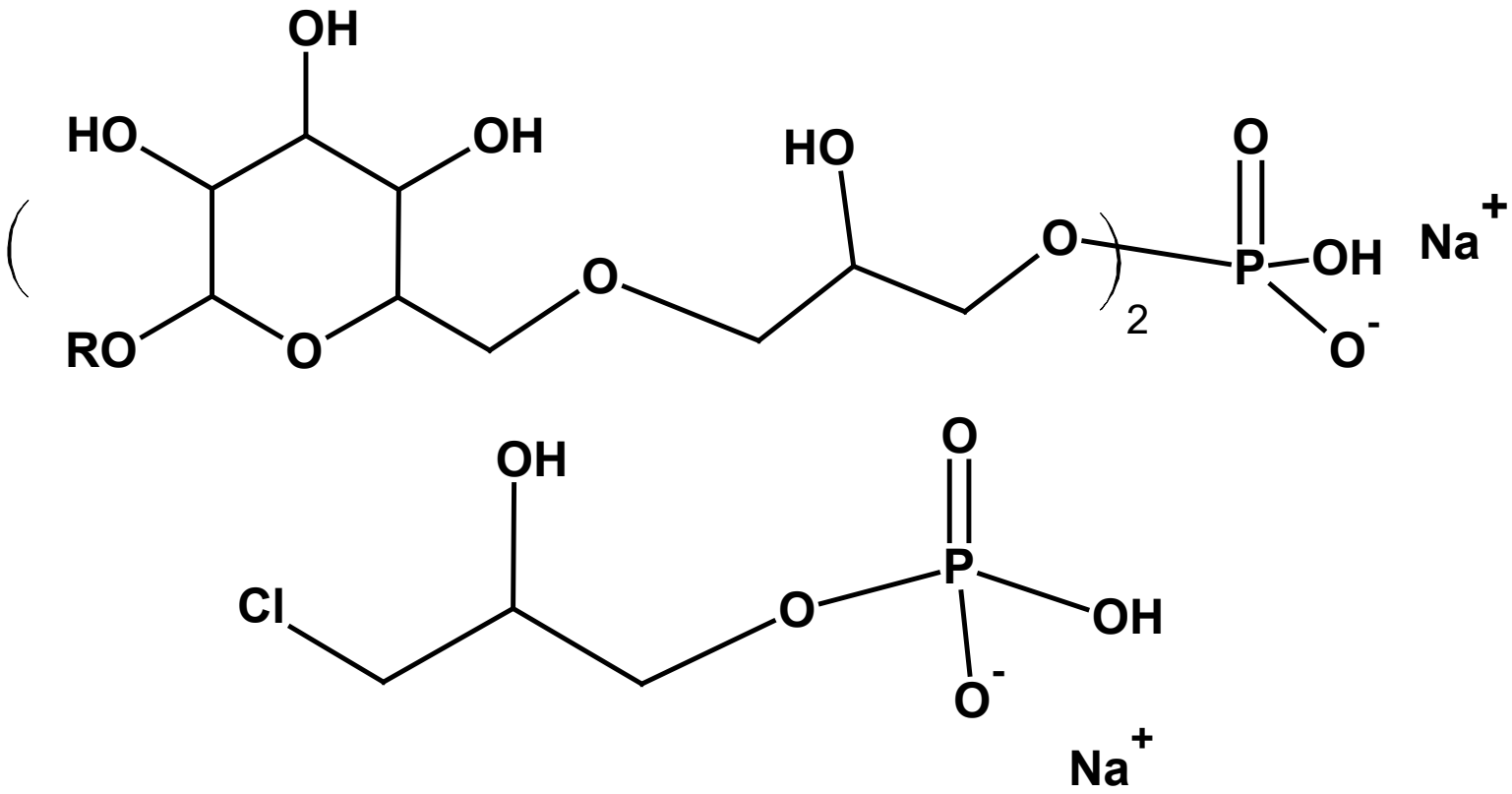
Starting Formulation

Example 3: Styrene-Acrylic Paint Emulsion Polymerization utilizing low levels of Suga®Nate 160NC

	INGREDIENT	Wt. %	Wt. gm
Reactor Charge			
1	Water	45.79	1377.00
2	***Suga®Nate 160NC*** / Sodium Laurylglucosides Hydroxypropylsulfonate	0.03	1.00
Pre-emulsion			
1	Butyl Acrylate	15.70	472.00
2	Styrene	21.95	660.00
3	Dodecyl Mercaptan	0.47	14.10
4	Acrylic Acid	1.20	36.00
5	Water	7.85	236.00
6	***Suga®Nate 160NC*** / Sodium Laurylglucosides Hydroxypropylsulfonate	0.65	19.60
Initiator			
1	Water	5.89	177.00
2	Sodium Persulfate	0.47	14.10
	TOTAL	**100.00**	**3006.80**

Suga®Fax D10NC

- Sodium Decylglucosides Hydroxypropyl Phosphate
  - 100% Bio-Based



Suga®Fax D10 NC APG Phosphate Ester

- Sodium Decylglucoside Hydroxypropylphosphate *(Patent Pending)*
- Anionic
- 100% Biobased
- Environmentally safe
- Alkyl phenol ethoxylate (APE) free
- Easy to handle
- Stable at high and low pH
- Alternative for traditional phosphate
- **Use alone for low solids styrene acrylic latex, or in combination with other surfactants in higher solids latexes**

  -Creates binomial particle size distribution

Suga®Fax D10NC Properties

Typical Properties		**Suga®Fax D10NC**
Color, Gardner		< 1
Activity, %		40
pH (10% aqueous)		7.5
Appearance, 10% aq.		Clear
Ross-Miles Foam Height (1%, 25C, tap water), mm		
Immediate		155
1 minute		145
5 minutes		140
Draves Wetting *(1% active), seconds*		Immediate
Solubility (10% active)	50% NaOH	Soluble
	25% H_2SO_4	Soluble

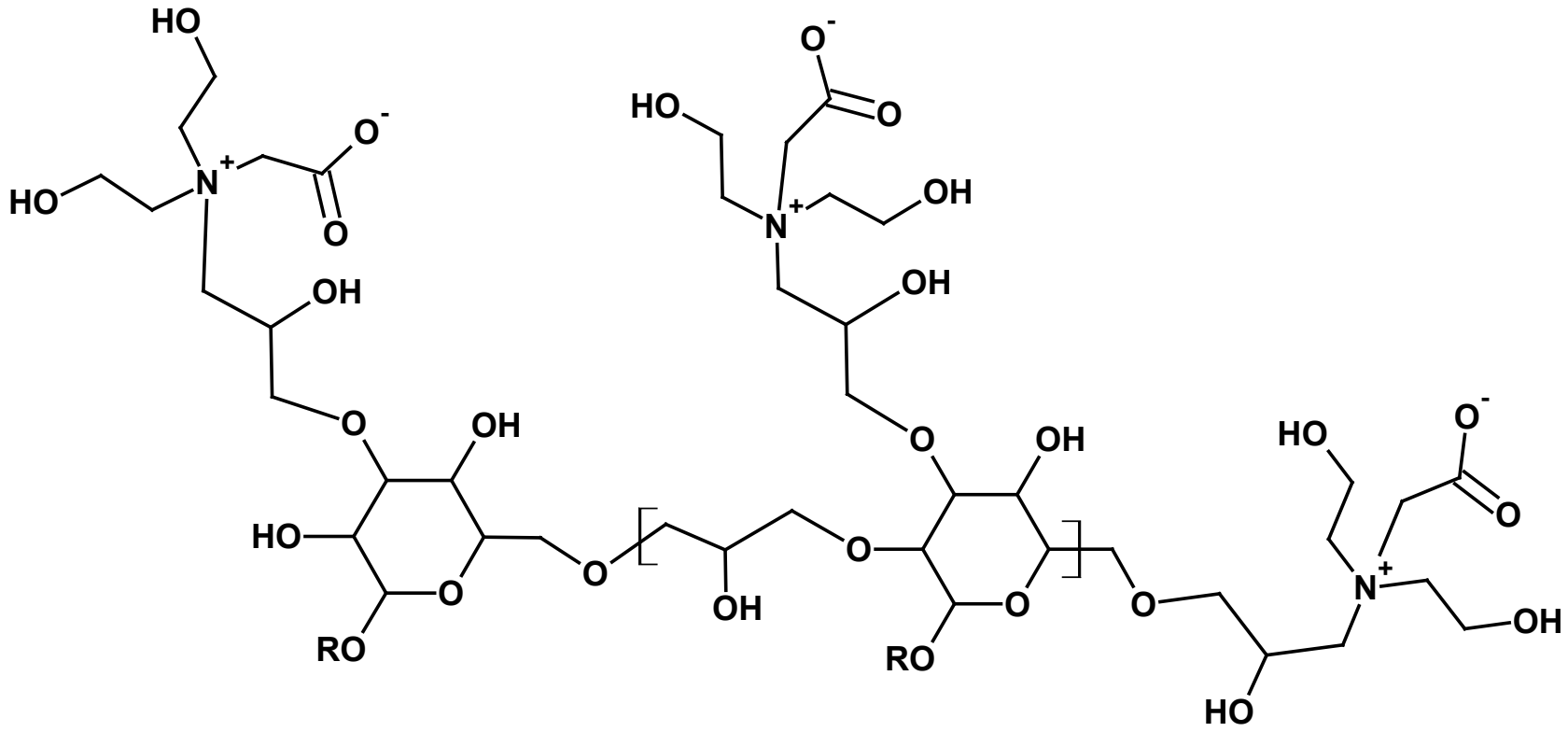
Starting Formulation

Example 7: Styrene-Acrylic Emulsion Polymerization utilizing low levels of Suga®Fax D10NC

	INGREDIENT	Wt. %	Wt. gm
Reactor Charge			
1	Water	45.79	1377.70
2	***Suga®Fax D10NC*** / Sodium Decylglucoside Hydroxypropylphosphate	0.03	0.90
Pre-emulsion			
1	Butyl Acrylate	15.70	471.00
2	Styrene	21.95	658.50
3	Dodecyl Mercaptan	0.47	14.10
4	Acrylic Acid	1.20	36.00
5	Water	7.85	235.50
6	***Suga®Nate 160NC*** / Sodium Laurylglucosides Hydroxypropylsulfonate	0.65	19.50
Initiator			
1	Water	5.89	176.70
2	Sodium Persulfate	0.47	14.10
	TOTAL	**100.00**	**3000.00**

Poly Suga®Glycinate C

- Sodium Bis-Hydroxyethylglycinate Coco-Glucosides Crosspolymer
  - US Patent 6,958,315



Poly Suga®Glycinate C Poly APG Amphoteric

- Sodium Bis-Hydroxyethylglycinate Coco-Glucosides Crosspolymer
- Amphoteric
- Environmentally safe
- Alkyl phenol ethoxylate (APE) free
- Easy to handle

- **Works well in acrylic formulations at low solids levels and can be used in combination with other surfactants for higher solids formulations.**

Poly Suga®Glycinate C

Typical Properties	Poly Suga®Glycinate C
Appearance	Clear, amber liquid
Color, Gardner *(ASTM D1544-98)*	1
Solids %	40
pH *(10% aqueous)*	7.0

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

Immediate	180
1 minute	165
5 minutes	160
Draves Wetting *(1 % active), seconds*	3.3

Starting Formulation

Example 5: Acrylic Emulsion Polymerization utilizing low levels of Poly Suga®Glycinate C

	INGREDIENT	Wt. %	Wt. gm
Reactor Charge			
1	Water	34.50	621.00
2	Sodium Persulfate	0.04	0.72
3	***Poly Suga®Glycinate C*** / Sodium Bis-Hydroxy-ethylglycinate Coco-Glucosides Crosspolymer	0.03	0.54
Pre-emulsion			
1	Methyl Methacrylate	29.01	522.18
2	Methacrylic Acid	0.87	15.66
3	Acrylic Acid	0.87	15.66
4	Butyl Acrylate	12.39	223.02
5	Water	8.13	146.34
6	***Poly Suga®Glycinate C*** / Sodium Bis-Hydroxy-ethylglycinate Coco-Glucosides Crosspolymer	1.00	18.00
Initiator			
1	Water	12.95	233.10
2	Sodium Persulfate	0.21	3.78
	TOTAL	**100.00**	**1800.00**

Summary of Green Surfactant Technology

- ***Cola®Tex 127***
  - Works alone in all types of latexes
  - 69% biobased, 100% Biodegradable
- ***Poly Suga®Mulse D9***
  - APE, EO, 1,4-Dioxane free alternative for Alkyphenol ethoxylate and Fatty Alcohol Ethoxylates.
  - 100% biobased
- ***Suga®Nate 160NC***
  - Works alone in low solids styrene acrylics, or in combination with other surfactants in higher solids latexes
  - 100% biobased
- ***Suga®Fax D10NC***
  - Works alone in low solids styrene acrylics, or in combination with other surfactants in higher solids latexes
  - 100% biobased
- ***Poly Suga®Glycinate C***
  - Works alone in low solids acrylics, or in combination with other surfactants in higher solids latexes
  - 100% biobased

***Please contact** for Brochures, Formularies, TDS, SDS*

kathie.hacek@colonialchem.com
andy.sun@colonialchem.com

www.colonialchem.com

Thank you!