

Versatility in Action:

Exploring Colonial Chemical's Comprehensive Ether Carboxylate Product Platform

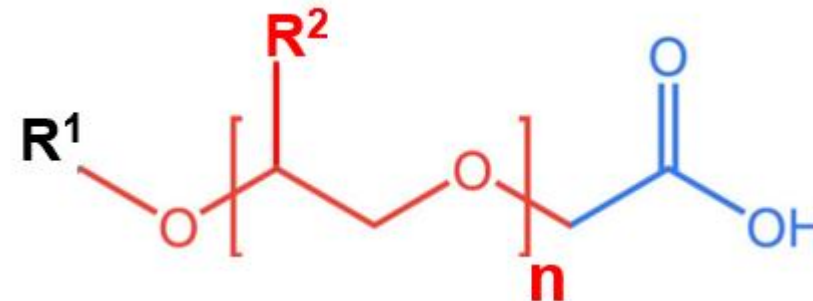
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About Ether Carboxylates (ECs)

- Combined nonionic and anionic Surfactants
- The weakly ionic, pH-responsive carboxylic acid termination in a single surfactant headgroup.
- Structure & performance customizable
- Well known for hardwater tolerance and lime-soap dispersing capabilities in industrial lubricants, oilfield operations, and other industrial applications

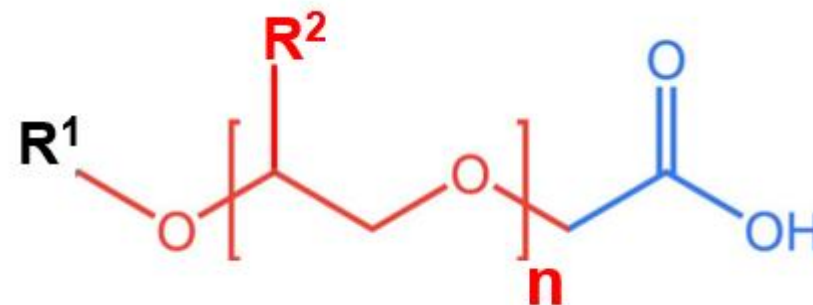


Other Generic Names

- Ether Carboxylates (ECs)
- Ether Carboxylic Acids
- Polyoxyethylene Alkyl Ether Carboxylic Acids (AECs)
- Alkoxylate Acetic Acid

Critical Structural Features

- Alkyl chain length (R^1)
- Branching pattern of alkyl chains (R^1)
- Degree of ethoxylation (n)
- Alkoxylation pattern (R^2): ethoxylates vs. EO/PO copolymers
- Carboxylic acid terminal group (OH)

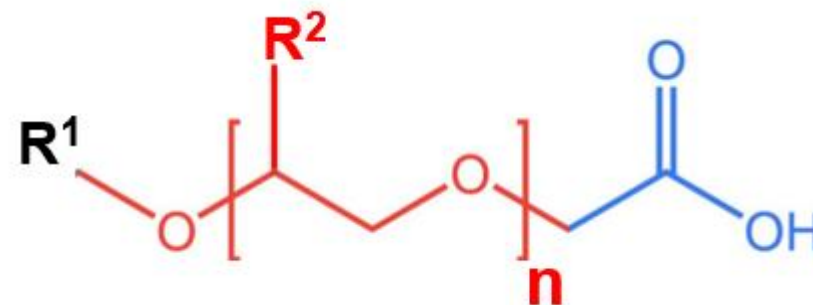


Critical Parameters

- Acid Value
- % actives

Key Performance Attributes

- Emulsion stability
- Lime-soap dispersing capability
- Hard water tolerance
- Foaming behaviors
- Surface wetting
- Corrosion protection
- Lubricity



Factors Impacting the Performance

- Alkyl chain length
- Branching pattern of alkyl chains
- Degree of Alkoxylation (Ethoxylation)

How the Alky Chain Length Affects Ether Carboxylates

With the increase of alkyl chains

- The melting point or freeze point increases.
- Gelation tendency increases.
- The wetting capability reduces.
- Foaming tendency increases, but peaks at a chain length of about C12 to C13; shorter- and longer- chain ones do not foam as much.
- Emulsifying efficiency becomes better.
- Odor decreases.

Branching Pattern of Alkyl Chains

Branching in the alkyl chain

- Reduces the effective chain length
- Reduces melting points and freeze points.
- Improves wetting performance
- Reduces the foaming tendency
- Increases critical micelle concentrations and reduces emulsifying efficiencies.
- Reduces gel points
- Leads to lower biodegradability.

Degree of Ethoxylation

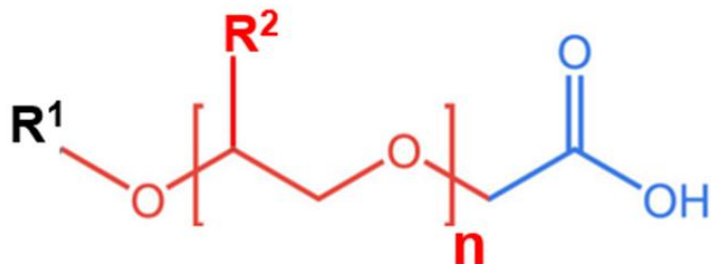
With the increase of ethoxylation

- The CMC increases
- Water solubility increases; Ether carboxylates shift from being oil-soluble and water-in-oil emulsifiers to be more water soluble and oil-in-water emulsifiers.
- Foaming tendency increases but peaks off at 4-5 EOs.
- Surface activity and wetting performance increase but peak off at 4-5 EOs.
- Critical performance attributes shift toward dispersing properties, emulsion stabilization, and hardwater and electrolyte tolerance.

The overall performance capabilities of an ether carboxylate

- Jointly determined by alkyl chain length, branching pattern, and degree of ethoxylation
- Can be impacted by the actual application settings

ColaCarb: Colonial's Ether Carboxylate Product Cascade

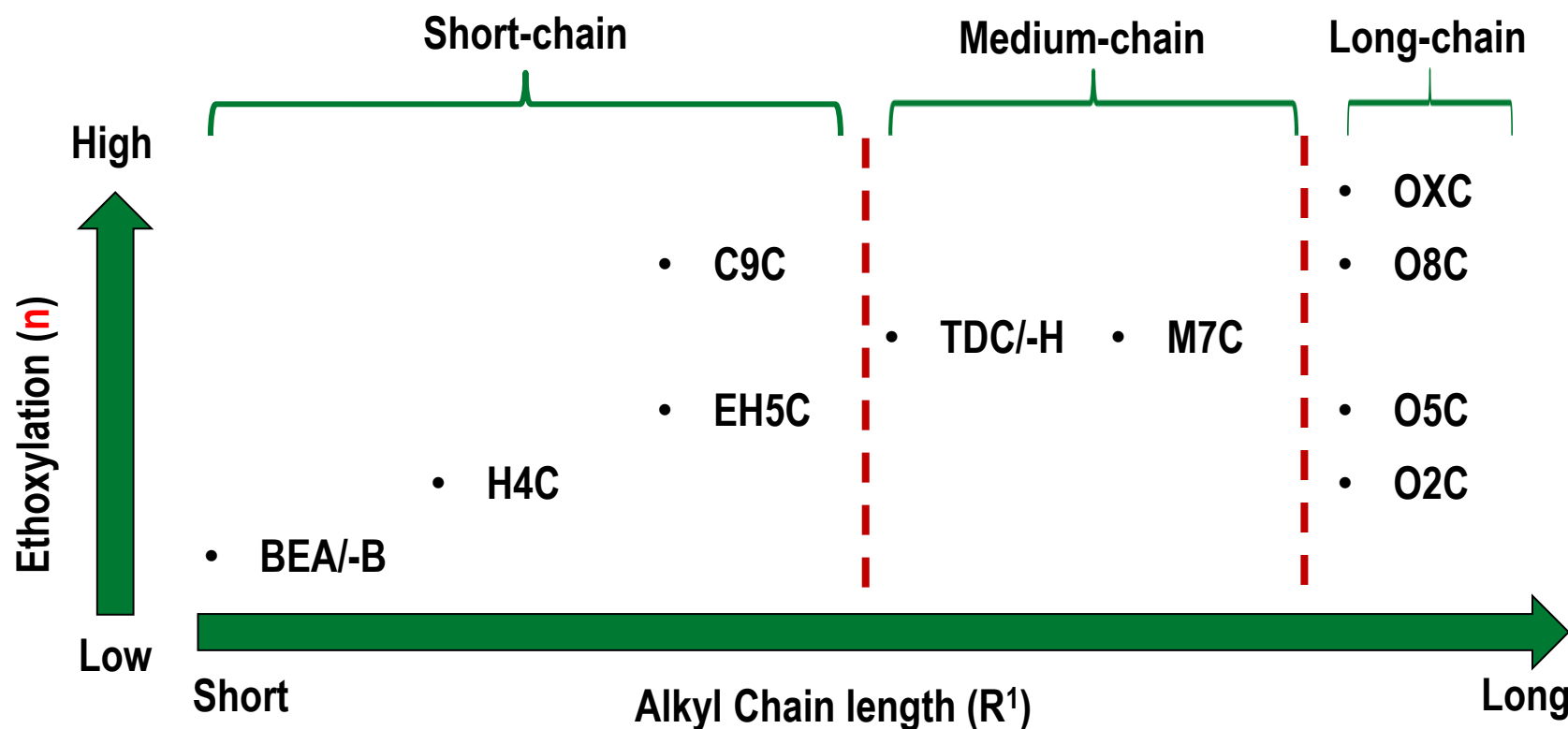


R¹: C₄, C₆ - C₁₈

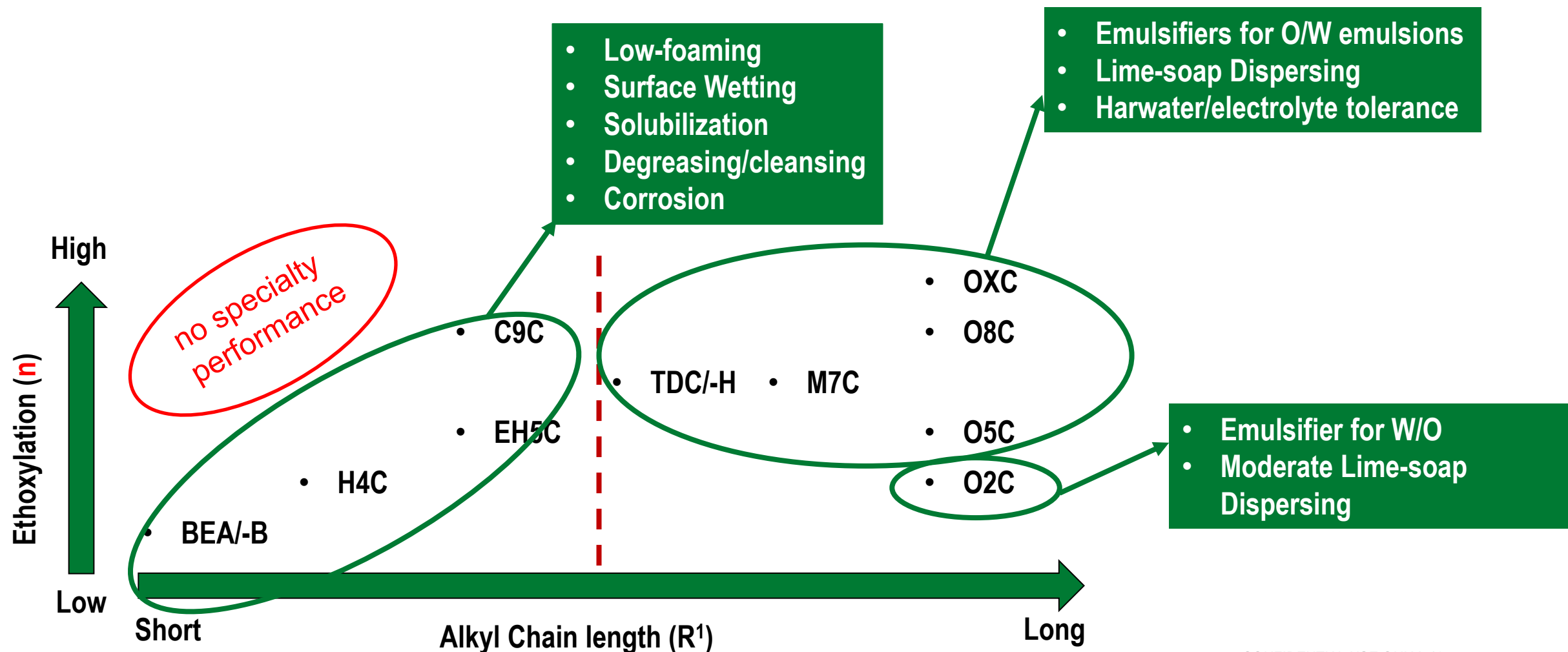
R²: H (all ethoxylate-based)

EO units (n): 1 to 10

Product Names: e.g., ColaCarb OXC



ColaCarb: Colonial's Ether Carboxylate Product Cascade



General Thoughts on Formulating with Ether Carboxylates

- No need to take anything above as Biblical teaching.
- But do follow the general understandings to balance performance: foaming, emulsification, wetting capability, hard water tolerance, etc.
- Formulating with ether carboxylates is NOT JUST about science. It is about arts as well. Experience and prior learning matter.
- Be mindful on your actual applications and what you are trying to achieve with ether carboxylates.
- Not all ether carboxylates are created equal or for universal purpose.
 - THINKING ABOUT BLENDING to achieve optimal performance!

Ether Carboxylate Blends

Why Needed?

- To enhance the desired performance attributes.
- To mitigate the impact of undesired performance tendencies.
- To achieve the synergies among the ECs to save the formulation costs.
- To improve the physical properties and handling capability

EC blends by Colonial

- **ColaCarb HC49C**: a short-chain EC blend
- **ColaCarb TCAM**: a multi-EC blend

ColaCarb HC49C

- Short-chain alkyl ether carboxylate blend.
- Co-emulsifier and solubilizer with hydrotropic properties.
- Low-foaming tendency
- Hard water stable
- Stable under acidic and alkaline conditions
- Compatible with other anionic, cationic, and non-ionic surfactants.
- Offers corrosion protection
- Suitable for metalworking fluids, cleaners, and other industrial applications

ColaCarb TCAM

- An optimized blend of multiple long and short alkyl chain ether carboxylates
- Functions as an emulsifier for industrial lubricants (MWF, HF, etc.) and other applications.
- Demonstrate outstanding hardwater tolerance and dispersing properties.
 - In a medium oil semi-synthetic fluids, the emulsion remains stable at 2000 PPM water hardness up to a week.
 - Helps extend lifetime of metalworking fluids
- Demonstrates low to medium foaming tendency
- Helps corrosion protection need.

Benefits of Ether Carboxylates in Industrial Applications

- Good emulsifying capability & emulsion stabilization stability
- Outstanding hardwater stability
- Outstanding lime soap dispersing properties
- Cleaning & surfacing wetting capabilities
- Chemical stability
- Corrosion protection
- Lubricity
- Low-foaming tendency
- Good dermatological properties
- Biodegradability

Applications

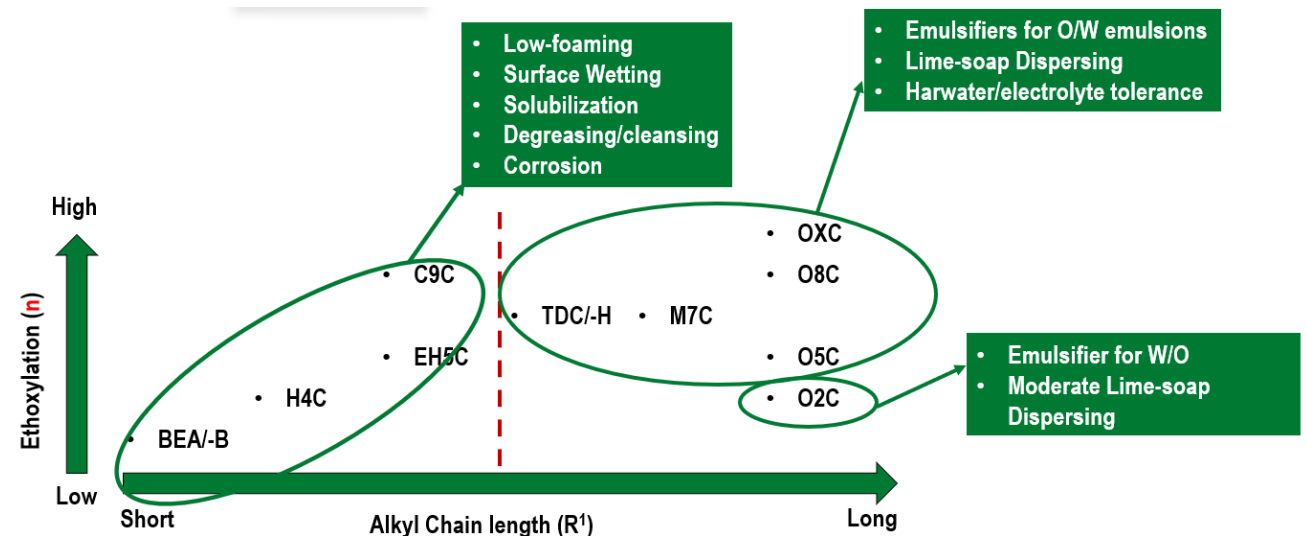
- Industrial Lubricants
 - Metalworking Fluids
 - Soluble oil, semi-synthetic, & synthetic
 - Metal cutting, forming, protection, & (pre)treatment
 - Hydraulic Fluids
- Cleaners/degreasers (HINI)
- Oil & gas
 - Water-based drilling muds
 - Enhanced oil recovery (EOR), especially for the tertiary oil recovery
 - Wax and scale inhibitors for flow control
- Personal care & cosmetics
- Others

Summary

- Ether Carboxylates have versatile structures which enable the unique performance attributes in emulsification, dispersing, wetting, corrosion inhibition, and lubrication.
- Ether carboxylates demonstrate exceptionally high hardwater tolerance and play pivotal roles in stabilizing emulsions to help extend the use life of metalworking fluids.

About Colonial's Ether Carboxylate Platform

- Offers a comprehensive range of ether carboxylates.
- Offers extensive tools to address product formulation needs.
- Extensive in-house know-how and know-why.
- Extensive production experience.
- US-based manufacturer.



Thank you!

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<https://colonialchem.com/wp-content/uploads/Colonial-High-Performance-Additives-Brochure-8-24.pdf>

