Putting science to work

OIL WELL PRODUCTIVITY

OIL AND GAS INDUSTRY

DUPONT®

The miracles of science™

OIL WELL PRODUCTIVITY

Putting the science of DuPont to work for our customers has allowed us to develop a wide range of products made specifically for enhancing oil well productivity in the oil and gas industry. Whether you're looking for stimulation additives, drilling fluid agents, surface tension reduction or bacterial control, DuPont has the products for your application, operational needs, critical issues, and your definition of success.

DuPont™ Capstone® Fluorosurfactants
Well Stimulation Additives

Extremely effective at low concentrations and can be used in combination with existing surfactants in well stimulation fluids for faster, more complete fluid recovery.

FUNCTIONALITY

Very Low Surface Tension (16 dynes/cm)

- Better wetting of rock
- Low pressure/low permeability
- Reduces worm holes
- Prevents capilliary blockage

Stable in Harsh Environments

- Thermal
- Chemical

Minimize formation damage

Provide foaming properties

Decrease need for demulsifiers

Create non-depleting stimulation fluids

Wider performance than hydrocarbon surfactants

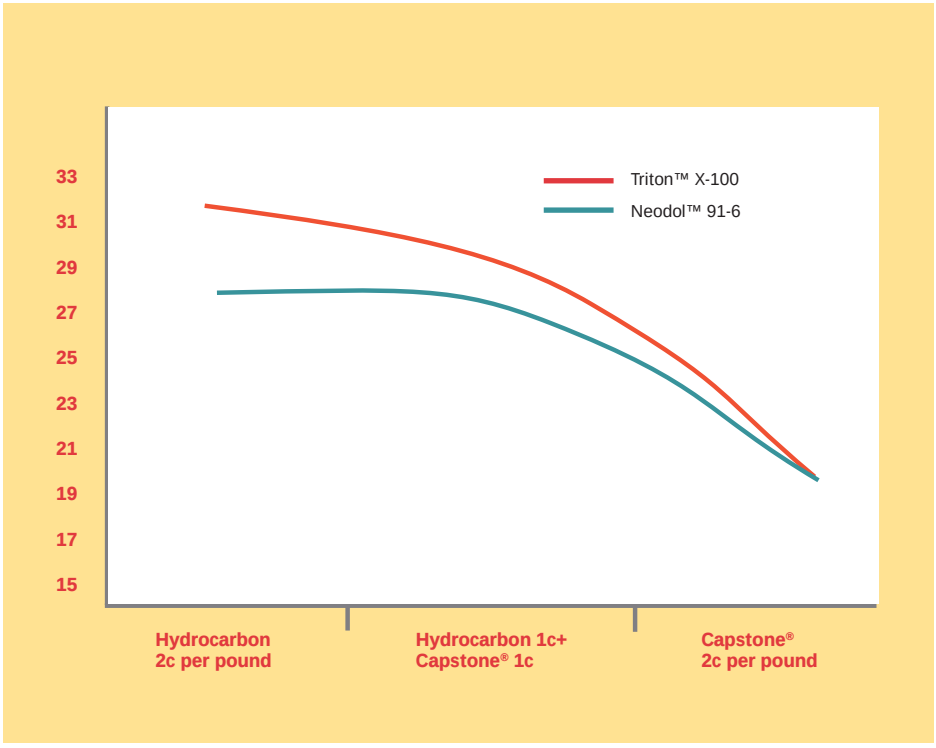
CAPSTONE® FLUOROSURFACTANTS VERSUS HYDROCARBON SURFACTANTS

Property	Fluorosurfactants	Hydrocarbon
Effectiveness	16 dynes/cm	30 dynes/cm
Efficiency	0.005% to 0.1%	0.1%-3%
Surface Activity:		
Aqueous Systems	Excellent	Excellent
StrongAcids/Bases	Excellent	Poor to Good
Organic Solvents	Excellent	Poor

DIFFERENTIATION

- Compatible with other frac fluid / acidizing fluid chemicals – production increase is realized sooner.
- Functions in high temperature, high pressure wells, low permeability wells.
- Stable in strong acid conditions, slows acid reaction to allow acid to penetrate further from wellbore.
- Depletes into the formation less than alternatives.
- Capstone® fluorosurfactants have the ability to alter the wetting of rock formations and create low surface tention fluids.
- Capstone® fluoroadditive products can create oil and water repellency in the rock formation to reduce blockage and maintain production in gas wells.

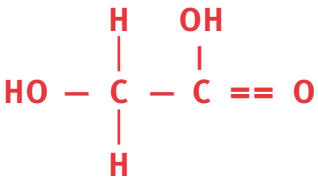
DUPONT CAPSTONE® VS HYDROCARBON SURFACTANTS – COST EFFECTIVENESS



With the same formulated cost lower surface tention is achieved

DuPont™ Glycolic Acid and Polyglycolic Acid
Oil and Gas Application

CARBOXYLIC ACID WITH ALCOHOL FUNCTIONALITY



Glycolic acid is used for a number of Oil and Gas applications, but most notably in acidizing, rehabilitation, and finishing.

PROPERTIES

- High water solubility
- Low odor, Low corrosiveness
- Efficient pH Adjuster
- NSF/ANSI Standard 60 Certified
- For use in potable water systems
- Biodegradable (~90% in 7 days)
- Solubilizes hard water salts; Ca, Mg, Fe
- Non-volatile, very low vapor pressure
- Low toxicity; LD50 for rats =1938 mg/kg
- VOC-exempt in California

The following properties contribute to glycolic acid's effectiveness and versatility for applications in the oil field industry:

- Glycolic acid chelates rust, scale and particulates found in wells.
- When glycolic acid complexes with the metal ions, a soluble salt is formed which can be easily pumped from the well.
- Lower corrosivity to most metals as opposed to mineral acids. Corrosion testing should be performed on the materials of construction prior to use.
- Good acidification properties to decompose carbonates and viscosity improving chemicals.
- Acid additive is compatable with other acids and additives.
- Glycolic acid formulation available for Industrial boiler cleaner - focus on utilities to clean boilers that are fouled with various scales.

DUPONT™ GLYCOLIC ACID - LOW CORROSIVENESS

DuPont™ Glycolic Acid ensures economical cleaning by providing low-cost metal complexing in a readily biodegradable form that will not add potentially undesirable Biological Oxygen Demand (BOD) or Chemical Oxygen Demand (COD) to formulated products. It can be used with hydrochloric or sulfamic acids to prevent iron precipitation in cleaning operations or water flooding. NSF-certified with low odor, low vapor pressure and non-flammability, Glycolic Acid can effectively eliminate harmful deposits while minimizing corrosion damage, all with safety in handling and ease of use. Glycolic acid is less corrosive than other competitive NIK acids on common metals.

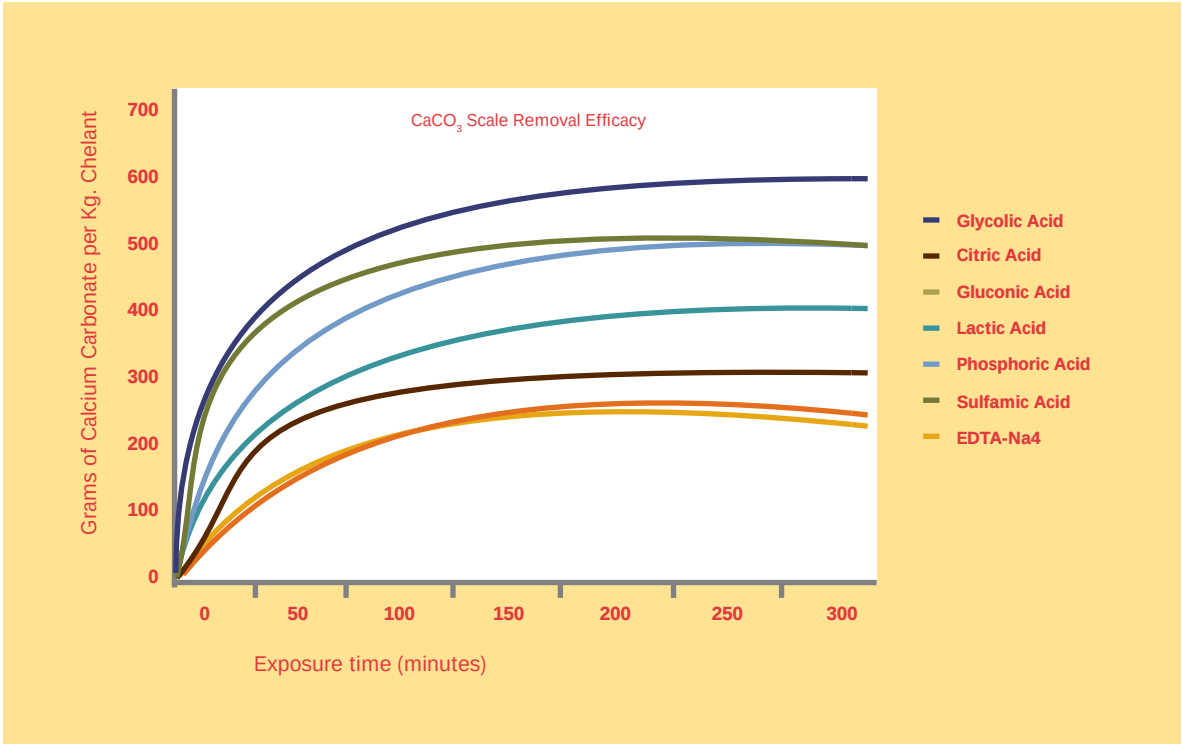
% Weight Loss at 70C

Metal	Glycolic	Lactic	Phosphoric	Sulfuric	HCl
C1018	10.53	8.84	15.70	39.08	53.22
AL1100	0.38	0.31	19.94	10.90	51.75
SS304	0.008	0.007	0.007	2.360	15.220
SS316	0.002	0.002	0.002	1.600	18.460
Cu110	0.045	0.044	0.086	0.095	0.310
CDA360	0.061	0.056	0.081	0.067	0.170
Galv. CS	15.50	20.33	83.81	100.00	100.00

Immersed in 200ml of solution for 48 hours. No Agitation.
Results are the average of triplicate analysis, 10% Acid (100% basis)

DUPONT™ GLYCOLIC ACID - COMPLEXING ABILITY

Glycolic acid uses both the hydroxyl and carboxylic group to form five member ring complexes with polyvalent metals

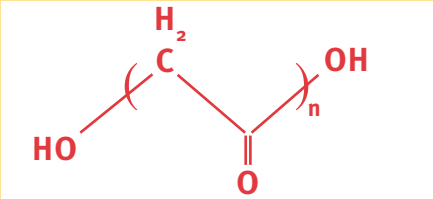


minutes	Glycolic Acid	Citric Acid	Gluconic Acid	Lactic Acid	Phosphoric Acid	Sulfuric Acid	EDTA-Na4
0	0g/Kg	0g/Kg	0g/Kg	0g/Kg	0g/Kg	0g/Kg	0g/Kg
15	223	201	56	110	202	272	58
30	347	310	88	222	297	386	87
60	463	323	139	319	405	470	137
120	554	323	178	397	489	505	193
240	603	323	211	445	514	512	225
300	612	323	222	447	521	510	237

DuPont™ Polyglycolic Acid (PGA) TLF 6267
Oil and Gas Application

TLF 6267, Polyglycolic Acid is a crystalline polyester with a molecular weight of approximately 600.

Structure:



PGA Properties:

- Appearance: finely ground tan powder.
- Melting Point: 200 - 210F.
- Density: 1.58 g. per cc. (lump form).
- Particle Size: 20 micron average.
- Toxicity: Oral ALD: >11,000mg/kg in rats.
- Solubility: insoluble in water and organic solvents.
- Readily dispersible in water.

Features

- Insoluble Polymer prepared to specific particle size.
- Hydrolyses predictably to free acid monomers.

Oilfield Chemical Placement Process

PGA used as a time release agent for corrosion inhibitors, dispersants, decomposition inhibitors for lubricants in moving equipment in the wellbore and other channels of the formation.

Time Delayed Gel Breaker

Temporary Plugging Agent

Diverting Agent

Ensures uniform injection of treatment area by creating a temporary blocking agent by reducing permeability of subterranean formations.

Completion Fluid / Fluid Loss additive

Added to an inert fluid used in the casing – tubing annulus to dissolve scale and prevent corrosion.

DuPont™ Anthium Dioxide® & Chlorine Dioxide
Bactericides and oxidizers for Oil & Gas applications

DuPont™ Chlorine Dioxide

DuPont™ Chlorine Dioxide is produced on-site.
A selective oxidizer for biofilm treatment, mainly for water treatment facilities and water processing affiliated with refineries or power/utilities plants. It is also a very effective biocide to control process water and waste water environmental issues associated with mill and process water.

DuPont™ Anthium Dioxide®

A stabilized chlorine dioxide solution, with similar benefits to Chlorine Dioxide. It is a highly effective bactericide for smaller Oil & Gas applications. For both brine and fresh water systems in the control abatement of poisonous and corrosive hydrogen sulfide gas (H2S) and the sulfate-reducing bacteria which occur in sub-surface injection wells.

K22650 (12/13)

For more information visit:

www.oilandgas.dupont.com

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