

# THIOGLYCOLIC ACID (TGA)



## TGA – a leading corrosion inhibitor and iron controller for the oil and gas industry.

Thioglycolic acid (TGA or mercaptoacetic acid, CAS 68-11-1) is a high-performance chemical containing mercaptan and carboxylic acid functionalities. TGA is completely miscible in water and is used in industries and applications as diverse as **oil and gas, cosmetics, cleaning, leather processing, metals, fine chemistry and polymerization.**

Thioglycolic acid forms powerful complexes with metals that give it specific characteristics sought after for the assisted recovery of ore as well as for cleaning and corrosion inhibition.

### TGA FOR OIL AND GAS PRODUCTION

Specialty chemicals are now taking on an important role in the enhancement of oil recovery and production at different stages:

#### Well Drilling

Drilling fluids are used to lubricate the drill bit, control the formation pressure, and remove formation cuttings. Chemicals can be incorporated into the drilling fluids to create specific effects (foaming, viscosity control).

#### Cementing and Stimulation

Specific chemicals are used to cement steel pipes and to encourage the flow of crude oil to the well (stimulation).

#### Oil Production

Chemicals are used at all stages, from oil production at the well bore to the delivery of crude oil at the refinery: as corrosion and scale inhibitors, biocides, and demulsifiers.

### TGA IN CORROSION INHIBITION FORMULATIONS

Water is present in most crude oil and gas production and is the cause of problems in the recovery and transportation of oil and gas. Water can come either from the formation itself or from the water flooding used in the secondary recovery operations.

Corrosion is mainly due to the presence of water with CO and/or H<sub>2</sub>S.

Corrosion inhibitors could be added to form a film which protects the metal from iron corrosion. Corrosion inhibitors are injected either continuously into the fluid stream or into a producing well. They can be added in the water flooding operations of secondary oil recovery, as well as pipelines, transmission lines and refinery units. Although the corrosion inhibition is a complex process, highly dependent of various parameters such as the nature of the inhibitor, fluid composition, pH, temperature, etc., the mechanism generally involves the anchoring of the inhibitor and the formation of a protective film.

A variety of corrosion inhibitors are known, particularly nitrogen-containing compounds such as a morpholine, cyclohexylamine or imidazoline. However, the sulfur-containing compounds can also be effective especially at elevated temperatures. With its unique properties (fast adsorption onto mild steel surfaces, strong chelant), TGA provides good inhibition even in concentrations as low as 5-10 ppm.



## TGA FOR STIMULATION

Well stimulation increases the rate at which hydrocarbons will flow out of the reservoir rock into the well. The flow is governed by the permeability and porosity of the rock.

Acidizing is mostly used in limestone (CaCO<sub>3</sub>) and dolomite formations. Acidizing consists of acid injection into the formation to dissolve rock, which creates large pores allowing the restoration or increase of the flow in the formation. Strong reducing and chelating agents are necessary to avoid precipitation of Fe<sup>3+</sup> compounds as they can cause damage (gelatinous precipitates of ferric hydroxide, asphaltic products).

## KEY BENEFITS OF TGA

At temperatures above 70°C – common temperatures in well bores – TGA is more efficient than classic ferric ion chelating agents (citric acid, acetic acid, EDTA, NTA). Moreover, TGA is more efficient than classic ferric reducing agents, such as erythorbic acid or ascorbic acid.

- TGA reduces Fe<sup>3+</sup> (ferric) ions to chelated Fe<sup>2+</sup> (ferrous) ions that remain in solution at pH < 7.5
- TGA is stable and efficient at low pH (TGA rapidly reduces high quantities of Fe<sup>3+</sup>)
- TGA can control very high concentrations of ferric iron – up to about 10%

## INDUSTRY APPLICATIONS

Due to its mercaptan functional group, thioglycolic acid and its salts provide essential properties in a wide range of applications:

**Polymerization:** TGA is a very effective chain transfer agent for emulsion polymerizations in aqueous media, in particular for acrylic acid and acrylates. The total miscibility of TGA with water is a benefit in this application.

**Petrochemical:** The Bronsted acid characteristics of thioglycolic acid and its thiol functionality make it a chemical of choice for the preparation or regeneration of metal catalysts for hydrodesulfurization.

**Cosmetics:** The salts of thioglycolic acid are used to formulate hair treatments, specialty hair styling products, and in the preparation of depilatory creams. The main salts are ammonium, calcium and potassium thioglycolate or its disulfide salts. In some formulations, glyceryl monothioglycolate is also used.

**Leather Processing:** Alkaline sodium thioglycolate is used in removal of hair from leather hides. It minimizes wastewater treatment costs as compared to the more toxic and harmful sodium hydrosulfide.

**Metals Recovery:** TGA derivatives are also used as depressants in flotation processes for separating valuable metals from ores in mining operations. TGA derivatives are a safer alternative to the more traditional sodium sulfhydrate (NaSH), particularly in mining environments.

**Cleaning Formulations:** Due to their ability to form complexes with metals, thioglycolic acid and thioglycolic acid salts are excellent additives in cleaning solutions, in particular for automotive applications including automotive wheel rim cleaners.

**Fine Chemicals:** Thioglycolic acid is used for the preparation of pesticides such as thifensulfuron herbicide, or for polythiols or thio-esters.

**Petroleum Refining:** In the catalytic cracking of hydrocarbons for petroleum refining, mercaptides of thioglycolic acid are effectively used as a heavy metal passivator that counteracts the adverse effects of metal (Ni, V, Fe) contaminants on catalysts.

**Arkema offers both distilled thioglycolic acid (TGA) with a minimum purity of 99%, as well as an aqueous 80% solution that provides longer shelf life.**

## FOR MORE INFORMATION

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