

# Emulsifiers for Metalworking Fluids





# Emulsifiers from Renewable Resources

Caring about nature

In water miscible metalworking fluid formulations, emulsifiers constitute one of the most essential components. As an integral part of metalworking fluid concentrates, emulsifiers enable stable self-emulsification of the concentrate when diluted in water.

**Our emulsifiers meet the following requirements:**

- Good solubility in base oils
- Good lubricating properties
- Good dermatological and toxicological properties
- Low foaming tendency
- Good heat stability

Our product range includes emulsifiers and co-emulsifiers that are based on renewable resources (e.g. ethoxylated or non-ethoxylated glycerol fatty acid esters, and sorbitan esters\*), various fatty acid polyglycol esters and lauryl polyglycol ethers. However, the focus of Evonik is on environmentally friendly glycerol fatty acid esters. In order to emulsify a specific base oil, emulsifiers with suitable HLB values are needed. The required HLB value needs to be adjusted according to the varying fatty acid distribution in vegetable oils or carbon distribution in mineral oils. To match the requirements of a specific oil quality, emulsifiers exhibiting different hydrophilicities and hydrophobicities can be blended (base with co-emulsifier).

\* not available in North America

### Formulation of emulsions – assessment of emulsion stability

The careful selection of the components for an emulsion and the evaluation of the latter's stability are important tasks. In many cases the instability of an emulsion becomes obvious in the form of creaming, the appearance of an oil phase at the surface of the system or by the sedimentation of components having a higher density. Thus it is logical to use centrifugation methods in order to speed up the potential destabilization process and to gain a deeper understanding of the factors that determine emulsion stability.

#### **Emulsion stability analyzer LUMiFuge**

In our labs we use the stability analyzer LUMiFuge to detect a large variety of demixing phenomena of disperse systems. It is a suitable tool for both screening purposes and optimization of emulsion formulations.

### Stability of emulsions using TAGAT® V 20

TAGAT® V 20 exhibits exceptional emulsifying properties when used in ester oil-based metalworking fluids. Particle size analysis by LUMiFuge technique demonstrates that TAGAT® V 20 yields emulsions of much lower particle size compared to competitive vegetable-based emulsifiers.

Lab bench top analysis verifies that the information determined by the LUMiFuge testing instrument is accurate. After storage over one month at room temperature, the TAGAT® V 20 based emulsion demonstrated superior emulsion stability compared to emulsions based on competitive emulsifiers.



Emulsion stability analyser LUMiFuge



**TAGAT® V 20 improves the lubricating properties of metalworking fluids**

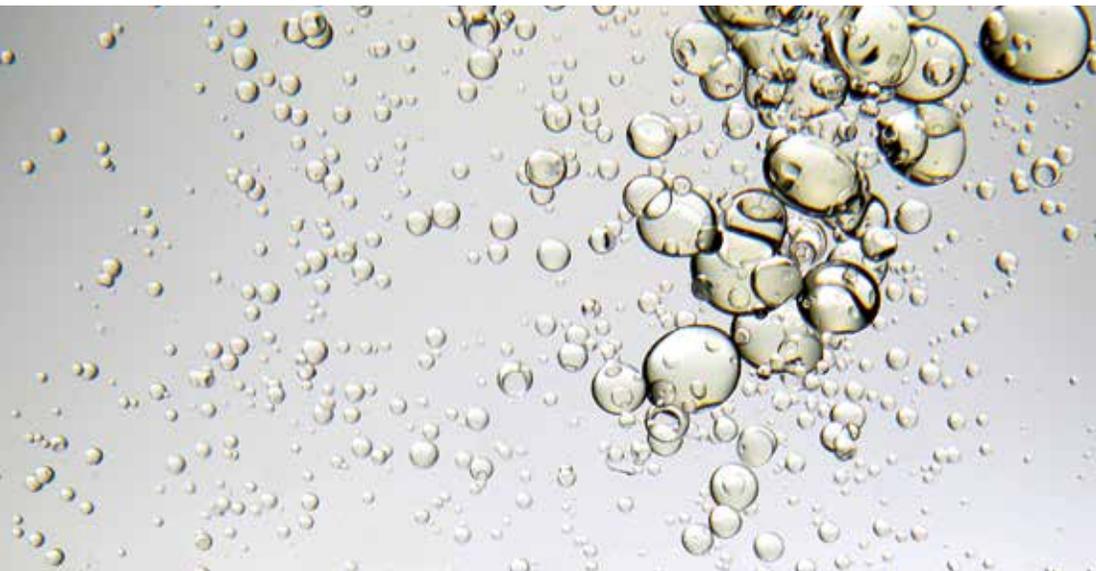
TAGAT® V 20 lubricating properties were evaluated with a Megatap II-G 8 (tapping torque test equipment). Torque values are measured as a tap cuts threads into a predrilled hole in a metal specimen. Test results may be illustrated either as a simple torque force value or as relative efficiency (ratio of the average torque value of a reference fluid to that of the test fluid).

The tapping torque test is a relatively good simulation of practical conditions in metalworking operations and is widely used by the metalworking fluid industry to evaluate cutting fluid performance and EP/AW\* additive response.

\* EP = Extreme Pressure, AW = Anti-Wear

**Tapping Torque Efficiency 1018 Steel**

Relative efficiency (%)	Sulfonate	Polyglycol Emulsifier	TAGAT® V 20
115			
110			
105			
100			
95			



Megatap II-G 8 tapping torque equipment



# Product Range Emulsifiers

Our emulsifiers, particularly our glycerol based emulsifiers, exhibit good dermatological properties and they do not have restrictive labelling.

## Base Emulsifiers

### **TAGAT® V 20**

Exceptional emulsifying properties combined with excellent lubrication properties for the formulation of metalworking fluids based on vegetable and synthetic ester oils; in combination with alcohol ethoxylates suitable for mineral oil based fluids. Additionally, it reduces the amount of antifoam and corrosion inhibitor required in formulations.

Glycerol-based; HLB = 8.4

### **TAGAT® V 15**

Exceptional emulsifying properties for synthetic ester oils combined with excellent lubrication properties.

Glycerol-based; HLB = 7

### **TAGAT® TO V**

Excellent emulsifier for the formulation of metalworking fluids based on naphthenic oils, synthetic oils (e.g. isooctyloliate) and ester oil/mineral oil blends; additionally, it improves lubrication properties of metalworking fluid emulsions.

Glycerol-based; HLB = 11.3

### **TEGO® STO 85 V**

Excellent emulsifier for paraffin oils, especially in combination with TEGO® STO V (soluble in mineral oil).

Sorbitan-based; HLB = 11.3

## Co-Emulsifiers

### **TEGIN® O V**

Excellent co-emulsifier in combination with TAGAT® V 20 and TAGAT® TO V.

Glycerol-based; HLB = 3.3

### **TEGO® SMO V**

Excellent co-emulsifier, especially in combination with TAGAT® V 20.

Sorbitan-based; HLB = 4.3

### **TEGO® STO V**

Excellent co-emulsifier, especially in combination with TEGO® STO 85 V.

Sorbitan-based; HLB = 1.8





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