

Water-miscible metalworking media and their care

Emulsions and dispersions

Emulsions are mixtures consisting of an oil-based concentrate and water. This becomes a dispersion if components of solid lubricants are also added. These ingredients, which, in themselves, are not mixable are transformed into a stable and usable emulsion or dispersion using an emulsifier contained in the concentrate. Oil-in-water emulsions are generally used in metalworking. Cooling lubricant emulsions / dispersions have a very high cooling effect, due to higher specific heats, better thermal conductivity and the greater evaporation heat of water. Emulsifiable cooling lubricants are complex mixtures of mineral oil, possibly synthetic hydrocarbons, emulsifiers, stabilisers, antifoam agents, biocides, etc. Completely mixed cooling lubricants have the following appearance, depending on the mineral oil content:

High mineral oil content	:	Deep white appearance
Medium mineral oil content	:	White, slightly translucent in part
Free of mineral oil	:	Clear solution

Storage conditions

Concentrates for emulsions must be stored in frost-free conditions and protected if possible during storage against major and frequent temperature fluctuations. It is recommended that the oils be stored in closed rooms at a temperature of 20°C. The specified concentrate storage durations should also be observed.

Emulsion formulation

The emulsion formulation must be realised very accurately. The operational emulsion is prepared by slowly pouring into the mixing water while simultaneously stirring thoroughly or with the aid of automatic mixing appliances. The mixing water used should be clean, of potable water quality and, where possible, have medium hardness. Information on water quality can be obtained from the local water supplier. Avoid water temperatures that are too low. The specified concentrations should not be excessively exceeded or undershot, as there is otherwise a risk of corrosion or foam formation. The concentrate is added slowly to the prepared mixing water. The product may then only be applied following a prescribed period which allows thorough mixing of the constituents. Utilisation of an automatic dosing system is recommended.

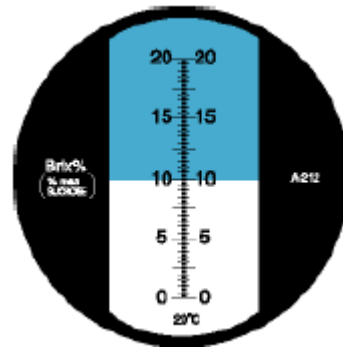
Care and maintenance of emulsions

Emulsions and dispersions are subject to extremely high stress during use which includes thermal stress, evaporation of water leading to concentration of mineral salts dissolved in water (e.g. chlorides and sulphates), degradation of additives contained in the emulsion, introduction of outside oil from the processing machine, etc. (tramp oil), formation of bacteria and moulds, etc. Emulsions and dispersions, etc. should be regularly inspected to achieve a high degree of process reliability and also meet the standards of employers' liability insurance associations.

Oil content



Hand-held refractometer



View through the eyepiece

For rapid determination of oil content. This method involves placing a drop of the filtered emulsion between two prisms and reading the measurement value on a scale at the light / dark limit line when looking through the eyepiece. This method should only be used for operational monitoring. A calibration curve should first be created for each emulsion or a conversion factor determined.

pH value

The pH value of an emulsion can deteriorate during use due to the introduction of other products from upstream production stages or enrichment with microbial metabolic products. In order to maintain the corrosion protection and stability of the emulsion, the pH value of the emulsion during use should always lie within the range of the freshly mixed-in emulsion. The pH value of the emulsion should therefore be regularly checked during use. The simplest inspection is with indicator paper. Indicator paper within a measuring range of pH 7 to 14 is used.



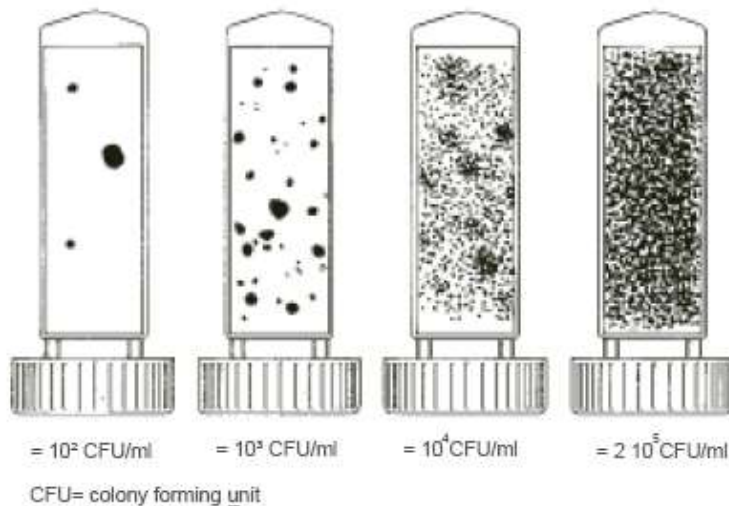
pH test strips

Microorganisms

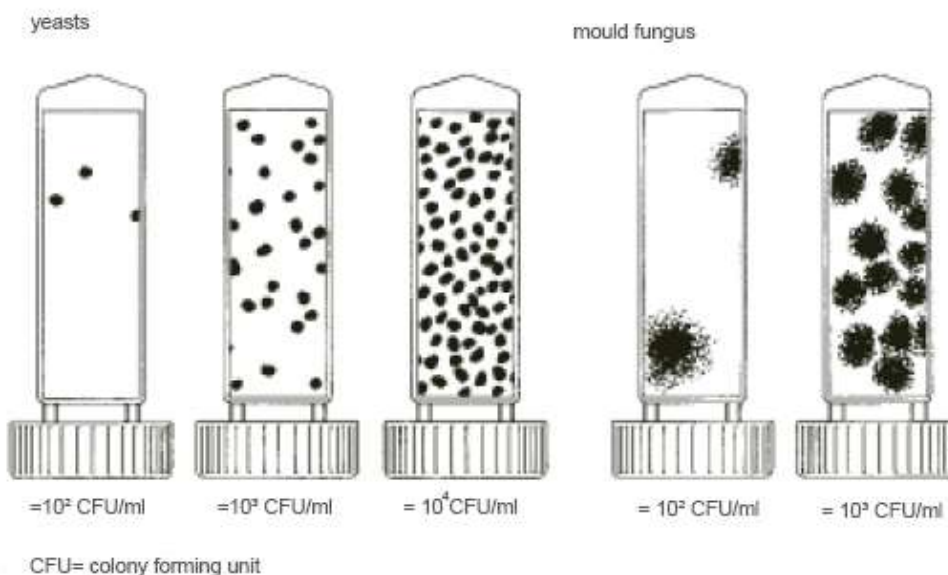
The formation of microorganisms (bacteria and moulds) is encouraged by contaminated water, emulsion / dispersion pH values which are too low, contaminants penetrating from outside, inadequate emulsion movement, etc. Regular inspections for fungi and bacteria must therefore be conducted. It is recommended that the mixing water also be inspected.

Germ testers known as dip slides are generally used for checking.

The number of the colonies on the agar correlates directly with the number of microorganisms of the sample.



2. Comparison of the growth of yeasts and mould fungus on the nutrition medium HS



Comparison of infestation of bacteria, yeasts and moulds

Image: heipha Dr. Müller GmbH

Nitrate / nitrite

New hazardous substances not present in the initial products can also be formed due to thermal stress or certain reactions. The formation of nitrosamines (classified as carcinogenic) in water-mixed cooling lubricants should be mentioned in this context. Nitrosamines can usually form in all cases where cooling lubricants contain nitrate and/or nitrite. Their content can be determined with nitrate / nitrite test strips (sticks). Appropriate measures must be taken if nitrate and/or nitrite content is detected.



Nitrate / nitrite test strips

Documentation

Regular inspections of emulsions / dispersions in use should be recorded pursuant to employers' liability insurance association guidelines. Employers' liability insurance associations keep examples of this documentation and other information (e.g. current limit values to be observed).

Suppliers:

Berufsgenossenschaft Energie Textil Elektro Medienerzeugnisse

Gustav-Heinemann-Ufer 130
D-50968 Köln
www.bgetem.de
(Brochure: Handling cooling lubricants)

Heipha Dr. Müller GmbH
Lilienthalstr. 16
69214 Eppelheim
www.heipha.de
(Source of pictures)

Behr Labor-Technik GmbH
Spangerstrasse 8
40599 Düsseldorf
www.behr-labor.de

neoLab Migge Laborbedarf-Vertriebs GmbH
Rischerstr. 7-9
69031 Heidelberg
www.neolab.de

MACHEREY-NAGEL GmbH & Co. KG
Neumann Neander Str. 6-8
52313 Düren
www.mn-net.com

Fleischhacker GmbH & Co. KG
An der Silberkuhle 18
58239 Schwerte
www.fleischhacker.biz

	Behr Labor-Technik	NeoLab	Macherey-Nagel	Fleischhacker	Schlee
pH test strips	X	X		X	X
Nitrate / nitrite test strips	X		X	X	X
Nitrite test strips	X			X	X
Bacteria/ fungi testers (dip slides)	X	X		X	X
Hand-held refractometer	X	X		X	X
Thermometer	X	X		X	X