STABLE FUNGICIDES ENERGIZED BY

LANXESS
Energizing Chemistry

OPP for Metal Working Fluids

Preventol®

METAL WORKING FLUID CIRCUITS – BREEDING GROUNDS FOR MICROBES

Fungi and yeasts prefer to grow in the air, in areas with high humidity – different from bacteria, which prefer to grow in liquids.

In cooling lubricant circuits this effect is well known, stalactites of fungi are hanging from covers of tanks and ducts. Nests of fungi and yeasts can form in damp places which are splashed occasionally. These in turn form the breeding ground for bacteria which then multiply within the liquid coolants.

OPP, A RELIABLE, STABLE FUNGICIDE FOR MODERN METAL WORKING FLUIDS

To combat acute fungal infestation as well as to prevent fungal growth in cooling lubricant systems, the fungicide o-phenylphenol (OPP), which is globally approved for the application in metal working fluids has proven very effective.

Even without the use of formaldehyde donors or CMIT/MIT a reliable protection against all kinds of microorganisms can be achieved by using more favourable bactericides like MIT or BIT/MIT in combination with OPP in coolant emulsions.

Coolant emulsions which are highly alkaline with amines can also be protected well with OPP and therefore may not need the addition of bactericides.

RISKS AND LABELING OF OPP-CONTAINING MATERIALS

OPP stands out with respect to the low handling risks compared to other fungicides which can be used in metal working fluids. Generally OPP is preferred as a fungicide in applications where low health risks are important, for example harvested citrus fruits are treated with OPP against mould.

Particularly noteworthy is the fact that OPP is not a sensitizing agent. According to GHS-CLP no OPP-relevant labelling is required for substances containing up to 10 % OPP.

The products Preventol OF 45 and Preventol ON extra, alkaline salt solution and alkaline salt of OPP, are corrosive due to their high pH values and must be labelled accordingly and handled with care (see also page 7: Forms of supply of OPP)

Labelling of OPP-containing substances:

< 10 % OPP:	**No labelling**
10 – 20 % OPP:	**H319 (Causes serious eye irritation), H315 (Causes skin irritation)**
20 – 25 % OPP:	**additionally H335 (May cause respiratory irritation)**
> 25 %:	**additionally H400 (Very toxic to aquatic life)**

OPP FOR POST TREATMENT OF METAL WORKING FLUIDS

With a curative dosage of 900-1,000 ppm OPP in cooling lubricant circuits, e.g. by addition of 2,000 ppm Preventol OF 45 existing fungi in damp areas of the circuit, e.g. on covers of tanks or channels etc. are quickly removed.

This can happen within hours and even lead to the blockage of fine filters with organic matter depending on the extent of the infestation.

For the preventive preservation of the clean system against further fungal contamination concentrations of 600-900 ppm OPP are usually sufficient.

To maintain a minimum level of 600 ppm OPP a corresponding amount of Preventol OF 45 can be added to the circuit or dosed to the coolant for refill.

OPP is not chemically disintegrated in the circuit. It is stable at temperatures up to over 100°C and to alkalinity far above pH 10. If dosed in sufficient quantities OPP, unlike most other biocides, is not reduced by germs.

However, OPP accumulates in oils, fats and some plastics, so the skimming of tramp oils may lead to a disproportional depletion of OPP levels in the circuit.

OPP FOR METAL WORKING FLUID CONCENTRATES

OPP is not only suitable for the treatment of diluted emulsions in coolant circuits, but also for incorporation into emulsion concentrates of mineral or synthetic oils.

All the benefits of OPP come into play here. In particular, the high stability of this fungicide allows manufacturers of cooling lubricants the basic preservation of novel, for example, strongly alkaline concentrates with the aim to largely do without bactericides. Neither high pH values nor the contact with iron lead to impairments of the concentrates even after long periods of storage.

The more favorable labeling requirements in comparison with other fungicides (non-sensitizing, no GHS labelling up to 10 % OPP content) fit well with the requirements of modern coolants.

Also important in this context is the worldwide availability and approval of OPP as a biocide in cooling lubricants, so global products can be produced locally.

The 100% supply form, OPP in flakes (Preventol O extra), is preferably used for the formulation of metalworking fluid concentrates

Most important is the addition of a sufficient quantity of OPP. Even at > 20-fold dilution of the concentrate there should always be a level of at least 600 ppm of OPP available in the circuit. Concentrates of metal working fluid emulsions should therefore contain enough OPP corresponding to their dilution in use. A minimum of 1.8 % OPP concentration in metal working fluid concentrates may be a regarded as a guideline, bearing in mind that concentrates for replenishment of drag outs are diluted more than 20-fold.

METHODS FOR DETERMINATION OF OPP IN METAL WORKING FLUIDS

HPLC and GC are the standard methods for determining the OPP content of liquids, such as metal working fluids.

Phenol index measurement with a photometer plays an important role in the measurement of phenol content in waste water. This is a method with less expensive equipment and may show sufficiently accurate results also for the OPP content in coolants.

OPP IN SEWAGE FROM METAL WORKING FLUIDS

The main advantage of OPP, its high stability, may also be a subject of concern. In the 1980s, OPP which, thanks to its good effects was commonly applied in metal working fluids in Europe, became largely replaced by other biocides as a result of general measures to avoid waste water pollution with phenolics.

The first question when looking at OPP again is: How much of the OPP used in metal working fluid circuits (400-1,000 ppm) eventually ends up in the waste water, how is this to be rated?

New investigations have confirmed: OPP accumulates in oils and fats. When the emulsion is split, e.g. by chemical means or by ultrafiltration, approximately 95 % of the OPP remains in the oil phase, where they do no harm, and only about 5 % ends up in the water phase. So of the 600 ppm OPP in the metal working fluid only about 30 ppm OPP will pass into the wastewater. This is significantly below the limit of 100 ppm phenol index recommended by the DWA[1)], even if only waste water from the emulsion separation process is discharged without the usual addition of wastewater from other origins.

In low concentrations OPP is readily biodegradable (Closed Bottle Test). The EC 50 value of OPP, the concentration which 50 % of test bacteria survive, is 60 ppm OPP.

The chemical oxygen demand (COD) for the degradation of OPP residues in waste water is of little significance. The oil residues which are still present in the sewage after ultrafiltration cause a COD with a factor of almost 1,000 higher than the OPP residues.

Water samples for the analysis of the OPP content should be stored in glass containers. When using plastic bottles, measurements of OPP traces could show too low results due to accumulation of OPP in plastics.

[1)] There is a standardized measurement method, the phenol index measurement (DIN 38409-H 16-2, June 1984) to determine phenolics in sewage. Traces of OPP are found with this method. The German Association for Water , Wastewater and Waste (DWA) recommends to local sewage treatment plants to impose a limit of 100 ppm phenol index for the discharge of non-domestic waste water. However, some sewage treatment plants have imposed lower limits.
Continuous monitoring of the effluent of a metal processing plant with a central tank of 140 m^3 metal working fluid, protected with 1,000 to 600 ppm of OPP, shows values between 2 and 1 ppm of phenol index within one year.

OPP IN COMBINATION WITH BACTERICIDES

Due to government regulations, especially in the EU, the choice of bactericides for use in metalworking fluids is very limited. In particular, attempts are made to avoid formaldehyde-releasing bactericides and also CMIT. In this context in the EU there is new interest now in OPP for metal working fluids.

Laboratory experiments with the aim to achieve a good protection of cooling lubricants without the use of formaldehyde-releasing bactericides and without CMIT/MIT, have shown a good effect in a mineral oil-based coolant emulsion with dosages of 600-1,000 ppm OPP combined with 80-100 ppm MIT.

It is premature to derive simple solutions for combinations of OPP and MIT alone for the reliable protection of the many types of coolants in practice.

A large-scale trial in practice shows clearly: OPP dosed in a sufficient amount stabilizes the hitherto very frail circuit so that there is scarcely a need for addition of curative biocides where formerly acute contamination had to be fought all the time. OPP with its slow and reliable action provides a basic stability in the system.

Concentrates of metal working fluids without bactericides, which are set to a particularly high alkalinity, for example with amines, are also well suited to be equipped with the robust OPP. Here are the starting points for the development of bactericide-free coolants, in which the weak bactericidal effect of the fungicide OPP can be enhanced by amines.

Please note: Incompatible biocides must always be dosed separately, they must not be mixed with each other before dosing into the metal working fluid circuit!

Bactericides, which release large amounts of formaldehyde are not suitable in combination with OPP in metal working fluids at high pH values > pH 9.5. In these conditions a chemical reaction can take place between OPP and formaldehyde (similar to phenolic plastic synthesis). Such reaction products are microbiologically not effective and can cause discoloration.

Also in the presence of iron and other metals a slight discoloration of OPP-containing metal working fluids may occur occasionally. This has no impact on the effectiveness and this is by no means to be compared in intensity with the discoloration which can occur when the fungicide sodium pyrithione is forming iron complexes.

Trial in a 140 m³ central system of an automotive parts producer in Germany:

Since OPP was first dosed at 1,000 ppm 15 months ago and then maintained at a level of 600 ppm in the hitherto highly instable circuit, which had to be treated constantly with curative biocides before, the system has been running without any problems, so that the anticipated short-term date for a complete exchange of the metal working fluid has been postponed already for the second time for one more year.

In this plant, however, the biocides previously employed continue to be used and OPP has been dosed additionally to try to stop the constant problems. There is a formaldehyde releaser and BBIT in the metal working fluid concentrate plus post treatment with a mixture of 2.5 % each BIT and MIT, of which a level of 100 ppm each is maintained in the circuit.

A simultaneous drop of both the OPP and the BIT / MIT dosage led to contamination again at levels of about 500 ppm OPP, 50 ppm MIT and 60 ppm BIT. After a short disinfection with CMIT / MIT the circuit has been running stable again at about 600 ppm OPP and about 100 ppm MIT and BIT each. There are other tests envisaged, especially without BIT and, if possible, even without formaldehyde releasers and without BBIT in the concentrate.

FORMS OF SUPPLY OF OPP BY LANXESS

OPP in pure form is a white solid. The melting point is approximately 57°C.

OPP is hardly soluble in water at neutral pH (only about 600 ppm). In strongly alkaline media and in most solvents it is very soluble.

In addition to this pure form OPP is also available in liquid form, i.e. dissolved in potassium hydroxide, and also as solid, water soluble OPP-sodium salt.

PREVENTOL® O EXTRA:

- min. 99.5 % OPP in flakes

PREVENTOL® OF 45:

- OPP dissolved in potassium hydroxide
- 45 % OPP content
- liquid

PREVENTOL® ON EXTRA:

- Sodium salt of OPP
- 62 – 65 % OPP content
- crystalline flakes
- soluble in water

Preventol®

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Energizing Chemistry

Use biocides safely. Always read the label and product information before use.

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