

Key Performance Advantages

- Excellent alternative to dicyclohexylamine
- Enhances the performance of many biocides
- Controls corrosion of ferrous metals



Metalworking Fluids

CORRGUARD[®] EXT

Amino Alcohol for Long-Life Metalworking Fluids Performance Comparison with Dicyclohexylamine (DCHA)

CORRGUARD[®] EXT Amino Alcohol is a commercially new-to-the-world primary amino alcohol (3-amino-4-octanol) and is an excellent alternative to dicyclohexylamine (DCHA). CORRGUARD EXT offers the following advantages in a full range of water-miscible metal removal and metal forming fluids; please note that CORRGUARD EXT is not a biocide and is not intended for use as an antimicrobial.

- Primary amine functionality meets applicable government regulations in most countries for formulations (low secondary amine fluids)
- Consistently enhances the performance of a wide range of biocides including the industry-standard triazine
- Exceptional performance with benzisothiazolinone¹ (a non-formaldehyde-based biocide)
- Excellent corrosion control of ferrous metals (cast iron, etc.)
- Lower surfactant demand

Primary Amine Functionality

The main active ingredient in CORRGUARD EXT, 3-amino-4-octanol, is a primary amine. CORRGUARD EXT contains less than 2.0% total secondary amines by specification. This is important for fluid producers formulating to meet German regulation TRGS 611; this regulation states fluid concentrates must contain no more than 0.2% total secondary amine impurities. Up to 10% CORRGUARD EXT Amino Alcohol could be used in such fluid concentrates without exceeding the TRGS 611 limit. DCHA, on the other hand, is a secondary amine. Please note that the secondary amine content of all fluid concentrate components must be known, to ensure that the total formulation does not exceed the TRGS 611 limit.

Consistent Enhancement of Biocide Performance

CORRGUARD EXT consistently improves the performance of a wide variety of registered biocides, as demonstrated in Figures 1 & 2 for a low oil semi-synthetic metal removal fluid (Figure 5). CORRGUARD EXT was present at 4700 ppm (dilution basis) vs. 4000 ppm for DCHA; since CORRGUARD EXT is 85% active, this gave equal weight concentrations of active amine. Triazine biocide, BIOBAN™ P-1487 Antimicrobial¹ and BIOBAN™ CS-1246 Antimicrobial¹ were tested at 750 ppm as supplied (dilution basis), while benzisothiazolinone (BIT) (BIOBAN ULTRA BIT 20 Antimicrobial¹) was tested at 600 ppm. Bacterial protection was defined as the number of weeks before reaching a total bacterial count of 1x10⁵ CFU/mL or more, and fungal protection defined as the weeks prior to reaching fungal counts of 1x10³ CFU/mL or above; the accelerated test protocol was ASTM E2275. The fluids with CORRGUARD EXT resisted bacterial growth more consistently (vs. DCHA) across the range of biocides. Fungal protection was more consistent with CORRGUARD EXT as well, although the fluids with DCHA resisted fungal degradation longer except with BIOBAN ULTRA BIT 20 where CORRGUARD EXT showed more positive results.

Fig. 1 – Bacterial Protection Results

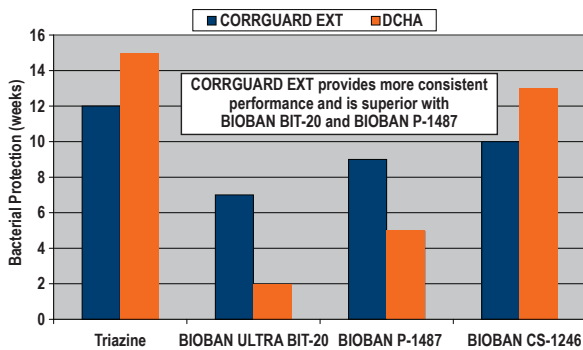
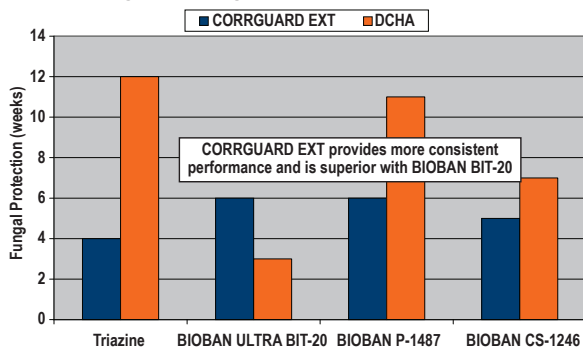


Fig. 2 – Fungal Protection Results



Exceptional Performance with Benzisothiazolinone (BIT, Non-Formaldehyde-Based)

Tests show exceptional performance of CORRGUARD EXT Amino Alcohol with BIOBAN ULTRA BIT 20, however bacterial and fungal protection were shorter overall versus some of the other biocide systems. The goal was to understand if performance with BIOBAN ULTRA BIT 20 could be improved to the level provided by some of the others, since non-formaldehyde-based systems are increasingly in demand. The data in Figure 3 show that addition of 3500 ppm CORRGUARD EXT with 900 ppm BIOBAN ULTRA BIT 20 Antimicrobial (dilution basis) in the non-boron containing formulation provided a significant improvement in both bacterial and fungal protection. CORRGUARD EXT enabled BIOBAN ULTRA BIT 20 to meet or eventually even exceed the performance of the more common formaldehyde-based biocides such as triazine. Data are also included for the same fluid with 2-amino-2-methyl-1-propanol (CORRGUARD®-95 Amino Alcohol) at 3000 ppm; this primary amine is one of the best historical products in terms of resistance to microbial degradation. DCHA was not included in this experimental series.

Fig. 3 – Bacterial/Fungal Protection with BIT-20 (900 ppm)

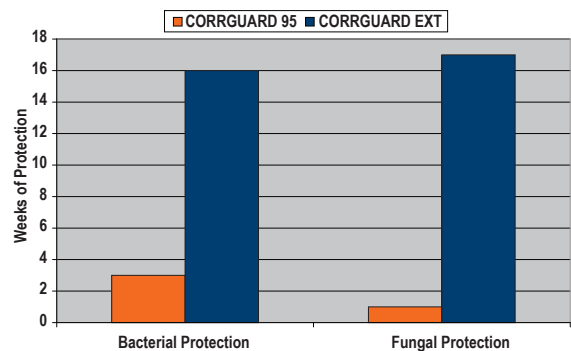
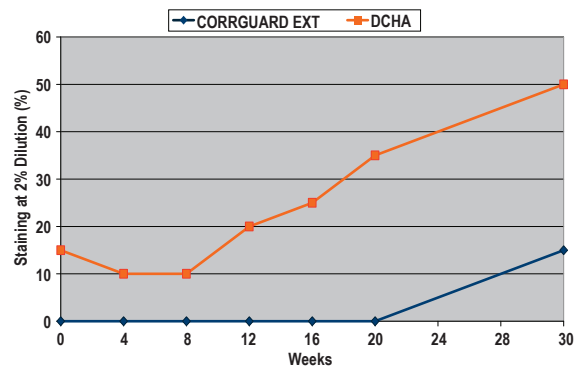


Fig. 4 – Cast Iron Corrosion Control



Excellent Corrosion Control of Ferrous Metals

CORRGUARD EXT Amino Alcohol provided better corrosion control of cast iron versus DCHA in a borated semi-synthetic fluid (Figure 6) containing 1000 ppm boric acid, 3500 ppm CORRGUARD EXT (or 3000 ppm DCHA), and 750 ppm triazine (all at dilution). Fluid samples were removed during microbial aging tests to evaluate corrosion control of cast iron chips. The results are presented in Figure 4. The fluid with CORRGUARD EXT provided better corrosion control initially, and excellent control remained throughout the test. This was in spite of the fact that fungal control was better in the fluid containing DCHA.

Lower Surfactant Demand

CORRGUARD EXT has greater hydrophilicity than DCHA and often requires lower levels of non-ionic emulsifiers to achieve stable emulsions. For example, in the two fluids below (Figures 5 & 6) the level of nonylphenol ethoxylate required in the fluids with CORRGUARD EXT was only 50% of that required for those with DCHA. This can reduce formulation cost and the foaming potential of the fluids.

Ingredient	CORRGUARD EXT	DCHA
Deionized water	43.0%	41.6%
Hydrotreated naphthenic oil	10.0	10.0
C10-12 Dicarboxylic Acid	4.5	4.5
Sodium petroleum sulfonate	14.0	14.0
Tall oil fatty acid	5.0	5.0
AMINE	6.0	6.0
CORRGUARD 95	4.6	4.5
Ethoxylated oxazoline	4.0	4.0
Ethylene glycol monobutyl ether	3.5	3.5
Phosphate ester	2.4	2.4
Nonylphenol ethoxylate	1.5	3.0
Triazine (78%)	1.5	1.5

Concentrate appearance	Clear	Clear
Dilution appearance	Milky	Milky
Dilution pH	9.3	9.3

Fig. 5 – Boron-Free Semi-Synthetic Fluid

Ingredient	CORRGUARD EXT	DCHA
Deionized water	44.3%	42.9%
Hydrotreated naphthenic oil	10.0	10.0
Sodium petroleum sulfonate	14.0	14.0
Tall oil fatty acid	5.0	5.0
Boric acid	2.0	2.0
C10-12 Dicarboxylic Acid	1.5	1.5
AMINE	6.0	6.0
CORRGUARD 95	4.0	3.6
Ethoxylated oxazoline	4.0	4.0
Ethylene glycol monobutyl ether	3.5	3.5
Phosphate ester	2.4	2.4
Nonylphenol ethoxylate	1.8	3.6
Triazine (78%)	1.5	1.5

Concentrate appearance	Clear	Clear
Dilution appearance	Milky	Milky
Dilution pH	9.4	9.4

Fig. 6 – Borated Semi-Synthetic Formulation

Formulating Guidance

ANGUS can help you formulate fluids with CORRGUARD EXT Amino Alcohol and appropriate biocides to meet your cost and performance requirements. Please contact your local ANGUS representative for technical assistance.

¹Supplied by Dow Microbial Control, a business unit of The Dow Chemical Company

Product Stewardship

ANGUS encourages its customers to review their applications of ANGUS products from the standpoint of human health and environmental quality. To help ensure that ANGUS products are not used in ways for which they are not intended, ANGUS personnel will assist customers in dealing with environmental and product safety considerations. For assistance, product Safety Data Sheets, or other information, please contact your ANGUS representative at the numbers provided in this document. When considering the use of any ANGUS product in a particular application, review the latest Safety Data Sheet to ensure that the intended use is within the scope of approved uses and can be accomplished safely. Before handling any of the products, obtain available product safety information including the Safety Data Sheet(s) and take the necessary steps to ensure safety of use.

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