ANGUS® CHEMICAL COMPANY

Key Performance Advantages

- Excellent alternative to isopropanolamine
- Greater microbial resistance
- Minimizes leaching of heavy metals

Metalworking Fluids

CORRGUARD®-95

Amino Alcohol for Metalworking Fluids
An Ideal Replacement for Isopropanolamine (MIPA)

CORRGUARD®-95 Amino Alcohol is an excellent choice for replacement of MIPA:

- Stable supply
- Similar use level to MIPA
- Equal to better pH stability
- Greater microbial resistance
- Significantly less leaching of heavy metals (cobalt, lead)

Key Benefits

Stable Supply Available

ANGUS Chemical Company (ANGUS) produces CORRGUARD-95 Amino Alcohol at two manufacturing locations and has a long history of globally reliable supply of this high-quality product. In addition, ANGUS has increased capacity to meet the growing demand for this key metalworking fluid ingredient.

Similar Neutralization and pH Development

Similar amounts of CORRGUARD-95 and MIPA are required to neutralize acid-functional ingredients and develop alkaline pH in metalworking fluids. This was demonstrated by neutralizing 0.5 percent solutions of several acids to pH 9.5 using CORRGUARD-95 versus MIPA. The results are presented in Figure 1.

Equal to Better pH Stability

CORRGUARD-95 Amino Alcohol provides equal to, or better, pH stability versus MIPA for two reasons. First, fluids with CORRGUARD-95 often resist microbial degradation better than those with MIPA (see Figures 4 and 5). Second, CORRGUARD-95 Amino Alcohol is less reactive than MIPA with atmospheric carbon dioxide (Figure 2). The improved pH stability with CORRGUARD-95, due to lower reactivity with carbon dioxide, is shown in Figure 3. The carbon dioxide reactivity experiments were done by continuously recirculating amine solutions (0.5 percent aqueous) in an open 19-liter aquarium at 38°C for 14 days. A potentiometric titration procedure was used to quantify the unreacted amine.

Improved Microbial Resistance with Registered Biocides

Properly preserved fluids with CORRGUARD-95 Amino Alcohol often resist bacterial and fungal growth longer than those with MIPA. Test results (Figures 4 and 5) show a longer time to bacterial/fungal failure for a soluble oil fluid containing CORRGUARD-95 versus the same fluid with MIPA; both contained triazine biocide. These tests are severe, with the fluids being inoculated initially and weekly thereafter with high levels of a mixed bacterial/fungal inoculum isolated from spoiled MWFs. Bacterial and fungal resistance are much greater in the fluid with CORRGUARD-95 Amino Alcohol.

Less Leaching of Cobalt and Lead

Amines and amino alcohols are known to leach metals such as cobalt (during the production of tungsten-carbide tools) and lead (during the machining of leaded-brass alloys). Leaching of these metals into MWFs can result in adverse skin reactions (dermatitis), as well as possible health issues associated with breathing mists containing these dissolved metals. However, amino alcohols vary significantly in their tendency to leach these metals, and CORRGUARD-95 Amino Alcohol has been found to be a lower leaching amine than MIPA. Figure 6 shows results for amine solutions (1 percent aqueous) adjusted to pH 9.0 using acetic acid. The tungsten-carbide and leaded-brass swarf (fine particles) were supplied by machining plants. The swarf was added to the amine solutions, mixed continuously for five days and then filtered through 0.2 micron syringe filters; the filtrates were analyzed for dissolved metals by atomic absorption.

Figure 1
Neutralization Efficiency
CORRGUARD-95® vs. MIPA

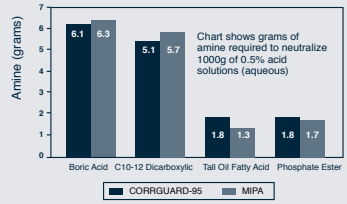


Figure 2
Loss of Amine to Reaction with Carbon Dioxide

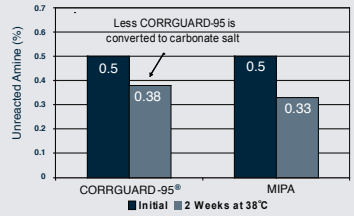


Figure 3
pH Stability During Recirculation Test

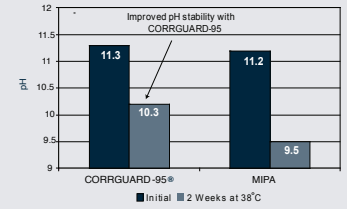


Figure 4
Soluble Oil Containing Triazine (Time to Bacterial Failure)

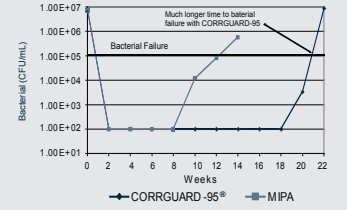


Figure 5
Soluble Oil Containing Triazine (Time to Fungal Failure)

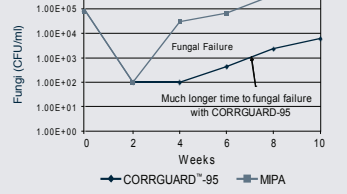
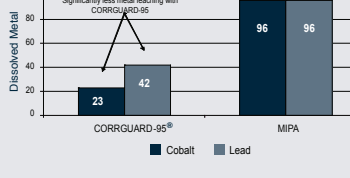


Figure 6
Metal Leaching Results- Aqueous Amino Alcohols



Formulating Guidance

ANGUS can help you formulate fluids with CORRGUARD-95 Amino Alcohol and appropriate biocides to meet your cost and performance requirements. Please contact your local ANGUS representative for technical assistance.

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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