Arkema And Metalworking

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Arkema is a global chemical supplier with back-integrated activities in chemical manufacturing, polymer production and specialty chemical supply. The Arkema Amines Business has over 50 years of experience in amine chemistry with dedicated R&D support from our research facilities in King of Prussia, PA and Châlons, France. Arkema has an active program aimed at discovering and optimizing new applications of both novel and established alkanolamines. Metalworking fluid formulators use alkanolamines to adjust and maintain the pH of their fluids. The ideal pH for most metalworking fluids is between 8.5 and 9.5, and alkanolamines are ideal agents for buffering metalworking fluids within this range. Alkanolamines offer the best combination of effective pH control and moderate alkalinity along with high aqueous solubility, good lubricity, excellent corrosion prevention and biocide synergy. The biocide active ingredient of an alkanolamine may be seen to be a trivial issue to the uninitiated, but biocidal stability can, if ignored, become a pronounced problem for the fluid user. The bacterial contamination of metalworking fluids leads to productivity reduction and to a number of occupational health problems contracted via skin contact and/or inhalation of contaminated metalworking fluids. Decreased productivity may result from decreased viscosity or increased emulsion stability, increased corrosion rates, clogged filters, deteriorated coolant chemistry and decreased tool life. Occupational diseases will obviously decrease productivity by disabling plant personnel, but beyond simple economic losses, disease can result in permanent impairment or even death. Recent investigations have shown that the genus Mycobacterium can be a particularly troublesome cause of disease, and the species Mycobacterium xenopi has been specifically implicated as the causative agent of EHP (hypersensitivity Pneumonitis). Hypersensitivity Pneumonitis is within a class of occupational diseases known generally by the acronym EIA (extrinsic allergic alveolitis). The metalworking industry is currently trying to grapple with hypersensitivity pneumonitis through better analysis and control of mycobacteria.

Mycomanage® Mycomanage® is a proprietary application method based on real-time PCR (polymerase chain reaction) and intended for the quantification of mycobacteria in metalworking fluids (patent pending). The first step in this method, and indeed in most PCR methods, involves quantitative extraction of DNA from the fluid of interest. This DNA provides the template DNA that a selective primer will chemically examine in order to find any sequences unique to the genus Mycobacterium. Arkema has developed a very selective 20-base pair (bp) primer that recognizes a portion of the basic bacterial genome that is unique to mycobacteria. In order to replicate only a specific sequence of DNA, primers must be long enough and unique enough that they do not anneal to other regions that would produce replication of undesirable sequences. A sequence is chosen so that its primers will anneal to a matching sequence that is only found in the DNA of a certain genus or species. In this way, primer technology can be used to determine whether a genus, such as Mycobacterium, is present in a sample based on whether or not the primers anneal to the DNA sequence replication subsequently occurs. The qPCR method provides a way to not only detect and identify mycobacteria, but also to continuously quantify the amount of replicated sequences with successive cycles, and ultimately the amount of starting template DNA (i.e. amount of mycobacteria originally present in the sample). The qPCR method does require a separate analytical technique that allows for continuous quantification of the amount of amplicon present, and for this purpose we have employed the intercalation of a fluorochrome dye, such as SYBR Green I, which selectively binds to double-stranded DNA (i.e., the amplicon). The fluorescence increases as each additional cycle produces more copies of the amplicon sequence. The rate at which the fluorescence increases in any given sample is compared to a calibration curve, prepared from known standards, in order to determine how much mycobacteria is present. A plot of the fluorescence intensity versus the cycle number for a real-time PCR experiment is used to determine the cycle number at which point the sample fluorescence exceeds a predetermined baseline value. This cycle number, which can be a decimal value, is the basic metric that is compared to reference curves in order to determine the concentration of mycobacteria in the fluid (see Figure 1).

Alkanolamines Synergex® and Synergex T amine additives are trademarked specially N-alkylalkanolamine additives used as multipurpose neutralizing agents in metalworking fluids. The biocide synergist, surfactant and corrosion inhibition efficiency of Synergex® and Synergex T amine additives are well known throughout the industry. Synergex T is a tertiary alkanolamine analog of the secondary amine Synergex®. Synergex T amine additive has higher biocide synergist efficacy than does Synergex® T but Synergex® T performs well in a number of niches. Synergex T is also TRGS 611 (German Industrial regulation restricting the use of secondary amines in metalworking fluids) compliant. Now, in an effort to develop the best possible adjuvants for use against the slow growing and persidious organisms known as mycobacteria, Arkema has commercialized (see next generation alkanolamine additives with unprecedented efficacy - Synergex® Premier and Synergex T-Plus). With Synergex® Premier and Synergex T-Plus amine additives, Arkema has revolutionized the way both formulators and users approach the control of mycobacteria in metalworking fluids and coolants. Synergex® Premier and Synergex T-Plus amine additives are alkanolamine neutralizing agents that display useful adjuvant activity (bio- cide synergist) against all species of the genus Mycobacterium. Biocide synergy is a term that describes the favorable influence of certain components of a fluid on the efficacy of any biocides in use. All alkanolamine neutralizing agents have some impact on the biocidal efficacy of an emulsion fluid, but certain alkanolamines have markedly greater influence than others. Arkema has in recent years demonstrated experimentally the commercially well-known differences in biocidal synergy of some different alkanolamines. The experiments reported below were performed on a Molecular Devices (Sunnyvale, CA) SpectraMax Plus® absorbance/fluorescence plate reader. Bacterial concentration was measured indirectly by monitoring absorbance at 660 nm in transparent growth media (e.g., TSB) with TDS (trifluoroacetic/methylamine, supplied by Dow Chemicals, USA) used as a pH buffer. The growth media were modified by the addition of compounds (trademarks belonging to Arkema) of 4% emmured actinid extract on DNA control standards representing 1.20 x 104 to 1.20 x 105 copy number.

Figure 1. Amplification curves of three duplicate 10 fold serial dilutions of Mycobacterium extract on DNA control standards representing 1.20 x 104 to 1.20 x 105 copy number.

Figure 2. The impact of Synergex® and AMPF on the biostability of systems stabilized with Procel DB20 (20% suspension of BIT in water).
Resist mycobacteria safely and effectively with very low odor.

SynergeX Premier and SynergeX T Plus

The control of mycobacteria is one of the greatest challenges facing the metalworking fluids industry. SynergeX Premier amine additive is part of your solution.

Benefits of using SynergeX Premier amine additive

- Excellent amine additive for the synergistic control of mycobacteria growth
- Excellent adjuvant to help control the growth of bacteria and fungi
- Very low odor additive for metalworking
- Completely compatible with most formulations
- Optimized HLB emulsification

SynergeX" T Plus, a tertiary amine, provides similar performance in helping to control mycobacteria.

SynergeX Premier and SynergeX T Plus are only effective when used with appropriate biocides.

For more information, including samples of SynergeX Premier and SynergeX T Plus

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