Opportunities and Market Trends in Metalworking Fluids

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The market for metalworking fluids is large and challenging. In the United States alone, metalworking fluids represent a business of approximately 155 million gallons, valued at $800 million, and account for roughly 15% of the overall value of sales of industrial oils. On a global level, metalworking fluids account for close to 600 million gallons.

The Americas constitute the leading region, with an estimated 36% of worldwide consumption. Asia is the second-leading consumer, with an estimated 30% of the worldwide total of metalworking fluids (Figure 1).

In addition to being large, the metalworking fluids business is also complex. This is a result of the myriad of metalworking applications in use, as well as the number of significant market developments and trends currently impacting the business. For some suppliers, these developments and trends present unprecedented opportunities. For others, however, the trends could have a substantial, negative impact on their business.

Complex Applications
Although commonly grouped together, metalworking fluids are used in four distinct applications: removal, forming, protecting and treating. A brief description of each application can be found on page 34.

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Removal fluid is by far the leading type of metalworking fluid consumed, accounting for close to 54% of the total on a worldwide basis. There are only slight differences between the shares of removal fluids consumed in the Americas, Europe, and Asia. Forming fluid is a distant second at 28% (Fig. 2).

The complexity presented by the four general types of metalworking applications is compounded geometrically by the variety of metals being worked, particularly in removal applications. Metalworking fluid requirements in removal applications vary considerably due to machining speed and depth, cutting tool type and geometry, operator preference, and other performance, health, and safety issues.

Suppliers meet the wide range of performance requirements in removal applications with two general categories of fluids: straight oil and water-miscible products. Straight oil products are typically made from petroleum base stocks and formulated with friction modifiers, extreme-pressure (EP), and occasionally corrosion inhibitor additives. Water-miscible products include soluble oil, semi-synthetics and synthetic-type metalworking fluids.

The Americas region has the highest share of water-miscible products (Figure 3). End users in the United States prefer water-miscible products to straight oils, primarily because of the former’s better overall performance. In addition, disposal of water-miscible products is less expensive, since the water is typically removed before disposal, thus greatly reducing the volume of disposed product.

The use of straight oil products is higher in Europe than in the United States. This is mainly due to a law in Germany that requires a weekly test for the formation of nitrates and nitrites. The pH level in emulsions of water-miscible metalworking fluids is also checked. As a reaction to these restrictions, many large companies have begun to use neat oils. It is questionable, however, whether this trend will continue due to the extra investment needed for explosion protection required by law.

The highest share of straight-oil consumption is in Asia, where there is still a high share of metalworking equipment with which water-miscible fluids cannot be used, mainly due to problems with corrosion. In addition, it is more difficult to maintain water-miscible products than straight oils and, in many Asian countries, end users are generally not very sophisticated and service is often expensive.

**Market Developments and Trends**

**United States.** There is a significant degree of uncertainty in the United States about the types of basestocks and additives that will be used to formulate these products in the future. This uncertainty centers primarily on health and safety issues, as well as the recent criteria for a Recommended Standard for Occupational Exposure to Metalworking Fluids published by The National Institute for Occupational Safety and Health (NIOSH).

The standard, published in January 1998, has increased the level of concern among some end users and has raised the safety of metalworking fluid formulations. As a result, competitive advantages will be enjoyed by suppliers capable of offering innovative chemistries that speak directly to health and safety concerns.

Another significant issue facing suppliers of metalworking fluids in the United States relates to changes in distribution channels. The first volley of change came with chemical management programs, which provide an entire set of products, including finishers,直线 oils, and metal treatment chemicals, as well as waste treatment companies, distributors, and others, to supply metalworking fluids through subcontracting with metalworking fluid producers.

In addition to the use of chemical management programs, the integrated supply model is reshaping distribution channels. This model moves metalworking fluids to end users through large, national distributors of industrial supplies, with metalworking fluids representing only a small portion of their product portfolios. In addition to purchasing metalworking fluids from producers, some of these distributors are aligning themselves with or acquiring small metalworking fluid manufacturers.

**Europe.** In Europe, the growth rate of metalworking fluids is well below the growth of the gross domestic product. Environmental issues are the major reason, as end users try to increase the total life of the fluids through better housekeeping and recycling, as well as through the use of fluids with a longer inherent service life. Other reasons include the use of new technologies, such as microlubrication, near net shape casting, high-speed cutting, and dry machining.

In Europe, there is a general trend toward the use of hydronic oil types. The major issue is the avoidance of potentially carcinogenic polynuclear aromatics. Hydronic oils are also less prone to misting and evaporation. Synthetic base stocks, as well as vegetable oils, are also viewed favorably, particularly in northwestern Europe. But their higher costs typically limit their use to niche applications, including microlubrication.

**Asia.** The volume of metalworking fluids consumed here is in a sharp decline in several countries because of the region’s current state of economic turmoil. Massive currency depreciations, a high proportion of nonperforming loans, and a general lack of liquidity and credit availability characterize the financial crises that began in mid-1997 because of very high levels of private-sector foreign debt. All of these factors have a negative effect on industrial activity.

The countries most affected so far are Thailand, South Korea, Malaysia, Indonesia, and South Korea. These three countries account for only a relatively minor share of the consumption of metalworking fluids in the region (Figure 4).

**What’s Ahead?**

Although the global market for metalworking fluids is large and is forecast to expand at a relatively robust rate in some regions of the world, many suppliers may find it difficult to grow their businesses over the next 10 years. The most significant challenges will come from health and safety issues, as well as developments reshaping channels of distribution.

The health and safety issues, particularly in the United States and Europe, are expected to put increasing pressure on suppliers to formulate straight oil products with new additive chemistries and hydronic base stocks. These new-generation formulations have the potential to reduce margins due to an increase in the cost of goods sold. In addition,
health and safety issues are also expected to continue to drive the market toward a greater reliance on water-miscible products, as well as toward those suppliers with expertise in developing them.

Chemical management and integrated supply are also expected to inhibit the growth for some suppliers. Chemical management will continue to block out suppliers with limited portfolios of products and services in the United States and Europe. Although integrated supply will have a similar impact, this channel development holds the potential to allow smaller players with diverse products lines to expand their geographic reach.

Suppliers of metalworking fluids will clearly find the next 10 years to be a very challenging time. History has proven, however, that suppliers of these products are innovative and progressive in meeting customer needs. For technology leaders with high-performance health and safety-conscious products, and for suppliers with the ability to plug into new channels of distribution, the next 10 years will offer a period of unprecedented opportunity.

NOTE:

Metalworking fluids are required in four distinct applications:

**Removal fluids.** Removal fluids, commonly referred to as cutting fluids or coolants, are used in metalworking operations in which cutting is the primary machining technique. Typical applications include screw machining, boring, broaching, drilling, shaving, grinding, milling, sawing, and tapping.

**Forming fluids.** Forming fluids are used in operations that involve changing the shape or contour of metals by bending, stretching, pounding, or squeezing. They are classified into three major types: rolling oils, drawing and stamping fluids, and forging compounds.

**Protecting fluids.** Protecting fluids are used to shield metal surfaces from air, water, and other undesirable materials during storage and transportation. The most common protecting fluids are rust preventives, which are applied to iron and steel. Protecting fluids are also used on such nonferrous metals as copper, aluminum, and brass.

**Treating fluids.** Treating fluids are used in such thermal processes as quenching where in the physical properties of metal are changed to meet application requirements. By heating and cooling a metal under controlled conditions, it can be made hard, soft, or elastic; brittleness and stiffness can also be controlled.

This article was co-authored by Thomas F. Glenn, marketing manager, and Frans vanAntwerpen, Ph.D., project manager, of Kline & Company, Inc. Established in 1959, Kline & Company is an international business consulting firm that offers a broad range of services to the chemical and petroleum industries. Kline & Company has completed several regional studies on metalworking fluids, covering the United States, Europe, and Asia-Pacific. The company is currently marketing its second study on the U.S. metalworking fluids industry, as well as a study on metalworking fluids in Japan.

"We spent a lot of time on respiratory diseases - asthma and hypersensitivity pneumonitis. We had a number of speakers who are principal investigators in this area," said Dr. Edward Stein, who is an OSHA health scientist.

"HP is a serious lung disease. The medical people in the field feel that this has possibly been occurring for years but has not been recognized as such - it could have been called pneumonia or some other lung disease," continued Stein. "In the '90s, there has been a rash of outbreaks of HP. There were about eight sites that were initially being investigated, some were GM plants, Ford plants and Chrysler plants. Recently, at the meeting in Denver, we had a presentation by the University of Maryland scientists who investigated a smaller machine shop which had a significant number of excess cases of hypersensitivity pneumonitis."

Although the NIOSH criteria document includes an abundance of information on exposure to MWFs in the workplace, OSHA acknowledges that more information is needed in relation to airway diseases.

"I feel ultimately that the respiratory issues are going to be the most important issues," Stein said. "People question me about doing a risk assessment on dermatitis problems. I have not come across a method for doing it. You can't just use the exposure from the air because most of the dermatitis problems are due to contact."

According to Stein, MWFSAC is obligated to submit a report by the end of August 1999 that will be submitted as a recommendation to the assistant secretary of OSHA. It will then be up to the assistant secretary to formally make a decision on which direction to go.

Minutes of MWFSAC's June meeting can be obtained through the OSHA Docket by phoning 202-219-7894. MWFSAC's next formal meeting will be held October 19-21 in Detroit. Maura Sheehan, committee chair and a professor at West Chester University in PA, is scheduled to report on her research with aerosols. Further details will be outlined in the Federal Register approximately one month prior to the meeting.

Hopefully, committee members and those interested in the committee's activity will have further input that will lessen the concerns of the producers and users. Perhaps until more information regarding MRF and MWF risk is known, it would be wise for industry to develop a cooperative compliance program. The adoption of a written protocol for good industry housekeeping, ventilation systems, MWF delivery systems and health and safety training for the worker will move the industry in the right direction.

The health and safety of the worker must be protected as it translates into an ultimate good for us all. We are optimistic that the collective ingenuity and talents of those concerned will be able to produce an acceptable solution.