

Clean and Green Technology to overcome health risks associated with cutting fluids in manufacturing industries

Machining operation plays a very important role in the manufacture of products. Huge quantity of cutting fluids are used in metal cutting industries for a variety of reasons such as improving tool life, reducing thermal distortion, lubricating the contact zones, preventing tool galling and seizure, improving surface finish and flushing away chips from the cutting zone etc. Despite the wide recognition of the aforementioned benefits, the negative aspects of cutting fluids become a serious issue for consideration in the recent years.

Cutting fluids are normally petroleum based products and particularly complex due to the wide variety of chemicals that are added to the fluids to improve their physical characteristics and to prolong their usable life. Common additives include biocides, surfactants, and corrosion inhibitors. The types of additives as well as the amount of each additive are generally determined at the plant level. The elevated temperature at the cutting zone during machining process, vaporizes a portion of cutting fluid and produces harmful fumes which cause adverse effects to the workers in the shop floor and causes environmental pollution. Sometimes, the cutting fluid may be applied in the cutting zone in the form of mist. People exposed to large quantities of cutting fluids may have skin contact and they may inhale or swallow the mist particles of cutting fluid. The additives present in the petroleum based cutting fluids may cause the following diseases.

Water-based fluids are subject to high levels of microbial contamination, including endotoxin-producing gram-negative bacteria, and the inhalation of endotoxin has been hypothesized to exert a protective effect against lung cancer. Skin disorders are common acute health effects from exposure to cutting fluids. Cutting fluids cause both allergic and irritant contact dermatitis. They often cause a cumulative insult type of irritant contact dermatitis. The problems associated with cutting fluids can be completely avoided by using dry machining. But it is very difficult to implement on the existing shop floor as it needs extremely rigid machine tools and ultra hard cutting tools. In order to alleviate the above-mentioned negative effects of cutting fluids, machining with minimal Cutting Fluid Application (MCFA) has been evolved. In minimal cutting fluid application, extremely small quantities (2 – 10 ml / min) of cutting fluid is

injected in the form of ultra fine droplets at very high velocity (about 100 m/s) into the cutting zone which is also called as pseudo dry turning. For all practical purposes it resembles dry turning in achieving improved surface finish, lower tool wear by maintaining cutting forces and power at reasonable levels. In this aspect, the Department of Mechanical and Aerospace Engineering of Karunya Institute of Technology and Sciences provides excellent infrastructure and efficient faculty expertise through consultancy and testing in the areas of design and manufacturing namely, green manufacturing, damping of vibration through smart materials, optimization of machining parameters, analysis on tribological properties, fabrication and machining of composites. It also offers post graduate degree programme in collaboration with Central Manufacturing Technology Institute, Bangalore.



Eco-friendly manufacturing