

Development of a Novel Metalworking Fluid Engineered for Use with Microfiltration Recycling

Microfiltration can increase the service life of metalworking fluid by removing contaminants. However, membranes quickly become clogged, a process known as fouling. Anti-fouling methods in practice in the mid-2000s involved backpulsing the membrane or modifying its surface to mechanically remove fouling. However, those methods merely slowed fouling and did not prevent it. Thus ISTC's Kishore Rajagopalan and colleagues from the University of Illinois set out to develop a new metalworking fluid that does not foul the membrane.

To develop the novel fluid, the research team needed to understand what mechanisms were causing the α -alumina microfiltration membranes to foul. Typically membranes foul because of three mechanisms:

- the pore size is reduced due to fluid component adsorption,
- destabilization causes microemulsion aggregates to block pores, and
- microemulsions are deposited on the membrane surface and constrict pore size.

Researchers designed a semi-synthetic metalworking fluid that is strongly electronegative and has a compact emulsion to prevent degradation and microemulsion formation. Flow tests showed no reduction in flux, meaning that none of the chemicals adsorbed to the membrane to reduce pore size. The newly developed fluid also compared equally to commercially available semi-synthetic metalworking fluids for both cooling and lubricity in drilling and tapping torque machines.

Contaminants

Aquatic Plastic Debris

Metals

Metalworking Fluids

A Turbidimetric Method for the Rapid Evaluation of Metalworking Fluids Emulsion Stability

An Evaluation of the Colloidal Stability of Metalworking Fluid

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Engineering of Ultrafiltration Equipment in Alkaline Cleaner Applications

Formulation and Testing of a Microfiltration Compatible Synthetic Metalworking Fluid

Impact of Environmental Contaminants on Machining Properties of Metalworking Fluids

Ingredient-Wise Study of Flux Characteristics in the Ceramic Membrane Filtration of Uncontaminated Synthetic Metalworking Fluids

Modeling the Effect of Tramp Oil Contamination on Selective Component Depletion in Metalworking Fluid Systems

Partial Pore Blocking in Microfiltration Recycling of a Semisynthetic Metalworking Fluid

Purification of SemiSynthetic Metalworking Fluids by Microfiltration

The Effect of Chip Adsorption on Selective Depletion from a MultiComponent Synthetic Metalworking Fluid

Per- and Polyfluoroalkyl Substances (PFASs)

Agricultural Chemicals

PPCPs in the Environment

PCBs & PBDEs

Polycyclic Aromatic Hydrocarbons (PAHs)

Energy

Resource Recovery

Water

Instruments & Equipment

Sponsored Research Program

Meet the Scientists

Kishore Rajagopalan

Publications

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