



*Using Logistic Regression to Predict the Stability of Metalworking Fluid Emulsions
in Varying Water Quality Conditions*

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Metalworking fluid emulsions are aqueous dilutions of a concentrated product. The water used for the dilution is often local tap water, which is readily available and cost effective. The emulsion is sprayed onto a tool and workpiece to cool, lubricate, and preserve both the tool and finished part. In order to perform its function adequately, the emulsion must have sufficient stability to remain homogenous under a wide range of conditions.

Many factors can affect the stability of a metalworking fluid, most of which can be controlled by the formulator during product development. One factor of primary concern that is not controlled by the manufacturer is the quality of the local tap water. Depending on the geology of the source the ionic content of the water may be detrimental to metalworking fluid stability. Ions of magnesium and calcium are most often responsible for emulsion stability issues, but other species can have detrimental effects.

An investigation was performed to gain a better understanding of the impact of individual ions on metalworking fluid emulsion stability. The experiment was a mixture design comprised of five ions that would be used to prepare synthetic water for emulsion testing. Precision instrumentation to determine emulsion stability was not available, but the experimental samples could be assessed visually on a pass/fail basis. The logistic regression function of *Design-Expert*[®] software was used to analyze a model that could both explain the effect of ions on emulsion stability and make predictions for a wide range of water quality conditions.