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## **TREATMENT OF WASTE METALWORKING FLUIDS BY COAGULATION AND CROSS-FLOW MEMBRANE FILTRATION**

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### **Abstract**

The primary objective of this study was to treat waste metalworking fluids (MWFs) originating from the metalworking industry. To achieve this goal, a series of treatment methods were employed in sequence, and various parameters were analyzed, including chemical oxygen demand (COD), pH, total suspended solids (TSS), turbidity, oil/grease, total organic carbon (TOC), and biochemical oxygen demand (BOD). In the initial stage of wastewater pre-treatment, cross-flow microfiltration (MF) and chemical coagulation using  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$  as the coagulant were implemented. The results revealed that the MF membrane (TM10) exhibited removal efficiencies of 67.2% for COD, 93.2% for suspended solids (SS), 99.3% for turbidity, and 98.6% for oil/grease. On the other hand, coagulation with ferric chloride achieved removal rates of 24.9% for COD, 66.8% for SS, 50.2% for turbidity, and 91.6% for oil/grease. Clearly, the TM10 MF membrane was more effective in the pre-treatment stage. Following the pre-treatment, the wastewater underwent further treatment using three different ultrafiltration (UF) membranes with molecular weight cut-offs (MWCO) ranging from 1 to 10 kDa in a cross-flow system. The GE (1 kDa) membrane demonstrated the highest removal efficiency, which was comparable to the GH (2 kDa) membrane. However, both the GH and GE membranes achieved fluxes of 25.58 and 20.43  $\text{L/m}^2/\text{h}$  at 6 bar pressure, respectively. For the final stage of treatment, the most efficient nanofiltration (NF) membrane (TS80) achieved removal efficiencies of 96.2%, 99.9%, 100%, and 70.7% for COD, SS, oil/grease, and electrical conductivity (EC), respectively. It was concluded that the NF filtrate could be reused as process water. This study successfully implemented a series of treatment methods for waste metalworking fluids (MWFs), effectively removing various pollutants and providing potential options for reusing the treated wastewater in the metalworking industry.

*Key words:* coagulation, membrane process, metalworking fluid, oil removal, wastewater

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