

Neat Cutting Oils - A Comparison of Vegetable vs Mineral-Based Oils

This technical bulletin provides a comparative analysis of vegetable-based and mineral-based oils, focusing on their distinct performance characteristics.

Aspect	Vegetable-Based Oils	Mineral-Based Oils
Lubricity & Performance	High lubricity due to natural polarity → reduced friction, longer tool life, better surface finish	Moderate lubricity and may require additives to improve performance
Cooling Properties	Higher heat capacity and strong film strength → better cooling in boundary lubrication	Lower heat absorption, less effective in dissipating heat
Tool Life	Typically, longer due to reduced wear and heat	Shorter tool life compared to vegetable oils, unless contain EP additives (e.g., Chlorine, Sulfur)
Surface Finish	Produces smoother, finer finishes	Varies, dependent on viscosity and EP additive levels
Oxidation Stability	More prone to oxidation or rancidity unless stabilized with additives	Naturally more stable over time, and have a higher resistance to oxidation
Shelf Life	It can be shorter without stabilizers	Generally, longer shelf-life and more predictable

Aspect	Vegetable-Based Oils	Mineral-Based Oils
Worker Health & Safety	Low toxicity, less skin irritation, no *PAHs	Potential irritation - may contain *PAHs or other hazardous compounds
Environmental Impact	Readily biodegradable, renewable source, eco-friendly disposal	Petroleum-based, slower to degrade, environmental risk if spilled
Sustainability	Derived from renewable plant sources	Non-renewable fossil fuel resources
Cost	Generally higher	Generally lower
Temperature Sensitivity	Can thicken in cold and thin in heat	More stable across temperature ranges

*PAH - Polycyclic Aromatic Hydrocarbons

Summary:

Vegetable-based neat cutting oils provide superior performance, worker safety, and environmental sustainability, often at a higher cost compared to mineral oils. Mineral Based oils have more resistance to oxidation, have higher temperature stability, and can have different EP additives to improve performance.