

FORMULATION AND PERFORMANCE ASSESSMENT OF FIXED OILS BASED CUTTING FLUIDS IN MACHINING OPERATION

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ABSTRACT

This research –formulation and performance assessment of fixed oils based cutting fluids in machining operation was done to examine the performance of cutting fluids developed from Shea butter and Neem seed oils (fixed oils) in the straight turning of AISI 1027 steel bar using high-speed steel (HSS) tool. The performance and characteristics of the cutting fluids developed were compared with mineral oil-based cutting fluid- USA metal cutting oil CA2000 (Model 2317 4200^N) as the control sample. Generally, mineral oils are costly, not environmentally friendly and so pose a serious problem of disposal since they are not biodegradable. The turning was done at different spindle speeds (530rpm, 750rpm, 1060rpm) and depth of cuts (1.0mm, 1.5mm, 2.0mm) at a constant feed rate of 0.25mm/rev for the mineral oil, formulated cutting fluids and dry turning operation. Each experiment was observed for at least 10minutes and the cutting oils were fed automatically at the tool-work interface. A thermocouple was used to record the temperature of the tool-work interface at every point. The result shows that a minimum temperature of 31.5°C was obtained when turning at 530rpm/1.0mm and a maximum of 37°C was obtained when turning at 1060rpm/2.0mm using Shea butter based cutting fluid. This shows that Shea butter based cutting fluid was far better than the control sample and Neem seed oil based cutting fluids in term of temperature dissipation. In term of acidic values, the minerals oil base cutting fluid contains more acid of 8.4g/dm³ relative to the two fluids developed from the fixed oils. The viscosity of the developed cutting fluids is better at higher temperatures standing at values of 233.76/227.35cp and 205.83/141.80cp at 40°C/80°C and that of the control sample at 111.34/46cp at 40°C/80°C.

KEYWORDS: Fixed Oils, Mineral Oil, Cutting Fluids, Turning, Steel, Spindle Speed and Depth of Cut

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