A comparative study on the surface finish achieved during face milling of AISI 1045 steel components using eco-friendly cutting fluids in near dry condition

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Abstract: This paper elucidates the effect of near dry machining (NDM) on the surface quality achieved during face milling of AISI 1045 steel components using the conventional emulsified mineral oil cutting fluid and emulsified cutting fluid prepared from eco-friendly non-edible unrefined oils such as castor oil, cottonseed oil and neem oil. This work was completed in a FANUC arrangement CNC vertical machining centre (VMC) with three TiN coated carbide inserts of 0.4 mm nose radius adjusted into a face milling cutter of 25 mm in diameter. The machining parameters considered in this investigation are number of passes, depth of cut, spindle speed and feed rate. The experiments were planned based on Taguchi's $L_9(3^4)$ orthogonal array. The surface roughness of the machined components is measured using a surface roughness tester and subsequently, a mathematical model was developed for the average surface roughness values through regression analysis for all the machining conditions. The significance of the selected machining parameters and their levels of surface roughness are found by analysis of variance (ANOVA). The results revealed that machining under near dry condition using eco-friendly cutting fluids provides better product surface quality than the conventional cutting fluid.