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Research Article

Investigation of Drilling Process Parameters of Palmyra Based Composite

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The drilling process is the most essential in the final assembly of the mechanical parts. Natural fiber based composites replace traditional materials due to their advantages, such as strength to weight ratio, availability, and environmental hazards. In this work, an attempt has been made to find the minimum thrust force produced by the drill tool at specified drilling process parameters. The drilling process parameters used for the investigation are rotational speed, tool feed, and resins. The spindle speed and feed rate are selected with three levels. Three resin materials were used, namely, epoxy, polyester, and vinyl ester. Taguchi's L_{27} orthogonal array was implemented. The result shows that the candlestick drill bit generated lesser thrust force at the specified drilling process parameters, followed by the twist and step cone drill bits.

1. Introduction

Environmental protection is the main focus towards the use of cellulose fiber as reinforcement in the polymer matrix. Natural fibers having many advantages compared to synthetic fibers are lightweight, available in plenty, biodegradable, and no hazards to the environment. Hence, they are used as load transfer material in composite material. However, they have few drawbacks compared to synthetic materials, such as poor resistance to water, lesser modulus, and lower strength. Few authors reported the different studies in the natural fiber based composites, namely, hemp, abaca, sisal, banana, oil palm, and wood pulp [1–3]. The strength and stiffness characteristics of the natural fiber based composite can be improved by increasing interfacial bonding of the fibers and matrixes [4].

The machining of the fiber based composite is complicated due to the property difference and the fiber orientation nature of the natural fibers reinforcement [5]. Hence, it is required special attention to analyze fiber based composite compared to homogeneous machining. During drilling of the fiber strengthened composite, the effect of the mechanical and thermal properties is more. Hence, the selection of the process factors of the drilling process and the experimental conditions is more essential to produce quality machining. During fiber based composite machining process, the manufacturing defects produced are cracks, voids, fiber pullouts, delamination, and thermal defects. The following factors are considered to determine the machinability of the fiber-reinforced composite: tool materials, tool geometry, cutting condition, and type of