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Process Parameters Optimization of Needle-punched Nonwovens for Sound Absorption Application

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Abstract

This paper reports a study on the optimization of process parameters of needle-punched nonwoven fabrics for achieving maximum sound absorption by employing a Box-Behnken factorial design. The influence of fiber type, depth of needle penetration, and stroke frequency on sound absorption properties were studied. These parameters were varied at three levels during experimental trials. From multiple regression analysis, it was observed that the depth of needle penetration alone was the most dominant factor among the selected parameters, which was followed by the interaction between depth of needle penetration and stroke frequency. Fiber type was the least dominant parameter affecting sound absorption. A maximum sound absorption coefficient of 0.47 was obtained from the selected parameters. The results showed that for a process such as needle-punching, which is influenced by multiple variables, it is worthwhile to study the interactive effects of process parameters for achieving optimum sound absorption.