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Experimental investigation of optimized machining time (drilling time) and surface roughness of drilled holes of particle board (PB) and medium density fibre board (MDF) with various cutting environments

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Abstract -Particle board (PB) and Medium Density Fibre Board (MDF) wood composites are widely used in building and furniture industries. Drilling process used in assembly of panel products. The input parameters used causes drilling damages and must be avoided. The experiments are achieved and the inspiration of input parameters on the output response has been studied and analysed. It is revealed that cutting parameters and tool size have major effect on delamination. In this article, an attempt has been made to predict and minimize the delamination in drilling of Particle Board and Medium Density Fibre Board. The experiments are carried out based on Orthogonal Array with feed rate and cutting speed as process parameters. The optimization results showed that the combination of low feed rate with high cutting speed is necessary to minimize delamination in drilling of MDF.

Index words– Machining Time, Delamination, Particle Board, Medium Density Fibre Board, Feed, and Speed

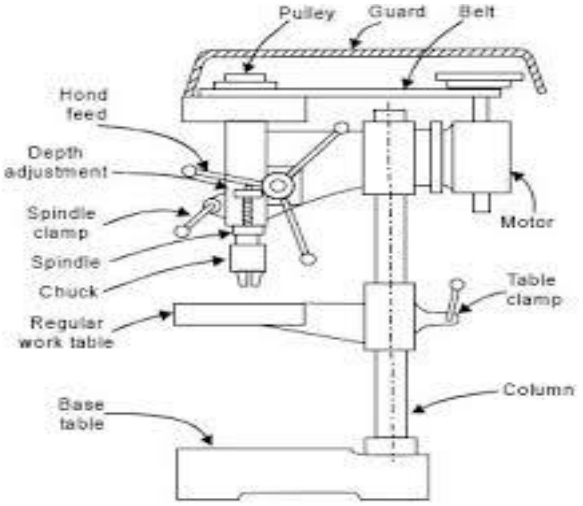
I. INTRODUCTION

Particle Board (PB) and Medium Density Fibre Board (MDF), a homogenous wood based composite material is extensively used for interior and exterior construction applications. MDF materials is not only compete with particle boards but also with solid wood and other wood composite board. MDF has more attractive and favourable properties such as high strength, good surface characteristics, dimensional stability, and excellent machinability, hence find many applications in wooden industries. The board usually coated with a layer of wood veneer or plastic laminate in order to get the appearance of a natural wood product. The MDF material is normally pressed into sheet form and then machined to required size and shape. The drilling of MDF is the most commonly used machining operation and the delamination damage is caused by the drill of MDF. The delamination damage is caused by the drill thrust during drilling process that occurs in the exit as well as in the entrance planes. The delamination of hole in MDF material is mainly due to localized bending in the zone situated at the point of attack of the drill and caused due to uncut material by the drills and thus reducing the strength against fatigue.

II.EXPERIMENTAL PROCEDURE

SL.NO	DESCRIPTION	SPINDLE SPEED	FEED(mm/min)
1.	PARTICLE BAORD (PB)	1000	0.5
2.	MEDIUM DENSITY FIBRE BOARD (MDF)	1000	0.5

Medium density fibre board manufactured by ASIS India Ltd., is taken for the study. Drilling operation was performed in a CNC machining centre, using carbide twist drill bits. Taguchi design of experiment was used and L27 orthogonal array was chosen in which the input factors considered for study are feed rate, speed and drill diameter and the output response is delamination. Delamination was measured using C-Scan equipment. The input factors that have been considered for the experiment along with their levels are shown in Table 1.



The drilling machine or drill press is one of the most common and useful machine employed in industry for producing forming and finishing holes in a work piece. The unit essentially consists of 1. A spindle which turns the tool (called drill) which can be advanced in the work piece either automatically or by hand. 2. A work table which holds the work piece rigidly in position. The rotating edge of the drill exerts a large force on the work piece and the hole is generated. The removal of metal in a drilling operation is by shearing and extrusion. A wide variety of drilling machines are available ranging from the simple portable to highly complex automatic and numerically controlled machines are as follows.1. Portable drilling machine: It is a small light weight, compact and self-contained unit that can drill holes up to 12.5 rnrn diameter. The machine is driven by a small electric motor operating at high speed. The machine is capable of drilling holes in the work pieces in any position. 2. Sensitive drill machine/press: This is a light weight, high speed machine designed for drilling small holes in light jobs. Generally the machine has the capacity to rotate drills of 1.5 to 15.5 rnrn at high speed of 20,000 rev/min. The column is a vertical post that Column holds the worktable and the head containing the driving mechanism. The column may be of round or box section. The table, either rectangular or round. Drill machine/press in shape supports the work piece and is carried by the vertical column. The surface of the table is 90-degree to the column and it can be raised, lowered and swivelled around it. The table can be clamp/hold the required the work piece. Slots are provided in most tables to allow the jigs, fixtures or large work pieces to be securely fixed directly to the table. The drilling head, mounted close to the top of the column, houses the driving arrangement and variable speed pulleys. These units transmit rotary motion at different speeds to the drill spindle. The hand feed lever is used to control the vertical movement of the spindle sleeve and the cutting tool.

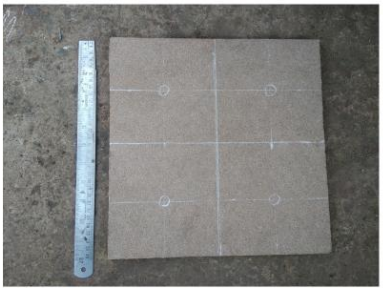


Fig.2 Marking of particle board

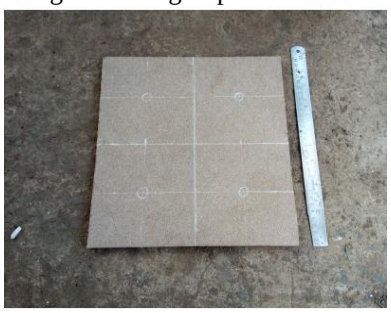


Fig.3 Marking of MDF board


Fig.4 Drilling machine


Fig.5 Drill setup

Table 1. Tabulation and readings

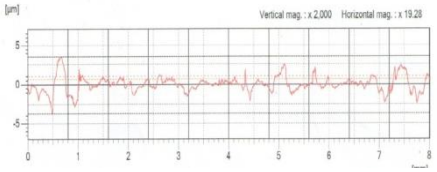
SL.NO	DESCRIPTION	MACHINING TIME (SEC)	AVERAGE TIME (SEC)	WEIGHT BEFORE MACHINING	WEIGHTAFETR MACHINING
1.	PARTICLE BOARD (DRY)	1.16.3 2.16.4 3.13.2 4.12.2	14.5	0.570	0.547
2.	PARTICLE BOARD (KEROSENE)	1. 14.1 2. 8.69 3. 8.64 4. 7.25	9.67	0.570	0.547
3.	MDF (DRY)	1. 7.39 2. 7.39 3. 7.38 4. 7.74	7.47	0.555	0553
4.	MDF (KEROSENE)	1. 4.91 2. 6.49 3. 8.25 4. 8.39	7.01	0.555	0552

First of all we setup the particle board on the drilling machine and to start a new hole in the board with various cutting environments like dry and kerosene along with various process parameters like spindle speed, feed rate etc….

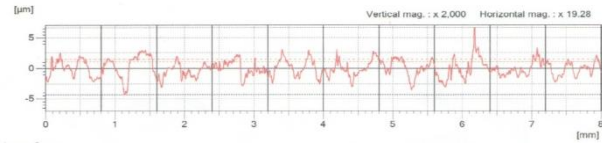
From this tabulation the machining readings are discuss and the average time (machining time) was optimized. The best process parameters are attained in Medium Density Fibre board (MDF) along with the cutting environments (Dry & Kerosene)

IV.RESULTS & DISCUSSIONS

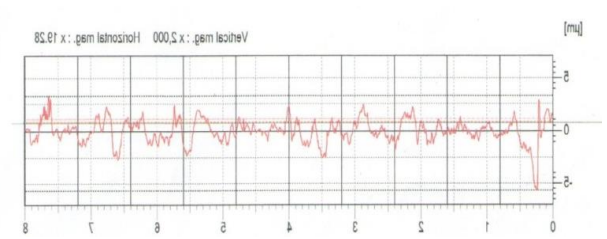
SURFACE ROUGHNESS GRAPH [PB] – HOLE 1



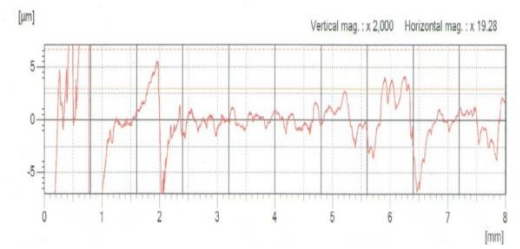
SURFACE ROUGHNESS GRAPH [PB] – HOLE 3



SURFACE ROUGHNESS GRAPH [MDF] – HOLE 1



SURFACE ROUGHNESS GRAPH [MDF] – HOLE 3



V. CONCLUSIONS

- We concluded the optimized Machining time and Maximum Surface Roughness by using the 10mm diameter drill bits in Medium Density Fibre Board
- In our project we estimate the drilling time along with the surface roughness of the selected holes
- Finally the MDF board of HSS drill to optimize the best parameter of hole no-1 and 3 comparatively the Particle Board
- In this MDF the best suitable drill bit to reduce the drilling time and increase the surface roughness

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