

# PRODUCTION OF LAYERED MDF PANEL HAVING FINE FIBERS IN FACE LAYERS AND COARSE FIBERS IN CORE LAYER FOR FURNITURE INDUSTRY

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**Abstract:** MDF (Medium Density Fiberboard) which is one of the wood-based panels used for industrial applications such as furniture, building materials, and laminate flooring the conventional MDF panels are produced using single layer in the mat forming machine. In this study, it is aimed to produce layered MDF panel for the furniture industry. The surface layers of the MDF consist of fine while the core layers consist of coarse fibers. The MDF panels having different face and core layer ratios could be produced using different defibrator disc gap, which results in different fiber sizes. In the production of layered MDF production, the MDF companies should change their mat forming system, which look like the mat forming of three layers particleboard. The MDF companies having the layered mat forming machine can also use the conventional production which is one layer mat forming production in the MDF. The advantages of three layer MDF are as follows; (1) The amounts of wood and adhesive can be decreased by using the cores fibers used in the core layer of the MDF, (2) The fiber production capacity of the defibrator can be increased using cores fibers, which positively affect the energy saving in the defibrator, (3) The splitting caused by side screw withdrawal resistance can be prevented using core layer consist of coarse fibers.

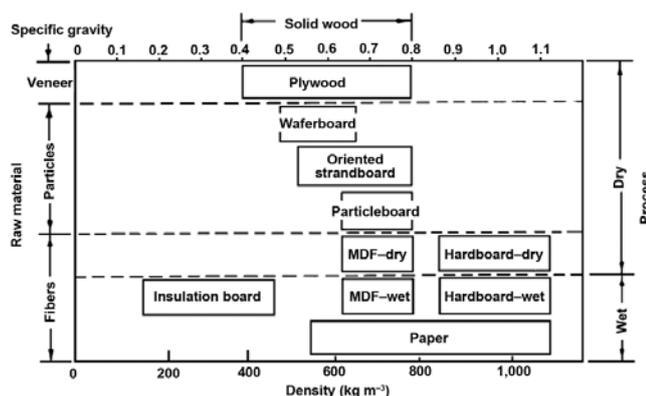
**Keywords:** MDF, FINE FIBERS, COARSE FIBERS, FURNITURE INDUSTRY, LAYER

## 1. Introduction

Conventional wood-based composites are manufactured products made primarily from wood with only a few percent resin and other additives. A useful way to classify conventional wood-based composites based on specific gravity, density, raw material, and processing methods is shown in Figure 1.

The term of fiberboard includes hardboard, medium-density fiberboard (MDF), and cellulosic fiberboard. Several things differentiate fiberboard from particleboard, most notably the physical configuration of the wood element. Because wood is fibrous by nature, fiberboard exploits the inherent strength of wood to a greater extent than does particleboard.

Fiberboard is normally classified by density and can be made by either dry or wet processes (Fig. 1). Dry processes are applicable to boards with high density (hardboard) and medium density (MDF). Wet processes are applicable to both high-density hardboard and low-density cellulosic fiberboard. The following subsections briefly describe the manufacturing of high- and medium-density dry-process fiberboard, wet-process hardboard, and wet-process low-density cellulosic fiberboard.



**Fig. 1:** Classification of wood composite panels by particle size, density, and process (Suchsland and Woodson 1986). Note that insulation board is now known as cellulosic fiberboard.

## 2. MDF Production

MDF is engineered wood-based panel materials made by bonding together wood fibers with a synthetic resin adhesive. Medium Density Fiberboard (MDF) is used the most commonly which is made by drying process.

MDF is used extensively in factory-assembled and ready-to-assemble furniture, as well as in cabinets, underlayment, drawer

fronts, molding, and countertops due to its ability to be produced in molded form, as well as in straight-edged flat panels.

Medium density fiberboard (MDF) is primarily used for industrial applications such as furniture, building material, and laminate because of its good mechanical and economical aspects is usually high in strength, easy to machine, and has good weathering properties (Suchsland and Woodson, 1986).

MDF can be manufactured with either softwood or hardwood species. Most MDF is composed primarily of softwood, although some individual brands may contain a higher percentage of temperate hardwood, depending on the location of the factory to the local forest resource.

### Manufacturing Process

A typical process involves reducing wood down to small chips, which are then thermally softened and mechanically refined into fibres. These are then mixed with a synthetic resin binder. The resonated fibres are dried and then formed into a mattress ready for pressing. The mattress is pressed between heated polished press plates to the desired thickness.

Standard forms of MDF typically have densities as follows:

- Average density: 700 kg/m<sup>3</sup> to 800 kg/m<sup>3</sup>
- Core density: 600 kg/m<sup>3</sup> to 700 kg/m<sup>3</sup>
- Face density: 1000 kg/m<sup>3</sup> to 1100 kg/m<sup>3</sup>

MDFs can have densities that range from below 450 kg/m<sup>3</sup> up to 800 kg/m<sup>3</sup> and above.

The Types of MDF which are used in furniture industry commonly;

- Fine Thickness MDF
- Middle-Coarse Thickness MDF
- Coarse Thickness MDF

Fine thickness MDF has 1.8-2.5 mm thickness. Its usage areas are such as drawer stands, furniture or cabinet backs and door panels.

Middle-Coarse Thickness MDF has 3-6 mm thickness. Almost all furniture's main structure consists from middle-coarse MDF.

Coarse Thickness MDF has 45-60 mm thickness. It can be used for architectural purposes and belt or column in buildings.

The face of particleboard usually consists of fine wood particles and the core is made of coarser material. The result is a smoother surface for laminating, overlaying, painting or veneering.

The purpose of this project is producing MDF by using thinner fibers for the surface and a bit more coarser fibers for the core differently from particleboard.

In this study, it is aimed to produce layered MDF panel for the furniture industry. The surface layers of the MDF consist of fine while the core layers consist of coarse fibers. The MDF panels having different face and core layer ratios could be produced using different defibrator disc gap, which results in different fiber sizes. In the production of layered MDF production, the MDF companies should change their mat forming system, which look like the mat forming of three layers particleboard.

Thus, there will be some advantages such as;

1. The amounts of wood and adhesive can be decreased by using the cores fibers used in the core layer of the MDF.
2. The fiber production capacity of the defibrator can be increased using cores fibers, which positively affect the energy saving in the defibrator.
3. The splitting caused by side screw withdrawal resistance can be prevented using core layer consist of coarse fibers.

### 3. Available Methods for Manufacturing

Some methods for the realization of this production are below:

- a. Change the wood species used
- b. Change the size of fibers (figure 2)
- c. Make some changes the density profile of wood material (figure 3)
- d. Change amount of adhesive

Changing the wood species using on the surface and core layers of MDF is one of the most important influence to decrease splitting during the screwing. According to this information, soft wood fibers (such as pine fibers) using on the surface of MDF while hard wood fibers (such as beech or oak fibers) using on the core of MDF.

During the conventional produce of MDF fine fibers are used on the core layer. It is caused side splitting during screwing because of MDF core layers having harder and denser structures. To prevent this, it should consist of coarse fibers.



Fig 2: Fine fibers use of the surface layer(left), coarse fibers use of core layers (right)

The density profile mainly means that a density changing in the board thickness. If the density of the core layer is decreased, side splitting is diminished during the screwing.

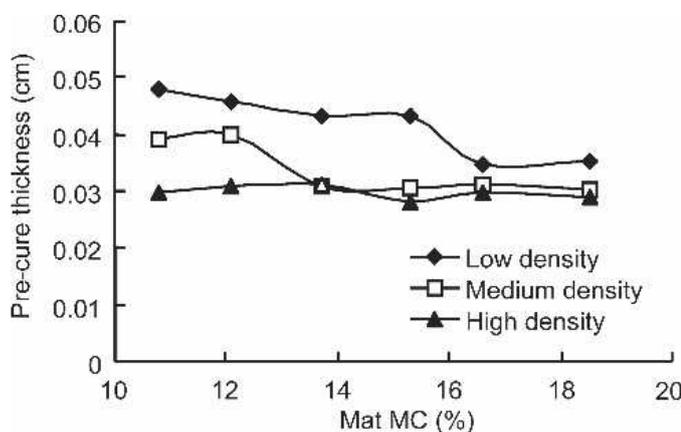


Fig. 3: Density ratios for different MDF panels.

Boards which are used coarse fibers inside the core layer, require less amount of adhesive. In this way, companies' adhesive costs are declined.

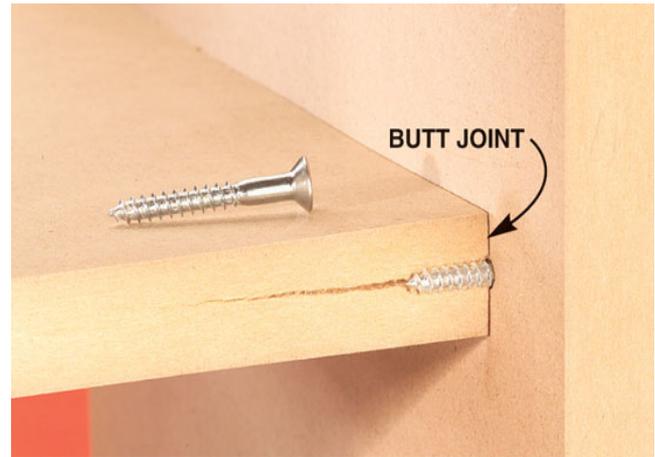


Fig. 4: Edge splitting during the screwing

### 4. Conclusion

In this study, it is intended to reduce side splitting, high costs because of using excessive adhesive and high density problems and to overcome the problems mentioned before. This study is a preliminary study due to has not completed yet and lack of relevant literature. The limits of this study are the process of preparation of fibers and the absence of information to be compared due to the literature scarcity.

In the future, it is recommended that for researchers who will perform similar research to use different wood species, different density profile values and mechanical sifting system.

### 5. Acknowledgement

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