

Methods Assessment for Particle board Properties: A Review

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ABSTRACT

Particleboard is among the most popular materials used in interior and exterior applications such as in floor, wall, and ceiling panel, office dividers, bulletin boards, cabinets, furniture, counter and desk tops. The objectives of this study is to compare earlier research results and reports produced by the adoption of either methods in making the particleboard using disc flaker and knife ring flaker. Findings indicate that the end-products using disc flaker and knife flaker differs in the length of their wood particles. By using disc flaker, the particles length is more than knife flaker particles. This characteristic can improve the board properties especially in mechanical and physical properties.

Keywords: disc flaker, knife ring flaker

INTRODUCTION

High demand for wooden materials and rises in agricultural areas and forest fires increases the importance of composite particleboard instead of using solid woods. (Wang and Sun, 2002. Guru, 2006).

Particleboard is a panel product produced by compressing small particles of wood (wood waste) while simultaneously bonding then with adhesive. The many types of particleboard differ greatly in regard to size and geometry of the particle, the amount of resins used, and the density to which the panel is pressed. Particleboard (sometimes called chipboard in the UK) is an engineered wood product manufactured from wood particles, such as wood chips, sawmill shavings, or even saw dust, and a synthetic resin or other suitable binder, which is pressed and extruded. Particleboard is a type of fiberboard, a composite material, but it is made up of larger pieces of wood than medium-density fibreboard and hardboard (Dorthe, 2000).

Particleboards are usually will be use in replace the solid wood and plywood usage in wood base manufacturing. For examples the particleboard nowadays has been used in making furniture, cabinets, flooring, table, counter and desktop, office divider, wall and ceiling, stair tends, home construction, sliding doors, kitchen worktops, interior signs, bulletin board, and many other wood base product (Mohammad D, 2011).

Manufactured of particleboard normally use the different type of glue or adhesive to have proper physical and mechanical properties of the final product. The glue will be choosing depend on the end use of the composite. UF (Urea Formaldehyde) is the common binder that use in the industry. This type of binder is cheap compared to other binder such as PF (Phenol Formaldehyde), MF (Melamine Formaldehyde), and MUF (Melamine Urea Formaldehyde). Event the price of UF is much more lower than others binder, the binder is makeup about 60% of cost overall particleboard production (Rokiah H, 2010).

Particleboards are usually produced in range of 590 kgm³ to 800 kgm³. Many of particleboard will be manufactured in panel form, however there are some of them will be produced in molded form especially in producing furniture parts, door skins and molded pallets.

Usually particleboard will be found in single layer form, but particleboards are generally manufactured in 3 to 5 layers and the outer layer referred as face of the particleboard and generally made up from the fine wood particle and the inner layer of the particleboard referred as the core. The core is usually mane up from the rougher materials from the face. Reason why the core and face are different, are to altering the relative properties of the particleboard and to increase the bending strength and stiffness of the board (Anon, 2001).

There are several steps to produce the particleboard. First prepare the raw wood from the log into the particle form. In this step, the raw wood will be refined by the disc flaker machine or the knife ring flaker machine. Then, the particle will be classify by size and will be dried in specific moisture content usually below than 5% MC. After that the raw particle will be blend with adhesive and sometime include some wax then form the materials into a mat, hot pressing and lastly finishing by sanding the face of the particleboard (Anon, 2001).

The particle size and geometry, as required for the core and surface layers of the particleboard, are produced by a diverse range of reduction equipment which is matched to the variety and size of wood and wood residues used. Chippers, knife-ring-flakers, hammer mills, disc refiners, etc., each operating on a different principle, using either knives, hammer

bars, grooved disc plates, etc., are but some in common use in the industry.

The particle size of particleboard will influence overall of the board properties either in mechanical and physical properties. The bigger particle size will improve the particleboard properties. This is because larger surface contact area between particles will improve the glueline that responsible for better strength characteristics of the particleboards (Rokiah H, 2010).

In this study, knife ring flaker and disc flaker will be reviewed. Ring flakers will produce the better shape of particles. The particle that produce from this machine are usually not curled flakes, although they produce a higher proportion of fines than disk flaker (Charles G. Carll, 1989). On the other hand, The disc flaker are usually a rotary machines for reducing wood into wood flakes or strands suitable for the production of particle board, headboard, or other kindred composite wood products (Farrell, et al 1990). The particles from this machine are usually much longer than knife ring flaker machine.

In the knife ring flaker operation, the raw log will be debarking, this is because the bark of the wood content much higher silica and ash content then inside the wood. This silica and ash content can influence the performance of the knife. The knife will be much easier to dull because of the silica and ash content. Then the raw log will be cut into the size to ensure that the process of chipping being easier. After that the wood chips will be refined by using the knife ring flaker (Charles G. Carll, 1989).

The disc flaker are usually a rotary machines for reducing wood into wood flakes or strands suitable for the production of particle board, headboard, or other kindred composite wood products. This type of machine are use to reduce the log directly into wood flaks or strands. First the logs need to debarked and reason to debark are the same with knife ring flaker to eliminate the silica and ash content and cut in suitable length. The present invention is more especially directed to a horizontal disc type flaker, which has an increased flake production capacity (Farrell, et al 1990).

REVIEW

The Knife Ring Flaker operates with counter-rotating knife ring. This allows for safe continuous operation on high wood moisture content and difficult types of wood process to produce particles. Even during flaking of waste wood this type of operation will prevent clogging problem to the flaking channels. The counter-rotating principle will improve for the operational safety as well as uniform utilization of all exchangeable wear parts. The knife ring flaker will produce a uniform geometry and high quality of the particle (Charles G. Carll, 1989). On the other hand, the disc flaker are usually a rotary machines for reducing wood into wood flakes or strands suitable for the production of particle board, headboard, or other kindred composite wood products. This type of machine is use to reduce the log directly into wood flaks or strands. First the logs need to debarked and cut in suitable length. The present invention is more especially directed to a horizontal disc type flaker, which has an increased flake production capacity (Farrell, et al 1990).

In a vertical disc arrangement, the input for supplying logs to the disc cutting face has to be on the down turning side of the disc. Because of this, only a single feed can be processed in one time. Vertical disc flakers are also use a belt drive to connect the disk to the drive motor. Belt drives can accommodate only a limited amount of load. If a dual feed were installed on a vertical disc machine, the power become too large for the belt drive to handle (Farrell, et al 1990). However, a horizontal disc wood flaker of the type now employed has a vertical chute. First the logs need to debarked and cut into suitable lengths, into contact with an upper cutting face of the horizontal rotary disc. Typically there is a vertical feed box on one side of the axis and a motor and drive transmission for the disc on the other side of the axis but also disposed above the disc. An area is left available for changing out knife blades on the cutting disc (Farrell, et al 1990). Figure 1 show the knife ring flaker. Figure 2 show the Horizontal disc flaker. Figure 3 show the vertical disc flaker.

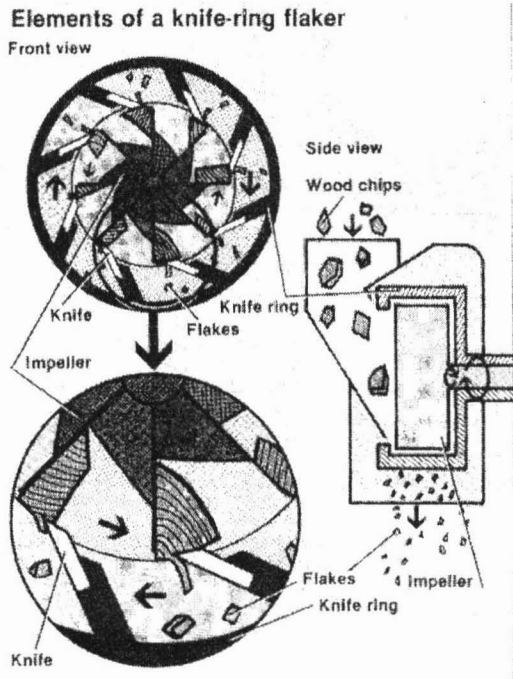


Figure 1 knife ring flaker

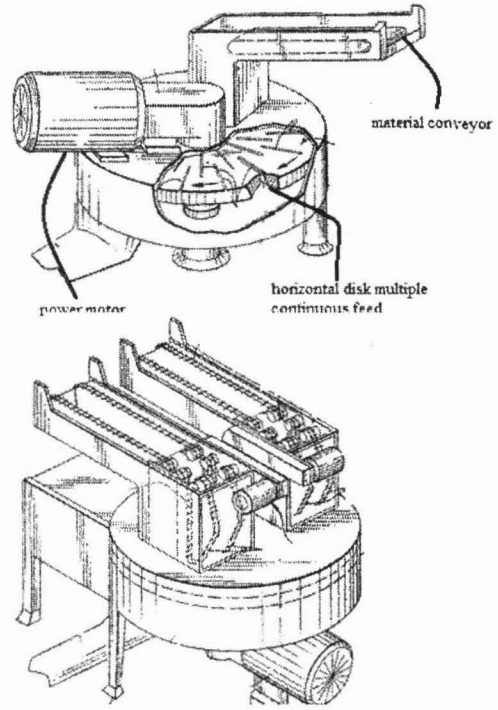


Figure 2 Horizontal disc flaker

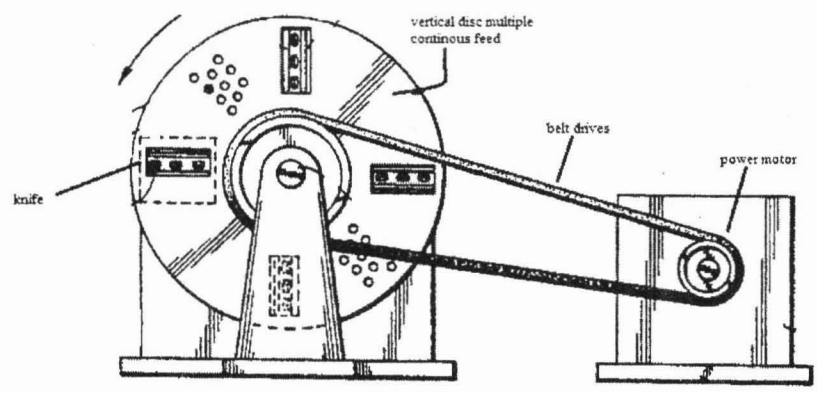


Figure 3: Vertical disc flaker

By using the knife ring flaker, overall properties of panels made by using the ring cut flaker from large chip some time call maxichips are usually homogenous in all properties either in mechanical and physical properties of the finish panels. Generally the panels made by using knife ring flaker will slightly lower in density however, they have greater internal bonding string than panel made by disc flaker. Ring flaker is suitable to use in hardwood species manufacturing, but the particle produce from knife ring flaker are usually shorter in dimension than the disc flaker particles (Charles G. Carll, 1989). Generally the particles produce from ring flaker suitable for core and intermediate layers because of the superior internal bond properties. For manufactured the core or intermediate surface of particleboard, high quality (large particle) are not required. The knife flaker will produce the particle at fast rate which means large quantity of particle will be produce in shorter time (Charles G. Carll, 1989).

In the other hand by using the disc flaker they will produce the curled flakes but they have more length particle produce when they have refined. The longer particle will influence overall board properties. The bigger particle size will improve the particleboard properties. This is because larger surface contact area between particles will improve the glueline that responsible for better strength characteristics of the particleboards (Rokiah H, 2010). The shorter particle size with the length less than 2.54 cm result a lower MOR and IB value determine by Rokiah. The longer and thinner particle geometry will increase the MOR and IB value of the finish panels (Rokiah H, 2010). Although in physical test for the greater particle size panel, the result is much more better than the panels made from the smaller particle size. By the research that has been made by Rokiah, the panels made from longer particle size has 41.6% in thickness swelling which is only 4.6% lower than the panel made from fine particle. This results are also influences by the larger surface contact area of the wood particle to the glue that use in making the panels (Rokiah H, 2010).



CONCLUSION

Particle geometry is one of the most important factors that influence in both mechanical and physical properties of the particleboard. The greater particle size will improve the overall particleboard properties. In this review, two type of machine has been reviewed. The machines are knife ring flaker and also the disc flaker. Knife ring flaker will produce the better shape of particle which means the particle will not curled and can produce in higher proportion then disc flaker. However the particle that produce from the disc flaker are much longer in dimension. This characteristic will increase the overall properties of particleboard. However from the review, the industries will use the knife ring flaker in their production line. This is because this type of machine can produce more particles in one time so the production become more efficient and will reduce their production cost.

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