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The Importance Of Particle Size

As you probably know, before any raw material can be used in a pellet mill it has to be reduced in particle size. However what many people are not aware of is that the size of those particles can have significant impact on the pellet production process.

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Thank You For Your Continued Interest

I hope you found the **Beginners Guide To Making Pellets** useful. We put a lot of time and effort into producing our free guides, and we hope you gain some new knowledge from them. As discussed in the first guide, all raw materials have to be reduced in size for the pellet mill. However that is a very general description and particle size can have a big impact on the pellet production process.

Therefore I have produced this guide to discuss how important particle size is in the pellet production process. Many different wood and biomass materials can be compressed into pellet form. We have produced a large variety of biomass pellets for our boiler.



1 Reducing The Particle Size Of Your Raw Material

Fuel pellets can be made from a wide variety of biomass materials. You may simply be interested in producing wood pellets from sawdust, however sometimes even sawdust has to be reduced and screened down to size before it is ready for the pellet mill. If you are dealing with wood shavings, wood chips and particularly wood logs these all need at least one or maybe even several processes to reduce them to the required particle size. This also applies to biomass materials such as straws and grasses. But how small do you need to go?

For instance one of the most common forms of size reduction is a wood chipper. A wood chipper is used as part of the pellet production process in some cases. However a wood chipper cannot be used to reduce the wood down to a small enough size and is also not suitable for other biomass materials. A hammer mill is most commonly used as part of the process, as particle size can be controlled. The hammer mill can be fitted with various screen sizes, this is discussed more in the **Full PelHeat Guide**. The screen size used will not only impact on particle size, but also pellet quality and pellet mill productivity.



2 The Maximum Particle Size Suitable For The Pellet Mill

The end use of the pellets you wish to produce is the starting point to discuss raw material particle size for the pellet mill. For instance if you wish to produce fuel pellets for the domestic market and specifically pellet stoves you will be producing a 6mm diameter pellet. If you wish to produce fuel pellets for pellet boilers you can produce either a 6mm or 8mm pellet. For larger scale operations that will be providing fuel pellets to industrial boilers or power plants a larger pellet diameter of say 10mm or 12mm is common. You maybe wondering why all fuel pellets are not just made to the same diameter. Well due to the size of most pellet stoves and their internal components, only a small diameter pellet can be used. However there are lower production costs for larger diameter pellets, the reasons for this are discussed more in the complete guide.

For the sake of this guide let us presume you wish to produce 6mm pellets for domestic pellet stoves. The general rule to follow is never introduce a raw material into the pellet press that is larger than the diameter of the pellet. Therefore only raw material with a diameter of 6mm or below should be used in the pellet press with a 6mm die. The reasons for this are the potential damage large particles can cause to the die and roller. Using larger particles can put immense pressure on the roller bearings.

3 We Now Know The Maximum Particle Size But What Is The Best Particle Size?

So in our example of making a 6mm pellet, we know the maximum particle size we should put into the pellet mill is a 6mm particle. We also know we can control the particle size through changing the screen size in the hammer mill. However that screen could have 5mm holes or 4mm holes, 3mm holes etc. What screen size do you choose, what are the benefits for larger and smaller particle sizes?

When it comes to the advantages and disadvantages of particle size it effects material conditioning and the relationship with the raw material in the pellet mill.

Possible affects in changing particle size:

- Improved or reduced material consistency
- Longer or shorter material conditioning times
- Improved or reduced pellet quality and durability
- Improved or reduced pellet mill productivity
- Increased or reduced pellet mill energy consumption



Various Hammer Mill Screens

4 The Effects Of Particle Size On Effective Material Consistency and Conditioning

Proper material conditioning is vital to help the pellet mill perform as efficiently as possible while maintaining an adequate balance between pellet quality and pellet mill productivity. Conditioning is after the material has been reduced down to a suitable moisture content, the best moisture content depends on the type of material and this is discussed more in the full guide.

Before you start the conditioning process you want a consistent raw material in the sense of a consistent particle size and also moisture content. As you can appreciate a material with a smaller particle size will have more consistent moisture content across the batch. This therefore can be one of the benefits of using a smaller diameter screen in the hammer mill than is strictly necessary.

Material Conditioning and Particle Size

The conditioner is a shaft with an auger or paddles to mix material and carry the material to the compression chamber of the pellet mill. The conditioner also controls material feed rate.

Conditioning is the process that takes place directly before the material enters the pellet mill. You condition a material to improve the qualities of the raw material for pellet compression.

Material conditioning can include:

- Adding water/oil to affect material compression
- Adding water/oil to affect die lubrication
- Adding steam to increase raw material temperature



PelHeat Mini Pellet Mill

The size of the particle in the conditioner will dictate the conditioning process, for instance:

- A smaller particle size will allow better water/oil absorption
- A smaller particle size will also allow faster heat penetration from steam injection

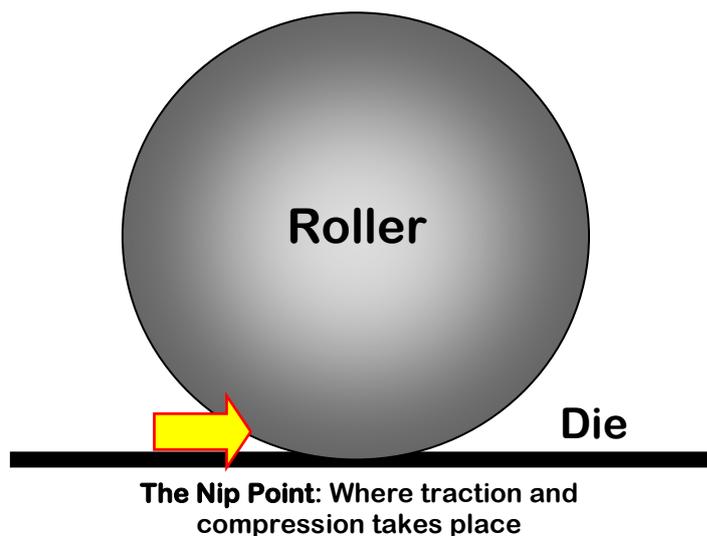
With conditioning, a smaller particle size accelerates the conditioning process. This means reducing conditioning times and also the conditioner can run at a higher speed up to the maximum limit of the pellet mill compression rate. For conditioning a particle size as small as possible seems ideal. However that may not be the case for the pellet mill.

5 The Effects Of Particle Size On Pellet Mill Performance And Pellet Quality

While the conditioner almost always performs better with a smaller particle size, is this also the case for the pellet mill? Well, yes and no. As you will see sometimes a smaller particle size can provide various benefits, however it can also generate certain issues:

Material Traction and Compression Issues

With a particle size that is too small, the roller of the pellet mill may struggle to get traction against the material. Therefore the roller may struggle to compress the material through the die. Unknown to many people the roller and die do not actually touch, and there is a gap between them. Particles which are too small may simply flow between the roller and die without actually been compressed between them. This then also will potentially reduce the productivity of the pellet mill and increase the energy and consumable parts costs per tonne.



Better Heat Penetration and Improved Pellet Density

While a particle size that is too small may struggle to gain traction in the pellet mill, a smaller particle size than is strictly necessary can also provide some benefits. For instance heat is a fundamental part of the pellet formation process. It is much easier to get heat into a smaller diameter particle. Therefore a smaller particle size can produce a better quality pellet due to improved lignin melting which is what binds the pellet together. Pellet compression within the die hole is also improved.

The Complete PelHeat Pellet Production Guide

Hopefully with this document on the importance of particle size I have made you aware of factors of quality pellet production you may not have been previously aware of. To learn more about the complete process, we have produced the complete pellet production guide. Remember, we do offer a 60 money back guarantee. If you are not completely happy with your purchase you will be refunded.

Thanks for reading!

Chris