

PRECONDITIONING

AN EFFECTIVE APPROACH TO MAXIMISING MILLING EFFICIENCY, FEED QUALITY AND FEED MILL PROFITABILITY

In today's highly competitive business landscape, having sound and effective cost management is increasingly important for feed millers. How well the feed production cost is managed will have a direct impact on the profitability of the feed mill. Furthermore, it is challenging to minimise the feed production cost as there are several factors that can hinder the feed millers from effectively reducing the cost.

Financial impact of feed shrinkage and feedstuff moisture variability

Feed shrinkage due to moisture loss is one of the biggest culprits in declining profitability of feed millers. During pellet feed production, grinding and cooling are the two main processes whereby loss of moisture occurs, with approximately 0.5% to 1.5% of moisture loss observed. The loss of moisture can have huge financial impacts on the feed millers. If a feed mill produces 100,000 tonnes of feed annually, 1% loss of moisture is equivalent to the loss of 1,000 tonnes of feed.

Variability in the moisture content of raw feed ingredients, such as corn, wheat and soybean meal, is another factor that can increase the feed production cost. The moisture level in these

feed ingredients varies greatly from batch to batch depending on factors such as source, harvest season, storage period, temperature and humidity. If the variability of moisture is not corrected during the manufacturing process, this results in lower profitability for the feed millers when the feed produced has a lower moisture content than the target moisture level.

Implications of insufficient moisture in feed

Insufficient moisture in the feed ingredients leads to other consequences and one of them is milling efficiency. Feed milling is an energy intensive process. Inadequate moisture in the feed increases the friction, resulting in consuming more electricity to pelletise the feed and reducing the production throughput.

Pellet feed durability and digestibility are also affected when the moisture level in the mash feed is inadequate before going through conditioning. One of the key objectives of conditioning the mash feed with hot steam before pelleting is to gelatinise the starch in the feed. Starch gelatinisation is a process where the starch granules in the feed swell and give a sticky texture when they are exposed to high temperatures in the presence of moisture.

Starch gelatinisation plays an important role

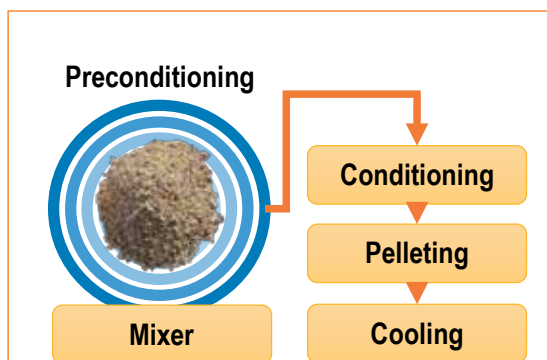


Figure 1. Schematic diagram showing where the preconditioning process is being implemented.

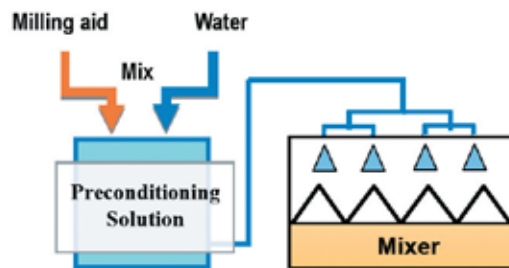


Figure 2. Schematic diagram showing how the preconditioning process is carried out.

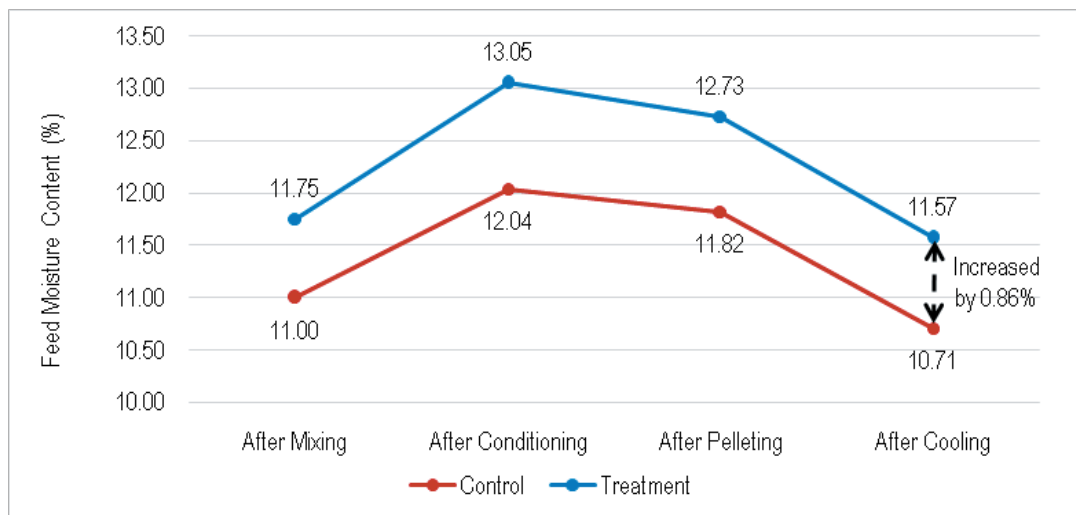


Figure 3. Feed moisture content of control and treatment feed at different sampling points during production

in pellet feed durability because the sticky texture of gelatinised starch helps to agglutinate the feed particles.

Starch gelatinisation also helps to improve the feed digestibility by making the starch more accessible to the digestive enzymes in the animal's body. Insufficient moisture in the mash feed discourages starch gelatinization during the conditioning process which results in poor pellet durability and feed digestibility.

Tackling feed mill challenges with preconditioning

An effective solution to these challenges is to include a process known as preconditioning in the pellet feed milling. As its name suggests, preconditioning is a process taken one step before the steam conditioning. This process is performed in the feed mixer after the dry mixing step (Figure 1).

The objective of the preconditioning process before the steam conditioning is to prepare and optimise the mash feed and to achieve its target moisture level in the feed mixer for optimal pellet feed milling through conditioning, pelleting and cooling.

During this process, a preconditioning solution is prepared by mixing water and a milling aid containing surface-active compounds, which is then added into a mixer to precondition the mash feed before it goes through steam conditioning (Figure 2).

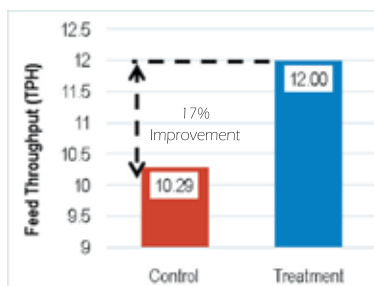


Figure 4. Feed throughput of control and treatment.

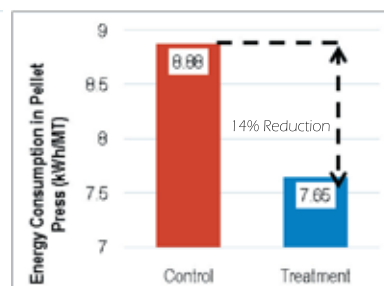


Figure 5. Energy consumption in pellet press of control and treatment.



Figure 6. Starch gelatinization of control and treatment feed.

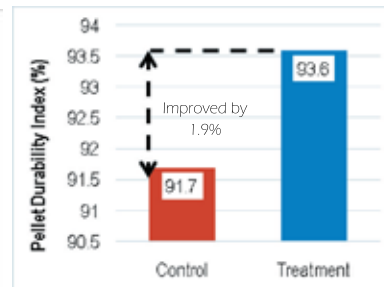


Figure 7. Pellet durability index of control and treatment feed.

The addition of milling aid into the water is to potentiate the preconditioning process. The surface-active compounds in the milling aid help to reduce the surface tension of the water, enabling it to be effectively absorbed and retained in the feed particles thereby minimising the moisture loss when the feed is passing through the cooler.

Furthermore, improved moisture absorption and retention in the feed particles promote and facilitate the starch gelatinisation when the feed is passing through the conditioner, resulting in better pellet feed durability and digestibility.

By reducing the surface tension of the >>>

preconditioning solution, it also helps to enhance the spreadability of the preconditioning solutions, allowing it to better spread and improve its distribution throughout the feed. This helps to lubricate the feed, smoothen the pelleting process enabling the production to be run at higher throughput with reduced energy consumption in the pellet press.

Kemin preconditioning programme - MillSMART™

Kemin has developed a comprehensive and integrated preconditioning programme for its customers called MillSMART™. MillSMART™ comprises liquid milling aids, tailor-made dosing system and engineering, technical and laboratory services and supports. Kemin has developed and formulated various milling aids to meet the specific needs of different feed millers:

- KEM WET™ LR Liquid: For feed with high turnover and short shelf life.
- Myco CURB™ Aw Liquid: For feed that requires strong mould inhibition for longer storage.
- KEM WET™ Bind Liquid: For feed to which a high level of fat or oil is added in the mixer.

Kemin's milling aids have been formulated with a synergistic blend of surface-active agents to maximise the benefits of the preconditioning process.

Preconditioning study in a feed mill

A feed milling trial was conducted in 2016 in a feed mill located in Southeast Asia to evaluate the preconditioning effectiveness of the mash feed (Treatment) prior to steam conditioning in improving the milling efficiency and feed quality, in comparison to the feed that was not subjected to the preconditioning process (Control).

This trial was done with broiler breeder pellet feed. For the treatment group, the mash feed was preconditioned in the mixer with 1% preconditioning solution prepared by adding Myco CURB™ Aw Liquid in water, to achieve a target moisture level of 11.5% - 12.0%. The evaluation criteria for both the control and treatment groups were feed moisture content, energy usage in pellet press (kWh/MT), feed throughput (TPH), starch gelatinisation and pellet durability index (PDI).

Moisture retention

All the parameters evaluated in this trial for control and treatment groups are presented in Figure 3, 4, 5, 6 and 7. The mash feed with 1% preconditioning solution showed an increase in the feed moisture content by 0.86%, from 10.71% to 11.57%, equivalent to 86% retention of the added preconditioning solution



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(Figure 3). The synergistic blend of surfactants in Myco CURB™ Aw Liquid enhanced the moisture absorption and retention in the feed by lowering the water surface tension. This helped minimise the loss of the added

moisture during the cooling operation.

Throughput and pellet press energy input

Throughput and energy consumption were another two important parameters for feed millers from the economic standpoint. Preconditioning the mash feed prior to conditioning and pelleting raised the feed throughput by 17%, up from 10.29 TPH to 12.00 TPH, and utilised 14% less energy in the pelleting process, down from 8.88 kWh/MT to 7.65 kWh/MT compared to control. Such improvement in the milling efficiency was attributed to the lubricating effect of preconditioning, which decreased the friction between the feed and the pelletizer during the pelleting process.

Starch gelatinisation and pellet durability

As mentioned earlier, starch gelatinisation plays a very important role in pellet feed production as it has direct impacts on the feed digestibility and pellet durability. In the present trial, the increased moisture retention in the feed of treatment group facilitated and increased starch gelatinization by 11%, up from 20.5% to 22.8% and strengthened the PDI by 1.9%, up from 91.7% to 93.6% (Figure 6 and 7).

Financial benefits of preconditioning

The preconditioning programme formulated in the present trial helped the feed miller to enjoy a net savings of US\$5.29 for every tonne of feed produced by achieving the targeted feed moisture level, increasing the feed throughput and reducing the energy consumption.

The cost savings were calculated based on the feed price, milling aid inclusion cost, electricity and production cost and the feed mill production capacity. With lower feed production cost, feed millers could improve their feed mills' profitability.

Summary

The feed production cost has a direct impact on the feed mill's profitability. Feed shrinkage due to moisture loss, variability in the moisture content of raw ingredients and insufficient moisture in the feedstuffs are some of the key factors that contribute to the increase in the feed production cost.

Preconditioning overcomes these challenges by optimising the mash feed and achieving its target moisture level in the feed mixer for optimal pellet feed milling prior to steam conditioning. The results of the trial presented here demonstrated that implementing a preconditioning process prior to the steam conditioning provided numerous benefits to the pellet feed millers:

1. achieving target feed moisture content
2. increasing feed throughput
3. reducing the pellet mill's energy consumption
4. improving the pellet feed durability and digestibility by promoting starch gelatinisation

All these benefits allowed feed millers to bring down the feed production cost significantly thereby improving profitability. 🌱

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