Effects of Pelleting on Lactomace® Enzyme Survival

Feed products in the livestock and poultry industries are commonly processed to a significant degree in an effort to improve handling, intake, digestibility and other parameters. One of the most common processing methods is pelletization or pelleting. The pelleting process takes a finely ground feed mix and compresses it into a “package” ranging from very small (~1/8” diameter) to substantially larger (~3/4” diameter). This methodology provides the feed product in a consistent, properly mixed form, insuring an increase in the consistent intake of nutrients by the animal. Pelleting also dramatically reduces the amount of loose, fine material (fines) in the feed bunk which can reduce the palatability and intake of the feed product.

Production of a quality pellet involves several steps:

1) Complete mixing of the feed product.
2) If necessary, grinding of the feed product to a consistent particle size.
3) Introduction of steam to the body of the feed mix to increase temperature and moisture content.
4) Introduction of the high temp, high moisture feed mix to the pellet mill where it is forced, under pressure, through a die where the feed is forced through numerous, specifically drilled orifices which form the feed into a pellet.
5) The newly formed pellets are then cooled and passed over a screen for the reduction of fine materials.
6) In poultry feed operations these pellets may then be sent through a crumbler which will break the pellets into smaller particles for ease of consumption by the birds.

The pelleting process exposes the feed product to several stressors including heat, moisture and pressure. These effects are all implemented to produce a better quality pellet, one which will hold together more effectively as it is handled and transported. It can also help improve the digestibility of certain nutrients, such as starch, where the heat and moisture levels can open up the starch molecule for more extensive action during the digestive process. A similar effect may be noted with certain protein molecules where once again, heat and moisture have been shown to open the protein molecule from greater digestive access.

Simultaneously, these effects can also be detrimental to certain nutritional components. Vitamins are well known to exhibit lability to heat and moisture exposure resulting in decreased activity. Subsequently it is not uncommon for nutritionists to “over-formulate” compounds such as vitamins to offset this potential loss of activity post pelleting.

Enzymes have become a staple in many feeds, especially for poultry and swine with more recent increases in use in ruminant diets. Like vitamins, feed enzymes can exhibit a certain degree of degradation during the pelleting process. Inborr and Bedford (1994) suggested in that partial enzyme (β-glucanase) inactivation occurs at pelleting. Their work indicated that the magnitude of the inactivation depends on the pelleting conditions employed, with higher temperatures and prolonged conditioning times increasing inactivation. Similarly, a study by Silversides and Bedford (1999) indicated a potential reduction in stability of certain enzymes (xylanases, proteases) especially at temperatures above 80°C. The stability of added feed enzymes to the pelleting process is a major concern of feed manufacturers, because pelleting can significantly reduce the safety margins incorporated into the feed formulation. Most of the inactivation takes place during conditioning, when the feed is heated with steam, rather than during extrusion of the pellets.
(Eckhout et al., 1995). However, some researchers believe that little activity loss would occur due to the stabilization of enzyme preparations as well as the relatively short heating period during the pelleting process (Kerley, 2013).

It has become clear that commercial enzyme preparations vary in their ability to withstand pelleting (Inborr and Bedford, 1994; Gibson, 1995; Petterson and Rasmussen, 1997), although the measurement of activity after processing is not straightforward.

**Effects on Lactomace® Enzyme**

Lactomace® manufactured by R&D Lifesciences, LLC, Menomonie, WI is a blend of fermentation products of *Aspergillus Oryzae* 458, *Bacillus Subtilis* 681 and *Trichoderma Viride* 007 fermentation products. An important component of Lactomace® are the enzymes produced during the fermentation of the microbial cultures included. Lactomace® is a potentially valuable feed additive for the improvement of digestibility in the diets of dairy cattle. Many dairy feed supplements and concentrates are delivered to the animal in a pelleted form so it was necessary to assess the stability of Lactomace® after pelleting.

Several samples of pelleted animal feed product which included Lactomace® in the formulation were obtained from a local feed manufacturer. While the exact temperatures and pressure measurements were unavailable, as noted above it is understood that the critical temperature point in this process is during steam introduction where initial contact with the feed mixture (which includes Lactomace®) is at a temperature at or exceeding 100°C. Also as noted in the previous section, inactivation of the enzyme, if it takes place, is also at this point and not during the pressure application during pellet extrusion.

Multiple pelleted feed samples were analyzed for enzymatic activity (cellulase and α-amylase). The activity data was then compared to estimated activities of un-processed enzyme activities in the base Lactomace® product, factored for inclusion rates in the pellet formulation. Recovered enzymatic activity from pelleted feed samples was reported at nearly 100% of the original base product (Figure 1).
Conclusions

The enzymatic activity of Cellulase and α-amylase exhibited very little degradation as a result of exposure to the pelleting process. Subsequently, Lactomace® inclusive, pelleted products routinely display performance results in the animal consistent with expectations of microbial fermentation product blends for enhancement of nutrient digestibilities. These results would suggest that Lactomace® enzymes and other metabolites survive the pelleting process with little reduction in performance.

References


