THERMOSTABILITY OF POWDER ENZYMES: IN VITRO RECOVERIES AND IN VIVO EFFICACIES

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Feed processing imposes strong physical constraints on feed additives. Enzymes are proteins and their structure and activity are highly sensitive to such constraints. Enzyme suppliers have thus attempted to protect as much as possible of the activity of their products. However, irrespective of the products, many studies have demonstrated that approximately 60 to 80% of the feed enzymes incorporated in the feed prior to pelleting are destroyed at a pelleting temperature above 80°C (Gadient, 1996; Piironen, 1996). Even in the case of low pelleting temperatures, the irregularity of the flow often leads to sharp and sudden increases in temperature resulting in enzyme denaturation. To evaluate losses of activity of powder products, in vitro enzyme activity analysis is often recommended. However, discrepancies might appear between in vitro recoveries and in vivo efficacies. It was thus decided to evaluate thermostability of different commercial products through two different laboratory in vitro methodologies and through their true in vivo efficacy.

The same wheat-based grower broiler feed was conditioned and pelleted at three different sets of temperatures (65-70, 75-80 and 85-90°C) in the IRTA feed mill. Powder enzymes were included in the premix prior to pelleting at their recommended dose. Eight commercial enzyme products from different companies were tested. Feeds were then assayed for enzyme recoveries either by spectrophotometric (azo-arabinoxylan) method at the IRTA laboratory or by viscometric method at RPAN laboratory (Sabatier and Fish, 1996). Apparent metabolizable energy (AME) of the feeds was also determined in growing broilers using ad libitum feeding and total excreta collection (Bourdillon et al., 1990).

The recovery results revealed that even at the lowest temperature most products lose at least 30% of their activity while, at the highest conditioning temperature, losses reached 90%. Coated or encapsulated enzyme products were also tested. In vitro assay results appeared to show an under recovery of activity at lower feed processing temperatures (70°C) and a greater than expected recovery of activity at higher temperatures. However, whereas in vitro recoveries suggested different thermostabilities, in vivo AME measurements showed that such products would not give further improvements compared with non-coated products.

Finally, whatever the feed form, pellets or crumbs, the easiest solution to solve the problem of such a loss of activity during feed processing is the post-pelleting spraying of liquid enzyme; the effect of enzyme being even more important in heat-processed feeds.


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