Enzymes are biological catalysts biology essay

Science, Biology

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Introduction

Enzymes are biological catalysts that perform some essential functions in living organisms. These enzymes are naturally in living organisms and they can produced by aerobic or anaerobic cultures of media. The enzymes have been used for the last 50 years but their use in animal feeds has received more attention in the last 20 year, s (Partridge and Wyatt, 1955) Enzymes, even in small quantities, can initiate or accelerate the rate of chemical reactions that transform dietary substrates into products of biological significance for broiler growth and production (Taylor-Pickard, 2008). The pelleting process has effects on the nutritional and handling characteristics of the feed, but the high temperatures that result (from 65 to 95°C) can inactivate heat-sensitive nutrients/ enzymes (Pickford, 1992). Phytase can decompose phytate in the feedstuffs and release phytate phosphorus, efficiently increasing the utilization of phytate phosphorus and reducing the phytic acid' santinutritional ability in the feed. The reason for using phytase enzymes in feed has been to separate the phosphorus from phytic acid in plant-derived ingredients (Ravindran et al., 1995; Bedford and Schultz, 1998). Phytase enzymes can be derived from many different sources (Liu et al., 1998). Soya bean meal produced by extraction with ethanol, rather then hexane, has these NSP's removed. Enzymes designed to improved carbohydrate digestibility of soyabean meal there fore have great potential in poultry nutrition.(Raney etal., 2009)Cellulose is hydrolyzed through a difficult process involving cellulases, and numerous specific enzymes contribute to cellulase activity. The major enzymes involved in hydrolysis of cellulose is cellulase. Xylanase is a class of enzymes produced by microorganisms to break down a component of plant cell walls known as hemicellulose. Enzymes, even insmall quantities, can initiate or accelerate the rate ofchemical reactions that transform dietary substrates intoproducts of biological significance for broiler growth andproduction (Taylor-Pickard, 2008). It is essential to find enzymes which are consistently e ective in enhancing the utilisation ofcereal grains in poultry diets (Scott et al., 1998).

Discussion:

Enzymes:

Enzymes are one of the many types of protein in biological systems. Their essential characteristic is to catalyze the rate of a reaction but is not themselves altered by it. They are involved in all anabolic and catabolic pathways of digestion and metabolism. Enzymes tend to be very specific catalysts that act on one or, at most, a limited group of compounds known as substrates. Enzymes are not living organisms and are not concerned about viability or cross infection. They are stable at 80-85 degree centigrade for short time. Therefore, we need to match the amount of enzyme with the quantity of substrate (Acamovic and McCleary, 1996). For example, pancreatic lipase, which splits fat or lipid into glycerol and fatty acids, is an endogenous enzyme. Those enzymes added to feed as a supplement are exogenous (Classen, 1996; Classen and Bedford, 1991).

Benefits of Enzymes:

Benefits of using feed enzymes to poultry diets include; reduction in digesta viscosity, enhanced digestion and absorption of nutrients which improved Metabolizable Energy (ME) value of the diet, feed intake increases, and feed–gain ratio, weight gain, reduced beak impaction and vent picking, decreased size of GIT tract, altered population of microorganisms in GIT tract, water intake reduced, water content of excreta reduced, ammonia production reduced from excreta, including reduced N and P (Campbell et al. 1989; Jansson et al. 1990)

Effects of phytase on broilers:

Phytase supplementation increased the availability of phosphorusand Ca (Rezaei, et al., 2007; Schooner, et al., 1991; Broze, et al., 1994; Kornegay, et al Similarly, phytase increased the availability of nutrient, when was included at rate of 500 FUK /Kg phytase. Toe ash , and toe ash Ca and P percentages were increased with the addition of phytase in both sexes but without significant effect on blood phosphorus concentration (Rezaei, et al., 2007). In another study when phytase was added at the level of 250PU/Kg to a low P broiler diets it increased body weight gain and feed conversion efficiency, more Ca and P in tibia ash and Ca and phosphorus retention was significantly increased (Mondal, et al., 2007). However, inclusion of phytase had no effects broilers growth performance and body levels of Ca and P (Akyurek, et al., 2005). When phytase was added to a corn based diet had a significantincrease in body weight in the broiler fed for 49 days (Huff, et al., 1998). Serum activity of alkaline phosphates was significantly decreased in the diet supplemented with phytase, while serum cholesterol was significantly decreased (Huff, et al., 1998). When phytase was added to broiler diets at level of 600 ppm had no effects on broilers growth (Hussein, 2005). It has been reported that phytase supplementation improved N retention in broiler chickens (Farrell, et al., 1993). Shirley, et al., (2003) indicated that broilers consuming a total P-deficient cornsoybean meal diet can achive maximum performance when phytase is supplemented at 12000 UKg diet and that current phytase supplementation levels within the poultry industry may need to be reevaluated.

Effects of phytase on layer hen feed:

This effect was investigated by several researchers. Ciftci, et al., (2005), Musapuer, et al., (2005) reported that phytase supplementation had a positive impact on hen's general performance and egg production. It was concluded that phytase supplementation to hens with P deficient diets improved P and Ca retention.. Both egg production and egg average weight were improved by addition of phytase to low P diets (Scott, et al., 1999). However, Peter, (1992)reported that feeding laying hens a low nonphytate phosphorous (NPP) diet supplemented with phytase had significantly higher egg production, egg weights and feed consumption compared to hens that consumed the low nonphytate phosphorous diet free of phytase. Similarly, supplementation of phytase at level of 300 PU/kg diet caused an increase in egg production and a significant decline in number of broken eggs and premature egg production rates (Lim et al., 2003). It has been also reported that phytase supplementation improved Nretention in laying hens (Vander Klis and Verteegh, 1991).

Impact on Environment:

Enzymes have been approved for use in poultry feed because they are natural products of fermentation and therefore pose no threat to the animal or the consumer. Enzymes will not only enable poultry producers to economically use new feedstuffs, , as they reduce the pollution associated with animal/poultry production. As well as contributing to improved poultry production, feed enzymes can have a positive impact on the environment. In areas with intensive poultry production, the phosphorus output is often very high, resulting in environmental problems such as eutrophication. This happens because most of the phosphorus contained in typical feedstuffs exists as the plant storage form phytate, which is indigestible for poultry. The phytase enzyme frees the phosphorus in feedstuffs and also achieves the release of other minerals (e. g. Ca, Mg), as well as proteins and amino acids bound to phytate. Thus, by releasing bound phosphorus in feed ingredients, phytase reduces the quantity of inorganic phosphorus needed in diets, makes more phosphorus available for the bird, and decreases the amount excreted into the environment.

Xylanases used in feed:

xylanases are currently added to commercial wheat-based compound feed for broilers in order to improve growth and feed conversion ratio. The degradation of arabinoxylans, the major nonstarchpolysaccharide (NSP) fraction in wheat, results in a reduction of intestinal viscosity. Enzymes are hypothesized to work in 2 steps, described as an ileal phase and a cecal phase (Bedford, 2000). During the ileal phase, enzymes remove fermentable substrates. During the cecal phase, degradation products of sugars, such as xylose and xylo-oligomers, are fermented by cecal bacteria, thus stimulating the production of VFA and the growth of specific beneficial bacteria (Bedford, 2000). The presence of viscous polysaccharides increases the microbial activity in the small intestine associated with poor broiler growth performance (Wagner and Thomas, 1978; Choct et al., 1996; Langhout et al., 1999). Microbial bile acid deconjugation, leading to an impaired lipid digestion, has been suggested to be partly responsible for poor broiler performance. Many indigenous bacteria, including lactobacilli, enterococci, bifidobacteria, clostridia, and bacteroides, are able to catalyze bile acid deconjugation (Masuda, 1981; Klaver and van der Meer, 1993; Smits etal., 1998). Among these bacteria, Streptococcus faecium and Clostridium perfringens have been shown to be very active regarding bile acid deconjugation and have been suspected to be primarily responsible for depression of chicken growth (Stutz and Lawton, 1984; Knarreborg etal., 2002). Until now, no information has been available as to whether and in which way the feeding of whole wheat and the dietary addition of xylanase influence the composition and activity of the broiler gastrointestinal microflora.

Using Enzymes to Improve Meat Quality:

Many researches (Bedford 2000; Ponte et al., 2004 ; Buchanan et al., 2007 ; Gruzuauskas et al., 2007)) have shown that the use of enzymes in broiler diets can increase production. However, the information on the meat quality of birds consuming enzyme based diets is not necessary. Therefore, a more coordinated approach to study the impact of enzymes on broiler meat quality is required.