THE SCIENCE WORLD
A Monthly e Magazine
ÍSSN: 2583-2212
April, 2022; 2(4), 392-395

Application Of Nanotechnology In Animal Nutrition

Pallabi Das*, Akshay R. Bariya and Anshu Ahlawat

Assistant Professor- Department of Animal Nutrition
M.B. Veterinary College, Rajasthan-314001
***Corresponding author**: dranshuahlawat@gmail.com
DOI: https://doi.org/10.5281/zenodo.6456720

Nanotechnology has a wide range of applications in biological research, therapeutics, and environmental concerns. Nanotechnology is a new and growing technology with enormous potential to transform the agriculture and livestock sectors in India and around the world. Nanoparticles can carry a wide range of components in a variety of environments. The process of reducing these bigger molecules to microscopic ones alters the underlying material's inherent physical and chemical properties. Mineral antagonism in the intestine or at the cellular level in animals and livestock causes mineral imbalances in absorption, transit, and excretion. As technology advances to the Nanoscale, qualities change fundamentally and unpredictably in comparison to bigger scales. Nutrition, diagnostics, pharmaceuticals, biotechnology, vaccine production, chemical industries, and other sectors appear to benefit from such improvements. The end product of this technology includes unique qualities such as increased penetrability, reactivity, surface area, and quantum properties that can be used in a variety of scientific domains.

Nanotechnology is mostly used in animal/poultry nutrition in the form of Nano-minerals. This area is important because it improves trace mineral absorption by minimizing the antagonistic interaction between bivalent cations. This unique technique could be used in livestock and poultry nutrition to increase nutrient uptake and improve feed and supplement usage. Nanotechnology is mostly utilized in animal nutrition to prepare Nano-minerals, particularly trace minerals with low bioavailability. Furthermore, minerals in form of nanoparticles minimize intestinal mineral antagonism, resulting in less excretion and contamination. According to studies, feeding nanoparticles to livestock and poultry enhanced digestive efficiency, immunity, and performance.

The Science World a Monthly e- Magazine, **April, 2022; 2(4), 392-395**

Properties of Nano minerals

Mechanisms of action

1. Longer chemical residence time in the gut due to nanoparticles tend to enhance the surface area for improved interaction with biological support
2. Lessen the impact of gastrointestinal clearance processes
3. Enable cells for efficient absorption
4. Effective distribution of functional substances to target areas and hence greater bioavailability
5. Penetrate deep into tissues via fine capillaries
6. Cross epithelial lining fenestration

Effect of Nano mineral Feeding on health and performance

Several studies have proved that feeding of nanoparticles improved the digestive efficiency, immunity and performance in livestock and poultry. In piglets and poultry, Nano ZnO has been demonstrated to promote growth and feed efficiency. Animals' immunity is improved by Nano Zn. Supplementation with micro ZnO resulted in a decrease in somatic cell count in a subclinical mastitis cow and an increase in milk production. In comparison to a standard dose of 15 ppm of organic and inorganic Zn, adding 0.06 ppm of Nano Zn to the broiler's basal diet will help in boosting immunity.

Nano Zn has also been observed to influence the fraction of volatile fatty acids generated in ruminants' rumen fermentation kinetics. In vitro, Nano ZnO supplementation improved ruminal microorganism growth, ruminal microbial protein synthesis, and energy utilization efficiency in the early stages of incubation. After calving, Nano antioxidants can help avoid retained placentas and other reproductive issues, as well as improve infertility.

Nanoparticles could be a viable alternative to antibiotics and could help keep diseases out of animal production facilities. In medicine and dentistry, silver is currently utilized to prevent wound infections and biofilm formation on catheters and dental equipment. Copper is frequently added to feeds because of its antibacterial characteristics as well as its potential to boost animal development and performance. Copper nanoparticles have been shown to pass through intestinal mucosa more easily than microforms, facilitating absorption. When compared to controls fed 60 ppm zinc oxide, Zhao *et al*. (2014) found that supplementing broilers with 20 ppm Nano zinc improved weight gain, feed efficiency, total antioxidant capability, and SOD and catalase activity. Ahmadi *et al*. (2013) found that supplementing broilers with zinc nanoparticles reduced LDL, TG, and cholesterol levels while increasing HDL levels. Uniyal, S. (2015) found that the group

supplemented with 20 ppm commercial zinc Nano particles had considerably higher overall gain and average daily gain than the other groups. When compared to control, Wang et al. (2009) found that supplementing the avian broiler with Nano Se (0.2 and 0.5 ppm) and sodium selenite (0.2 ppm) results in better daily weight gain and survival rate, as well as lowered feed conversion ratio, liver Se content, and GSH-Px enzyme activity. At particular inclusion levels, Joshua *et al*. (2016) found that Nano versions of zinc, copper, and selenium provided the best feed efficiency. Dietary supplementation of nano-Se at the rate of 0.3 ppm showed an increase in the final body weight and average daily growth in male goats. Supplementation of chromium (Cr) as chromium nanocomposite (CrNano) at the dose rate of 200 μg in finishing pigs reduced serum levels of glucose, urea nitrogen, triglyceride, cholesterol and non-esterified fatty acid. It also had appreciable effects on carcass characteristics, pork quality, skeletal muscle mass and increased tissue chromium concentration in selected muscle and organs.

Demand for dairy products has been steadily increasing. This is because milk is a good source of nutrients, and its use has an impact on people's health and well-being. It's vital to note that the amount of minerals (particularly micronutrients) in milk is determined by the number of minerals in the feed, that's why it is critical to utilize high-bioavailability preparations, such as Nano minerals.

So far several types of research on the use of Nano minerals in ruminant nutrition have been conducted. Those researches were conducted to see how Nano minerals affect animal health, digestibility of feed ingredient, and odor reduction (L. Shi *et al*., 2011). Rajendran *et al*. (2013) fed Nano-zinc to dairy cows and found that the usage of this Nano mineral lowers the number of somatic cells in cow's milk with subclinical mastitis. In these experiments, they also found that feeding Nano-zinc to dairy cows boosts milk output when compared to conventional zinc sources.

References

Ahmadi, F., Ebrrahimnezhad, Y., Sis, M. N. & Ghalehkandi, J. G. (2013). The effects of zinc oxide nanoparticles on performance, digestive organs and serum lipid concentrations in broiler chickens during starter period. Int. J. Bio. Sci. 3(7): 23-29.

Joshua, P.P., Valli, C. & Balakrishnan, V. (2016) Effect of *in ovo* supplementation of nano forms of zinc, copper, and selenium on post-hatch performance of broiler chicken, *Veterinary World*, *9*(3): 287-294.

Rajendran, D., Thulasi, A., Jash, S., Selvaraju, S. & Rao, S.B. (2013). Synthesis and application of nano minerals in livestock industry. In: Animal Nutrition and Reproductive Physiology (Recent Concepts). Satish Serial Publishing House, Delhi, pp. 517-530.

Shi, L., Xun, W., Yue, W., Zhang, C., Ren, Y., Shi, L., Wanga, Q., Yanga, R. & Lei, F. (2011). Effect of sodium selenite, Se-yeast and nano-elemental selenium on growth performance, Se concentration and antioxidant status in growing male goats, Small Rumin. Res. 96: 49–52. Uniyal et al BEPLS Vol 6 [4] March 2017 8 | P a g e ©2017 AELS, INDIA

Uniyal, S. (2015). Effect of zinc nanoparticles supplementation on growth and health status of guinea pigs (Cavia porcellus). Thesis, M.V.Sc. Deemed University, Indian Veterinary Research Institute, Izatnagar, India. 70 p.

Wang, Y. (2009). Differential Effects of Sodium Selenite and Nano-Se on Growth Performance, Tissue Se Distribution, and Glutathione Peroxidase Activity of Avian Broiler. Biol. Trace Elem. Res. 128: 184-190.

Zhao, Y. C., Shu, T. X., Xiao, Y. X., Qiu, S. X., Pan, Q. J. & Tang, X. Z. (2014). Effects of dietary zinc oxide nanoparticles on growth performance and antioxidative status in broiler. Biol. Trace Elem. Res. 160(3): 361-367.

Cite as

Pallabi Das, Akshay R. Bariya, & Anshu Ahlawat. (2022). Application Of Nanotechnology In Animal Nutrition. The Science World a Monthly E Magazine, 2(4), 392–395.
https://doi.org/10.5281/zenodo.6456720