THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Popular Article
October 2024 Vol.4(10), 4017−4021

Ethanol's Hidden Gem: Unlocking the Potential of Distillers Dried Grains with Solubles (DDGS) in Animal Nutrition

Shalinee G V*[1] and Indur Dilishma [2]
[1]MVSc scholar (Animal Nutrition)
[2]MVSc scholar (Poultry science)
College of veterinary and animal sciences, Mannuthy - 680651
https://doi.org/10.5281/zenodo.14034909

Abstract

Distillers Dried Grains with Solubles (DDGS), a co-product of the bioethanol industry, is emerging as a highly valuable feed ingredient for livestock in India. With increasing bioethanol production, DDGS provides a sustainable and cost-effective alternative to traditional feed components, particularly in dairy, poultry and aquaculture diets. This article explores the chemical composition and physical attributes of DDGS, detailing its advantages in improving growth rates, feed conversion ratios, and overall health parameters across animal sectors. Key challenges, including quality variability, handling, and nutritional balancing, were also addressed. Optimized use of DDGS through enzymatic treatments and proper dietary formulation can offer an economically and nutritionally efficient solution, enhancing India's agricultural sustainability and livestock productivity.

INTRODUCTION

India's bioethanol sector is poised for significant growth driven by government mandates, technological advancements in feedstock utilization, and increasing investments in infrastructure. The BEP30 initiative represents a crucial step towards achieving energy independence and sustainability goals. The primary feedstocks for bioethanol production in India includes Sugarcane molasses, Broken grains (such as rice and maize) and Agricultural residues (like rice straw and wheat straw). Distillers dried grain is a byproduct of ethanol industry produced in the fermentation process of cereal grains starch in dry mill ethanol plants. By valorising this byproduct, producers can reduce waste and generate additional revenue streams. Furthermore, integrating processes that recycle or repurpose distillers dried grain with solubles (DDGS) can lead to significant reductions in operational costs and environmental footprints associated with bioethanol plants.

Definition

According to AAFCO (2004), DDGS is defined as the product obtained after removal

of ethyl alcohol by distillation from the yeast fermentation of a grain or grain mixture by condensing and drying atleast 75% of the resultant stillage by methods employed in the grain distilling industry.

Opportunity To Use DDGS As Feed Ingredient

Dried Distillers Grains with Solubles (DDGS) is increasingly recognized as a valuable feed ingredient across various livestock sectors, including cattle, pigs, and aquaculture. Its utilization presents several benefits and considerations for animal nutrition. DDGS is rich in protein, typically containing around 27-30% protein and 6-7% oil, making it a competitive alternative to traditional protein sources like soybean meal. As a coproduct of the ethanol industry, DDGS is often available at a lower price compared to conventional feed ingredients, making it an attractive option for livestock producers looking to reduce feed costs while maintaining nutritional quality, particularly when replacing corn or soybean meal.

- Studies indicate that incorporating DDGS into cattle diets can enhance growth rates, nutrient intake, and feed conversion ratio. It also improved milk production and overall health in dairy cattle. Feeding cattle with DDGS has shown to improve microbial structure in the rumen, leading to better digestion of nutrients and increased weight gain.
- DDGS has shown positive effects on feed intake, conversion ratios, body weight gain, and overall meat quality in poultry. Furthermore, it improves egg production and quality by enriching it with omega-3 fatty acids.
- Research has demonstrated its effectiveness in aquaculture, where it can be included in diets for species like common carp and tilapia, often improving growth parameters and intestinal health.

Physical Properties of DDGS

Colour: Typically brown, with variations in color scores depending on the specific sample and processing methods. Hunter color values have been recorded with L values ranging from 43.1 to 49.8

Smell: It ranges from burnt or smoky to sweet and fermented

Moisture Content: Typically ranges from 10% to 17% depending on the source and processing methods.

Water Activity: Generally, around 0.55, indicating a moderate level of moisture retention which can affect spoilage and shelf life.

Particle Size: The geometric mean diameter is crucial as it influences flowability and other physical properties. Larger particles tend to flow better than smaller ones, reducing agglomeration issues.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 28/10/2024

Bulk Density: Loose bulk density (LBD) typically averages around 483.3 kg/m³, while packed bulk density (PBD) can vary significantly based on particle size and moisture content. PBD tends to increase with larger particle sizes. Higher bulk density allows for more efficient storage but requires careful management to prevent spoilage due to moisture

Chemical Composition of Various DDGS (Pedersen *et al.*, 2014)

Parameter	Corn DDGS	Mixed DDGS	Rice DDGS
DM	87.6-93.5	87.3-92.6	89.691.4
CP	27.1-36.4	33.8-38.3	44.7-48.4
EE	6.5-11.8	4.4-5.0	5.5-6.5
Ash	5.4-9.0	8.0-10.2	4.01-5.03
NDF	30.2-39.7	28.9-31.2	40.5-45.60
ADF	8.9-11.9	11.5-12.3	12.9-16.82
CF	6.4-9.5	5.6-7.6	9.12
Starch	2.9-13.9	<1.0-3.7	-
Total sugars	5.4-12.6	9.9-14.2	-
Total NSP	24.2-29.1	23.8-25.7	-
S	0.72	0.37	0.55
Ca	0.05	0.15	0.13-0.70
P	0.77	0.92	0.35-1.34

Factors Affecting Nutritional and Physical Properties Of DDGS

1. Type of grain and their composition
2. How much solubles are being added
3. Modification in Processing Technologies
    - Fine grinding, germ and germ-fiber removal
    - Enzymatic milling processes
    - Dilute-acid pretreatment (sulphuric acid increased sulphur content)
    - Type of fermentation (continuous vs batch)
    - Drying temperature and duration (the darker the color of DDGS more heat damage to protein)
    - Processing technologies of the plant to ferment starch

Utilisation of DDGS In Livestock And Poultry Feed

- DDGS can be included upto 20% in the swine diet without negatively impacting growth performance or carcass quality. However, results can vary depending on the specific growth stage of the pigs
- DDGS in the poultry ration should be limited to 6 % in the starter, 12 – 15 % in the grower and finisher and not more than12 % in layer ration.
- DDGS in the cattle ration:
    - Pre weaned calves - 25 %
    - Heifers - 30 %

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 28/10/2024

- Dry cows - 15 %
- Lactating cows - 20 %

- DDGS can be included at 20 - 30 % in the ration of sheep and goat. In the ration of lambs/kids, use of DDGS should be limited to 20 %.

Challenges In Using DDGS

1. **Quality variability:** The quality of DDGS can vary significantly based on the production process and raw materials used. There is no standard nutrient profile available for DDGS. Factors such as moisture content, crude protein levels, and the presence of anti-nutritional factors can affect its market value and nutritional efficacy. Standardized testing methods are crucial for ensuring consistent quality. Palatability should also be considered.
2. **Handling Challenges:** DDGS may present handling issues due to poor flowability in bulk storage systems. This can complicate feeding logistics and requires careful management during transport and storage
3. **Nutritional Balancing:** While DDGS is nutrient-rich, it must be balanced with other feed components to meet the specific dietary needs of different livestock species. For example, high levels of non-starch polysaccharides in DDGS may necessitate fractionation or supplementation with other ingredients to optimize digestibility. High risk material for mycotoxin contamination (3-4 times higher than grains). High level of unsaturated fatty acids makes DDGS more susceptible for oxidation.

Precautions While Formulating Feed With DDGS

- Analysis: Complete analysis of DDGS before use.
- Quality: Physical qualities like color, smell, texture etc. and chemical parameters like mycotoxin level, pH etc. need to be checked properly before incorporating into diet.
- Considering variations in nutrient profile like crude protein, amino acid level and digestibility, ME content, and bioavailability of P, use of combination enzyme is best strategy to tackle economical and nutritional variation challenges.
- Enzyme solution having xylanase, amylase, beta glucanase, cellulase, amylase and multi-protease should be used. The use combination enzyme not only help to reduce the cost but also helps to mitigate the risk of anti-nutritional factor. It also helps to release simple sugars by breaking non starch polysaccharide component like beta glucan, mannan, and oligosaccharides.
- The storage period of DDGS should be decided upon initial moisture and toxin levels.
- The maximum inclusion level of DDGS has to be finalized based on other raw material pricing, target production level, stress level, prevalence of any disease etc.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 28/10/2024

- To have complete gut health protection probiotics having activity against *Clostridium sp.*, *Salmonella sp.* and *E. coli* species are needed.
- Considering overall risk and threat factor protection against target organs like liver, kidney, bursa, and gut health needs to be considered. Sufficient levels of biotin, choline, and methyl donors need to be considered for liver health. To maintain immune status good quality toxin binder with multi-toxin binding and pesticide binding should be used in feed formulation.

Conclusion

In summary, DDGS offers a promising opportunity as a feed ingredient due to its nutritional benefits and cost-effectiveness. However, careful consideration of quality variability and proper dietary formulation is essential for maximizing its advantages in livestock production.

References:

1. AAFCO (Association of American Feed Control Officials). 2004. Official Publication, Association of American Feed Control Officials Inc. West Lafayette, IN 47971 USA.
2. Buenavista, R.M.E., Siliveru, K. and Zheng, Y., 2021. Utilization of distiller's dried grains with solubles: A review. *Journal of Agriculture and Food Research*, *5*, p.100195.
3. Pedersen, M.B., Dalsgaard, S., Knudsen, K.B., Yu, S. and Lærke, H.N., 2014. Compositional profile and variation of distillers dried grains with solubles from various origins with focus on non-starch polysaccharides. *Animal Feed Science and Technology*, *197*, pp.130-141.
4. Rosentrater, K.A. and Zhang, W., 2021. Selected physical and flowability properties of evolving distillers dried grains with solubles (DDGS). *Frontiers in Energy Research*, *9*, p.722899.
5. Schingoethe, D.J., Kalscheur, K.F., Hippen, A.R. and Garcia, A.D., 2009. Invited review: The use of distillers products in dairy cattle diets. *Journal of Dairy Science*, *92*(12), pp.5802-5813.
6. Segic, Srdjan and Mauna, Gordana. 2023. Bioethanol production and use of distillers's wet grains as dairy cows' feed. In: 9th International Zeugma conference on scientific research. February 19-21, 2023, Turkey.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 28/10/2024