Animal Husbandry Production and Global Climate Change

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Abstract: The influence of methane and ammonia which come from animal production on global climate changes was discussed in this paper. Meanwhile, the author analyzed the effect of this change on agriculture and animal industry, and also analyzed its control measures in this article..

Key words: animal industry production, global climate change, methane, ammonia

There is only one earth in the world, so the problem of the global environmental change is generally paid attention around the world. Increasing human activities leads to the deterioration of ecological environment. According to UNEP(Union Nations Environment Plan Department) and WMO(World Meteorology Organization), because of greenhouse effect, it is possible that average air temperature of the earth is increased by 0.5~2.0? , change takes place in the pattern of rain and snow, rainfall and evaporation are increased by 2%~13% and Asian monsoon system is strengthened. All these changes will have great impact on the utilization of land and agriculture in our country. Fluctuation and change of future climate, especially the effect of the warm-increasing of greenhouse gases, may further lead to the disaster of flood and drought. According to data concerned, carbon dioxide, methane and nitrogen oxide and so on are major gases resulting in greenhouse effect. 15%~20% of results of climate warming are due to methane, which is the second major greenhouse gas next to carbon dioxide and whose influence is 21 times that of carbon dioxide , so the problem of emission of methane is concerned by all professionals. During animal industry, the output of methane emitted from ruminants accounts for 1/5 of that in atmosphere. In particular, cattle produce the greatest amount of methane, being 2~3 times that of other ruminants. Other livestocks are also major resources creating greenhouse effect in the globe, for they also release large amount of gases, such as carbon dioxide and ammonia making air pollution heavier. Consequently, it is very important to control harmful gases of animal husbandry production.

1.0RUMENTAL DIGESTION AND THE PRODUCTION OF METHANE

Methane is a product of ruminant regular digestion. Methane in rumen is produced by many kinds of methane bacteria through the reduction reaction of carbon dioxide and hydrogen. It has stable chemical character and is emitted outside through mouth in the form of eructation. It is very difficult to be digested in the body. In general, 2%~12% of the total energy assimilated by ruminants is lost in the form of methane.

1.1 FACTERS THAT INFLUENCE THE PRODUCTION OF METHANE

The output of methane is related to rumen contents, type of dietary carbohydrate and VFA(volative fatty acid) in rumen. Methane bacteria in rumen abundantly adhere to ciliates. The relation of them two is facultative symbiosis. Ciliate promotes the production of methane. Protozoa is an important microbe producing methane in rumen. Cooperative function of ciliate and protozoa controls the production and output of methane. It is very

possible that influence of type of carbohydrate on the output of methane is by way of its influence on pH and microbe flora in rumen. There is a highly positive correlation between the output of degradated ADF (Acid Detergent Fiber) and NDF(Neutral Detergent Fiber) and the output of methane. Under the condition of diet with different ratio of concentrate and roughage, the output of VFA in rumen has relevance with that of methane. There is a highly negative correlation between the output of propionate and that of methane, on the contrary, the output of methane has a highly positive correlation with both that of acetate and the ratio of acetate to propionate. If the proportion of cereal concentrate accounts for 80% of diet, 3%~4% of forage energy can be transformed into methane energy and emitted outside while, if animals are completely provided with fiber roughage, maybe over 10% of energy can be emitted in the form of methane. The output of methane doesn't have great relevance with animal sex, age and strain.

1.2 OUTPUT OF EMISSION OF METHANE

The yearly output of methane from ruminants of the world accounts for 15% of the total output of methane released into atmosphere, being 7.7×10^7t, and this proportion continually increases at the speed of 1% every year. Simple and easy method supplied by IPCC was adopted by Environment Protection Scientific Research Monitor Institute of China Agriculture Department to assess the output of emission of methane produced from our domestic animals and their wastes: in 1988, 6.314Tg methane was produced, 89% of which come from ruminants, being 5.67 Tg; in 1990, 6.61Tg was produced, 89.4% of which come from ruminants, being 5.91Tg. The average output every year increases at the speed of 2.34%. The output of methane released by cows occupies most part of that coming from ruminants (approximately cattle 74%, water buffalo 8%, sheep 13% and camel 1%), while the proportion of the output of other non-ruminants to global total output is as follows: mule and horse 2%, pig 1% and wild ruminants 5% , respectively. Fermentation of livestock excrement and urine is also a resource of methane.

2.0SINGLE-STOMACH ANIMAL DIGESTION AND THE PRODUCTION OF AMMONIA

A chicken daily excretes about 100g, yearly 36kg; a pig daily excretes 6kg, yearly 2.5t or so. Fecal nitrogen of single-stomach animals is made up of somatic proteins. When indigestive proteins in small intestine are carried into large intestine, part of them are degraded into amino acid and ammonia by intestine bacteria. Bacteria applied amino acid and ammonia to compound somatic proteins. Fecal nitrogen gives first place to organic nitrogen, reaching above 80%. Under normal condition, nitrogen-containing substances in excrement and urine of livestock and poultry are all non-proteins, mainly urea, ureidohydantoin, uric acid, purine bases, hippuric acid, ammonia acid, indicant and ammonia etc. In pig urine, the proportion of urea nitrogen and ammonical nitrogen to urine nitrogen is 26.60% and 0.79%, respectively. Through deamination, surplus amino acid in single-stomach animal body is formed into ammonia, which is transformed into urea through ornithine cycle in the liver. Urine nitrogen is excluded outside together with urine in the form of urea. ammonia released by pig excrement comes from urea in urine. Fecal nitrogen contains two parts of indigestive diet-N and endogenous-N. They exist mainly in the form of amino acid, microbe-N and nucleic acid. Due to urease activity of microbes in excrement, urea in urine, together with those microbes, is quickly decomposed into ammonia that is released into atmosphere. It is slow that organic nitrogen in excrement is

degraded into ammonia under anaerobic condition. Fecal nitrogen is easy to be transformed into gaseous state and evaporated into atmosphere so as to increase content of nitrogen in atmosphere.

Carbohydrates in organic acids of excrement and urine of livestock and poultry can not be completely oxidized under non-oxygen condition, so they can be decomposed into methane, organic acids and alcohol.

Content of ammonia depends on the number of livestocks, diet structure, nutrition condition, management level, transfer capability of forage and sewage handling, and so forth.

3.0MEASUTES OF CONTROLLING THE PRODUCTION OF METHANE

3.1 METHANE INHIBITOR

3.1.1 NEGATIVE ION CARRIER COMPOUND it contains monensin, lasalocid and salinomycin etc. Wang zhonghua et al (1999) showed that monensin inhibited selectively microbes in rumen. It held up gas-producing microbes and promoted the growth of non-gas-producing microbes. Adding 20~30mg/kg DM of monensin to ruminant diet can significantly enhance the output of propionate and reduce the output of methane.

3.1.2 MULTOHALOGENING INHIBITOR it contains chloral hydrate, chlorinated fatty acid and bromochloromethane etc. J.B.Russeu (1984) stated that chloroformum could totally inhibit the production of methane, for it could hold up the transfer of methyl of CH_2-VB_{12} to CH_3-COM that is necessary to compound methane.

3.1.3 OTHERS certain methane bacteria are relatively sensitive to ion carriers. According to Johnson(1995), ion carriers could reduce the output of methane in rumen of ruminant by 25%. The experiment with castrative sheep was carried out by Smagola(1996) and turned out that anthraquinone could significantly reduce the output of methane. It could directly act on methane bacteria, hold up electron transfer chain, uncouple the coupled reaction of electron transfer and cell pigment compounding ATP, thus inhibit the reduction of CH_3-COM to methane. Long-chain unsaturated fatty acid could also inhibit the production of methane in rumen, because unsaturated fatty acid utilized competitively hydrogen and inhibited activity of methane bacteria so as to decrease the production of methane.

In addition, the decrease in the output of methane of unit forage can be made by taking some measures, for example, adding nutritious elements, improving diet ingredients, increasing rumen by-pass protein, ammoniating stover and enhancing management etc.

3.2 IMPROVING ANIMAL PRODUCTION PERFORMANCE AND APPROPRIATELY REDUCING THE NUMBER OF ANIMALS

In the past of 20 years, the yield of animal products was generally raised through increasing the number of animals rather than improving level of productivity of animal individuals in developing countries, which added and the output of methane of ruminants into the atmosphere. Recently, experts have pointed out that it was beneficial for making global methane density stable to reduce the number of ruminants and emission of methane produced by other crucial resources in work conference held by IPCC. From now on, the task is to enhance the production capacity of ruminants so as to improve

production performance of animal and enhance production efficiency so as to satisfy people's demand for animal products by relatively small number of animals.

4.0MEASURES OF CONTROL OVER THE PRODUCTION OF AMMONIA

The production of ammonia has relevance with the amount of nitrogen absorbed by animals and the transfer of nitrogen in body. Improving the availability of nitrogen can reduce the production of ammonia, which is conducive to both production and environment.

4.1 UTILIZATION OF ADDITIVES

4.1.1 ORGANIC ACID It contains mainly fumaric acid, citric acid and lactic acid etc. Organic acid additives can change intestinal flora, lower pH of diet and promote activity of pepsinum. Acidity of organic acids can slow the speed of excretion of stomach and lengthen the time of stopover of protein in stomach, which are beneficial to protein digestion. Improving metabolism of nutrients reduces excretion of nitrogen, thus decreases the production of ammonia.

4.1.2 UTILIZATION OF ENZYME PRODUCTS By increasing availability of amino acid in plant forage, proteinase can release high-content protein and amino acid existed in forage to reduce the excrement of fecal nitrogen.

4.1.3 UTILIZATION OF LIVE BACTERIA PRODUCTS Digestion and assimilation of nutrient substances can be promoted by probiotics, thus the production of ammonia and other putrilages, such as intestinotoxin, toxic amine, indole and methane in intestine, can be reduced, which benefits the health of animals, mitigates malodorous smell of excrement and purifies environment around livestock and poultry. Zhao furong et al (1998) showed that when 0.1% of probiotics was added into diet of 35~85-day pigs, density of ammonia was decreased by 32.5% ($p<0.05$).

4.2 PATTERN OF IDEAL AMINO ACID

The closer ingredients of diet amino acids are to maintenance and production requirements, that is to say, to ideal protein, the less effective demand of animals for content of protein is, and thus the excrement of nitrogen is reduced. The most effective key to decrease excrement of nitrogen is to reduce content of dietary protein and control excessive foraging. However, the premise of reducing content of protein is that enough amino acid is supplied to satisfy animal nutrition requirement. It turned out in practice that diet of laying hen that was calculated and mixed on the ground of pattern of digestive amino acid and ideal protein could decline dietary protein and nitrogen content of chick manure by 2.5% and 20%, respectively, but not lower production performance.

5.0THE INFOUENCE OF GLOBAL CLIMATE CHANGE ON AGRICULTURE ANIMAL HUSBANDRY PRODUCTION

Among agriculture animal husbandry production, to control and decrease emission of harmful gases of animals has become important in environmental protection. It should be noticed that certain gases released in agriculture animal husbandry production, such as methane, carbon dioxide, and ammonia, directly affect global climate change which influences the development of social economy by acting on agriculture animal husbandry and water resources. If the warming of global climate is continually accelerated, it is possible to further increase the occurrence of flood and drought. The transfer of agriculture and pasture belt in our country towards southeast will result in the reduction of

areas of plant product industry that originally belongs to agricultural areas and the drop of yield in grain and oil. Transitional belt of agriculture and pasture is a potential desert area, because it possesses the condition of desert. New transitional belt will suffer from the danger of desert and the resources of herbage will descend if greening protection can not be taken by planting trees and grass in time. Because of the deterioration of contradiction in water supply and demand of agriculture and pasture transitional belt, the shortage of water will become more serious and the quantity and quality of herbage will largely decline. The increase of temperature will lead to the decline of the yield of crops so as to decrease the forage of livestock. Therefore, animal production performance and reproduction performance will be decreased to different degree. Climate change also acts on the influence of etiologic bacteria and parasites around the environment on livestock.

In short, in order to avoid disastrous destroy of global environment and prevent it from further deterioration, it is a vital matter of immediate urgency to keep and control density of greenhouse gases in atmosphere.

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