Pollution and Cooperative Treatment of Livestock and Poultry Waste: A Review of the Literature

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Abstract. By reviewing the current situation of livestock and poultry wastes pollution, the disposal methods, influencing factors and the related theories of cooperative treatment and literature on livestock and poultry farming pollution, it was found that most of the research on Cooperative treatment of livestock and poultry farming wastes in rural areas remained at the theoretical level, but less in practice. There are few studies on the development of a cooperative system and aquaculture subjects. The future research directions can be focused on the benefit evaluation of pollution control mechanism of livestock and poultry farming and the practical mode of cooperative pollution control of livestock and poultry farming.

1. Introduction

Animal husbandry, as the pillar industry of agriculture in China, is changing the mode of production and management and developing on a large scale. At the same time, the agricultural non-point source pollution caused by livestock and poultry manure is becoming more and more serious. Under the traditional government-led environmental governance model, the utilization degree and efficiency of livestock and poultry excrement resources in China are low, so it is necessary to explore a new environmental governance model. This paper reviews the current situation, problems and related cooperative management of pollution in livestock and poultry farming in order to have a more in-depth understanding of the above issues and provide reference for further research.

2. Study on Environmental Pollution of Animal Husbandry

2.1. Water Pollution by Animal Husbandry

The pollution of animal husbandry to water body is mainly due to the causes and hazards of livestock and poultry wastewater. Any discharge of agricultural wastes such as livestock and poultry manure in the production process of animal husbandry, pollutants enter the nearest water body through volatilization, farmland surface runoff, farmland drainage and underground seepage in the process of precipitation or irrigation [1]. Toxic and harmful substances from wastes infiltrate into groundwater through soil, and a large number of pathogenic microorganisms such as bacteria, viruses and parasites enter the water body, resulting in groundwater pollution [2]. Most farms in our country do not have special treatment technology and facilities. Manure is mainly stored in the open air. Urine is discharged by itself. In addition, washing livestock pens produces a large amount of sewage, which aggravates environmental pollution [3].
2.2. Air Pollution from Animal Husbandry
The pollution of animal husbandry to atmospheric environment is mainly manifested in the stench of animal manure and the influence of animal husbandry on greenhouse effect. Odor gas caused by livestock and poultry manure not only does great harm to livestock and poultry itself, but also poses a potential threat to the health of the surrounding population. The impact of odor pollution on society, environment and economic benefits has become the "bottleneck" of the development of aquaculture industry. The odorous gas in livestock and poultry manure contains a large number of toxic and harmful components such as ammonia, sulfide and methane, which will seriously affect the surrounding air quality [5]. The impact of animal husbandry on greenhouse effect. As an important industrial sector, animal husbandry has become the main source of global greenhouse gas emissions while meeting people's living material requirements. The greenhouse gas emissions of livestock and poultry mainly come from CH4 produced by ruminant gastrointestinal fermentation, CH4 and N2O [6] produced by livestock and poultry manure treatment.

2.3. Soil Pollution by Animal Husbandry
The research on soil pollution caused by animal husbandry mainly focuses on the present situation and causes of soil pollution. In the process of resource utilization of manure wastes, people pay more and more attention to the content of heavy metals and their impact on the environment. It is a common phenomenon that the heavy metals of copper and zinc in livestock and poultry manure exceed the standard [7]. The excreta of livestock and poultry farming contains a large number of undigested and absorbed nitrogen and phosphorus compounds, heavy metals and drug residues. The excreta directly discharges surface and soil elements such as calcium, copper, complexes to form insoluble complexes, resulting in soil consolidation, water permeability and air permeability decline [8]. The direct application of livestock and poultry manure without full maturation to soil will result in the increase of nitrate content and the destruction of soil physical and chemical properties, thus causing soil pollution [9]. If manure does not enter the soil directly without harmless treatment, if the amount of manure application exceeds the self-purification ability of the soil, it will appear incomplete degradation or anaerobic decomposition, produce odorous substances and nitrite and other harmful substances, because changes in soil composition and properties, affect the sustainability of soil management, and even trigger agricultural products. Security issues [10].

3. Study on the treatment of livestock and poultry manure

3.1. Types and Functions of Livestock and Poultry Feces Treatment
When studying the impact of livestock and poultry waste treatment on the environmental efficiency of large-scale farming, some scholars used hen manure conveniently, including the sale of manure, waste of manure, biogas utilization of manure and self-use of manure compost [11]. There are five ways to treat livestock and poultry manure in China: returning farmland, biogas, marketing, feed and waste [12]. From the point of view of environmental impact, biogas, sale and organic fertilizer disposal methods make use of livestock and poultry excrement resources, which has less impact on the environment and belongs to the environment-friendly treatment of livestock and poultry excrement. Direct returning to the field is also a way to utilize livestock and poultry excrement resources, but livestock and poultry excrement contains a large number of pathogenic microorganisms and parasite eggs. Therefore, the treatment method has a greater impact on the environment; the waste method is to treat livestock and poultry manure as a pollutant, which has the greatest impact on the environment [13].

3.2. Influencing factors of livestock and poultry manure treatment
Scholars believe that environmental policy, income level, education level and other factors will affect the treatment of livestock and poultry manure. The factors influencing the disposal intention of livestock and poultry manure from 754 pig farms in Shandong, Jiangsu, Fujian, Jiangxi and Sichuan
provinces were analyzed. It was found that the perception of human health impacts, environmental protection laws and regulations, government subsidies, technical training, regional characteristics, industrial organization, proportion of non-polluted pig farming, education level, scale of farming and annual total family income had significant positive effects on the willingness of livestock and poultry feces to be treated harmlessly [14]. Environmental pollution control policies, feeding scale, per capita sown area, income level and other factors affect farm households' livestock and poultry manure disposal methods [15].

3.3. Study on the Utilization of Livestock and Poultry Manure Waste and Biogas Fertilizer

Biogas manure is a general term for residual substances such as biogas slurry and biogas residue from livestock and poultry manure, crop straw and domestic waste after anaerobic fermentation. The nutrient of biogas manure is comprehensive and has abundant organic matter, but it can make up for the shortage of new cultivated land fertility. It has great potential to improve the fertility of new cultivated land [17]. Effective comprehensive utilization of biogas slurry can not only reduce the use of chemical fertilizers, avoid the phenomenon of soil consolidation caused by large-scale use of chemical fertilizers, but also achieve the purpose of improving soil, and improve the yield and quality of crops [18]. Biogas fertilizer is not only rich in organic matter, N, P, K and other nutrients, but also contains amino acids, vitamins, enzymes, trace elements and other life-active substances. These nutrients have high utilization rate and can be quickly absorbed and utilized by crops. It is a kind of organic compound fertilizer with both quick and effective effects. Scholars believe that there are some problems in the utilization of biogas fertilizer, such as transportation difficulties, unscientific application technology, lack of agricultural machinery and equipment for biogas slurry fertilization. The production and application of biogas fertilizer has been paid attention to all the time, and its application effect has been widely confirmed in production, but there are many problems in production, such as the mechanism of increasing crop yield by biogas residue and biogas slurry besides nutrients, and the best method of applying technology to different soils and crops is not yet clear. Systematic research reports; considering the application technology, there is no accurate and scientific quantitative basis for the application of different crops and soils; and there is no special agricultural machinery and equipment for biogas slurry fertilization [20]. There are some problems in the application of biogas fertilizer, such as difficult transportation of large yield of biogas fertilizer, unbalanced nutrients, secondary pollution caused by long-term pastoral fertilizer irrigation, etc. [21].

4. Cooperative Control and Pollution in Livestock and Poultry Breeding

Human beings have entered a highly complex and highly uncertain era. It is the general trend to change from participatory governance mode to cooperative governance mode. However, China's current environmental protection and governance model is still generally government-led, public participation, that is, participation in governance [22]. The development of animal husbandry has brought about a wide range of air pollution and water pollution. Pollutants flow or cross-over across administrative regions. Some scholars have put forward a reasonable division of the responsibility boundaries of each main body to control pollution, establish a competitive and cooperative governance relationship between the government, enterprises, non-governmental organizations and the people, and form a solid way and mechanism for non-governmental organizations and the people to participate in the governance of rural environmental pollution [23]. At present, China's research on cooperative governance mainly focuses on the analysis of the theoretical basis and connotation of cooperative governance, the status quo and prospects of cooperative governance, and the effectiveness of cooperative governance. There are few studies on its practical operation mode, methods and the practical application of environmental pollution control [24]. From a practical point of view, relying on a single governance model has been unable to effectively deal with and solve the increasingly serious and complex environmental problems in rural areas. Promoting the integration of different governance modes, giving full play to the synergistic role of multiple subjects, adopting administrative,
legal, economic and other governance means to achieve the overall governance of rural environment is the inevitable choice to solve rural environmental problems [25].

5. Conclusion
In summary, scholars have done a lot of research on environmental pollution and comprehensive utilization of Biogas Fertilizer in animal husbandry. Some scholars have realized that there are problems in the way of environmental management of animal husbandry in China at present, and need to change from a single government-led way to a Multi-Cooperative way. However, according to the relevant literature, most of the research on cooperative management of manure from livestock and poultry farming in rural areas has remained at the theoretical level, less analysis on the development and cooperative system in the practical application level, and less research on the mechanism of biogas fertilizer recycling for different farming subjects. Future research directions can be carried out from the following perspectives:

(1) Benefit evaluation of pollution control mechanism in livestock and poultry farming. Different governance mechanisms will bring different benefits, so how to compare the advantages and disadvantages of different governance mechanisms? Is there any difference between the benefits of the traditional pollution control mechanism of livestock and poultry farming and that of the cooperative mechanism? At present, there are few studies in this field, which need to be further studied.

(2) Practical model of cooperative pollution control in livestock and poultry farming. Previous studies have recognized that cooperative management is an important way to control pollution in livestock and poultry farming, but lack of specific practice model. At the practical level, what are the participants of cooperative governance, what are the specific mechanisms and what are the effects?

(3) The government and cooperation to control pollution from livestock and poultry farming. What role should the government play in livestock and poultry pollution? From the previous literature review, we can see that the government, as the main body of supervision of traditional livestock and poultry farming pollution, has low efficiency in its supervision and control. Cooperative governance can reduce the burden of the government. Through the practice of multiple Co-governance of livestock and poultry farming pollution, what role should the government play in this process? This is worthy of our in-depth study.

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