Popular Article

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Air Quality and Emission from livestock Production system: - A Review

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Abstract

Air quality defined as the degree of pollution of clean air. The lower the concentration of air borne pollutants, the better is the air quality. Odour, ammonia, nitrous oxide, hydrogen sulphide, methane, non-methane volatile organic carbon, dust, and microbial and endotoxin aerosols from livestock and poultry buildings have an impact on animal health. Animal production operations like manure handling, floor washing, feedlot surface and dung are the major contributor of air pollution in livestock farm. The rates of odour, manure gases, microbes, particulates, and other constituent's generation vary with weather, time, species, and housing, as well as manure handling system, feed type, and management method. The emission factor is typically used to refer to emission expressed in terms of animal unit. Employing specific practices can reduce ammonia, hydrogen sulphide and odour emissions. A number of practices are available but not all are suited for all operations. Careful consideration and selection will help ensure that you achieve the desired results and reduce the impact of harmful gases on animal, and worker.

Keywords: - Air quality, Ammonia, Hydrogen sulphide, Particulate matter, odour, Volatile organic compound.

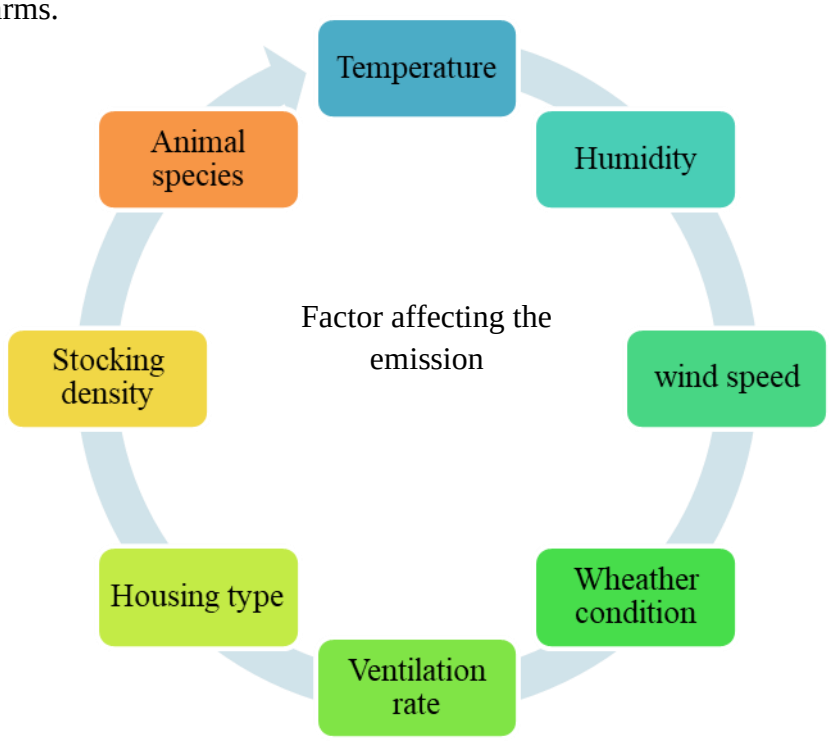
Introduction

Air quality define as the degree of pollution of clean air, air quality can be determined by measuring the concentration of pollutants in the air. Air pollutants are compounds or materials that, when suspended in or mixed with air, degrade air quality and impair its utility for any of a wide range of purposes (Zhang *et al.*, 2005). Airborne contaminants from animal production processes include gases, odour, dust, and microbes. Decomposition of animal and poultry dung produces gases and odours. Particulate particles and dust are mostly made up of feed and animal debris, such as hair, feathers, and faeces. (Casey *et al.*, 2014). The health, welfare, and performance of animals, as well as the health of farm personnel doing various activities in livestock buildings, are all directly affected by air quality. Additionally, air pollutants released by livestock buildings can degrade the quality of

the air, water, and soil, thus endangering the health of neighbouring residents. Livestock farming is a source of many different emissions (Auvermann *et al.*, 2006). Ammonia, methane, nitrous oxide, and particles like dust and microbes are among the airborne pollutants. In addition, air ventilation, slurry, and/or solid manure from animal buildings may release additional potentially dangerous compounds such heavy metals, antibiotic residues, and disinfectant component.

Emission

The rate at which gases or particles are released into the surrounding air is referred to as emission, and it is typically stated in terms of mass per unit time. Emission rates are determined by multiplying the concentration of a component by the volumetric flow rate at which a component at a given concentration is being emitted (Singh *et al.*, 2020). Barns, manure storage unit, feedlot surfaces, silage heaps, manure applications and dead animal compost structures are all sources of emissions in livestock farms.



Ammonia emission from livestock production

Nitrogen in the urine and faeces causes ammonia to be produced. Ammonia also results from the biological and chemical breakdown of urea, uric acid, and protein in manure during storage and decomposition. Urease enzymes found in faeces can quickly hydrolyze urea in the urine of mammals to produce ammonia and carbon dioxide (Atia and Amrani, 2004).

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Level of ammonia in different buildings

Condition	Ammonia level concentration
Well ventilated	10-20 ppm
Liquid manure	50 ppm
Solid manure	>50 ppm
Not well ventilated	100-200 ppm

Hydrogen sulphide emission from livestock production

Hydrogen sulfide is formed by bacterial sulfate reduction and the decomposition of sulfur containing organic compounds in manure under anaerobic conditions (Arogo *et al.*, 2000).

Hydrogen sulphide emissions rate from animal housing

Species	Ventilation	Emissions rate (µg/m2 s-1)
Dairy	Natural	0.18-0.97
Poultry	Mechanical	0.08-0.30
Swine	Mechanical	1.9-26.9
	Natural	0.2-8.2

Particulate matter and dust

Particulates in animal production include soil particles, feed leftover, dried skin, hair or feathers, dried feces, bacteria, fungi, and endotoxins (Koon *et al.*, 1963). Feed was found to be the primary component of the dust in animal housing. Flooring design has been shown to significantly affect the airborne dust levels; solid floors have much higher levels than open-mesh floors. Particulate matter mainly responsible for respiratory problem in animals and workers (Dawson, 1990).

Particle penetrability according to size

Particle size	Region to which penetration can occur
> 11 µm	Captured in the nostrils.
1.1-7 µm	Secondary bronchial section
0.65-1.1 µm	Bronchioles

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0.43-0.65 µm	Alveolar

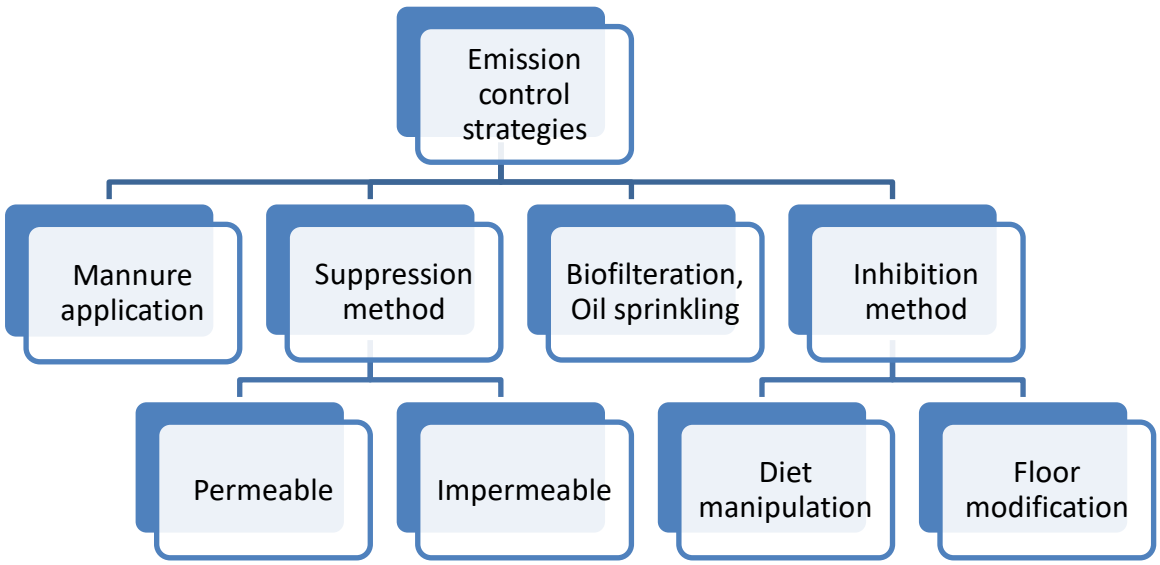
Odours

The majority of odors associated with cattle and poultry are produced by the anaerobic breakdown of animal wastes such manure (faeces and urine), spilled feed, bedding materials, and wash water. The organic matter in these wastes is microbial transformed into non-odorous end products under aerobic conditions (Westerman and Zhang, 1997). However, in anaerobic environments, the decomposition of organic compounds results in the production of odorous volatile compounds that is metabolic intermediates or end products of microbial processes (Zhu *et al.*, 2000). Since the sense experience is capable of easily detecting odours, odour emissions from animal production facilities are one of the most crucial factors to take into account when setting setback distances from neighbours. Furthermore, odors are often perceived as indicators of airborne pollutants.

Volatile organic compounds (VOCs)

The principal VOCs released during animal feeding operations include carboxylic acid, alcohols, carbonyls, phenolic compounds, sulphur and nitrogen-containing species. VOCs are organic chemicals with high vapour pressure at normal room temperature; their high vapour pressure arises from a low boiling point. Alcohol and carboxylic acid are dominating VOC concentration, sulfur containing and phenolic species are more important in term of odor.

Ammonia emission control strategies



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Conclusion

The use of confinement system brought not only increase in productivity but also resulted in potential physical, chemical and biological health hazards to both farm workers and animals. Substantial research has been conducted to quantify the air quality and emission rates from livestock and poultry facilities and waste management systems. Employing specific practices can reduce ammonia, hydrogen sulphide and odour emissions in a livestock farm improve welfare of animals. Careful consideration and selection of best mitigation strategies will help ensure you achieve the desired results. From this review of the literature, there is seen to be a clear need for the development and use of standard methods for measuring emission rates of odor, dust and gases from livestock and poultry facilities.

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