Odour Control and Reduction in a Pig Feeder Barn Using an Enclosed Dunging Area and Biofiltration

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BIOFILTRATION OF ODOURS

BACKGROUND

Biofiltration is one of the techniques used to reduce odours produced in livestock facilities. It uses a filter capable of sustaining microbial life to treat odourous air. Microorganisms in the biofilter break down the odours in air flowing through the system.

Several factors influence the performance of biofilters. These include:

Filter media

Airflow

Moisture

Temperature

Nutrient availability

Filter Media

The type of filter media used in a biofilter is crucial for optimum performance. The filter media should provide a suitable environment for microorganisms to thrive.

Some desirable properties of filter media include:

- Capacity to retain moisture necessary for the survival of microorganisms
- Sufficient porosity to enable easy flow of air through the biofilter. This influences the size and ultimately the cost of the fan used to deliver the air flow.

Peatmoss, wood chips, compost and perilite are some common filter media used in biofilters.

A fan located in the hut draws air from the treatment plant (building on the left) through some insulated ductwork.

In the hut, the air is warmed to the desired temperature before being directed through the biofilters

Airflow

When designing biofilters it is necessary to take into consideration the rate at which odourous air will flow through the system. For example, in a pig barn, airflow rate through the biofilters is determined by the capacity of the exhaust fans.

If the airflow rate through the biofilter is too high, the odourous air travels through the filter media rapidly. This means that a smaller volume of odourous gases would be available for breakdown by the microorganisms.

Moisture

Moisture is essential for the survival of microorganisms. Thus, a biofilter should always retain sufficient moisture in the filter media to support microbial life.

It is also important to ensure that moisture distribution through the media is uniform in order to keep the biofilter performance high.

Temperature

Temperature of the filter media also influences performance of biofilters. As a general rule, at temperatures above refrigeration microbial activity is enhanced. It is important to note though that different microbial populations thrive best over specific temperature ranges.

Nutrient Availability

Another requirement essential for the survival of microorganisms is the availability of nutrients, including minerals.

Nutrient availability may be affected by the type of filter media in use. For example, compost from animal manure is typically richer in its nutrient value compared with peatmoss. Thus, depending on the type of filter media, supplemental nutrients may be required.

RESEARCH

The University of Alberta, in collaboration with Alberta Research Council (ARC) and Alberta Agriculture Food and Rural Development (AAFRD), is conducting research to determine optimum operational conditions for biofilters.

Currently, two biofilters located at the Swine Centre, Edmonton Research Station, University of Alberta, are in use to evaluate the effects of temperature and supplemental mineral nutrition on odour reduction from a pig manure treatment plant..

Test Conditions

Temperature	15 ˚C, 22.5 ˚C, 30 ˚C
Nutrients	chloride and phosphate salts

Operational Conditions

Filter media	1000 L of a homogeneous mixture of 75% polystyrene and 25% peatmoss
Airflow rate	100 L/s (200 cfm) through each biofilter
Moisture	The volume of water applied to each biofilter is dependent on the target temperature and relative humidity of the odorous air from the treatment plant.
Duration	28 days

Monitored and Measured Conditions

Percentage Odour Reduction

Temperature in Filter Media

Moisture Content in Filter Media

Pressure Drop across Filter Media

Identification of Microbial Populations

ENCLOSED DUNGING AREA (EDA)

BACKGROUND

The use of an EDA as a strategy for odour control is currently undergoing investigation by the University of Alberta in collaboration with the Prairie Swine Centre, ARC and AAFRD.

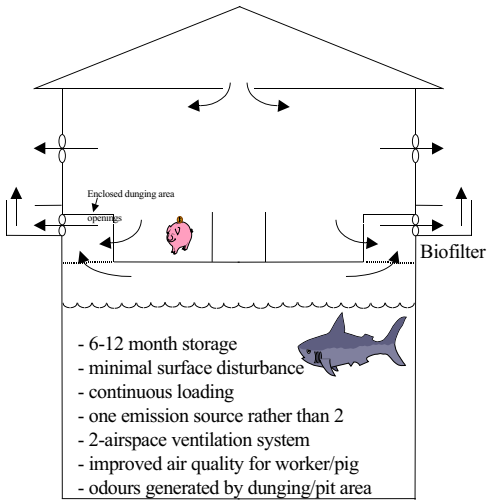
Typically, an enclosure (EDA) is constructed over the slats in a partially slatted floor pig barn. This strategy attempts to take advantage of the fact that pigs reared on partially slatted floors will defecate and urinate in the slatted area of the pen floor. It is also in this area that the most odours are generated.

A pen with an EDA in the background. On either side of the front panel are doorways with mudflap curtains. A 200 L biofilter is mounted On top of the EDA.

In the foreground is a crowding-panel which is used to control the floor space available to the pigs.

Thus, an EDA helps to contain the odourous gases within a confined area thereby isolating the odours from other parts of the pen and room.

The odourous air contained within the EDA may either be exhausted outside the building or, preferably, filtered with a biofilter.



A pig entering an Enclosed Dunging Area (EDA) through one of the doorways.

RESEARCH

The University of Alberta is conducting research to determine the effectiveness of using EDAs to maintain air quality in pig barns with partially slatted floors.

Two rooms in a grower/finisher barn located at the Swine Centre, Edmonton Research Station, University of Alberta shall be used for the study.

Each room contains 8 pens. In one of the rooms, an EDA is constructed in each pen. The second room is used as a control.

Odour samples will be collected at the exhaust fans in each room, within each EDA, and at the exhaust of each biofilter fan.

Enclosed Dunging Areas (EDAs) and biofilters shown in the background of one of the rooms.

ACKNOWLEDGEMENTS

Canadian Pork Council
Alberta Pork Producers
Saskatchewan Pork
Alberta Agriculture Research Institute
Ontario Pork
Beaver Plastic
SunGro Horticulture
Swine Centre, University of Alberta

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