

# Possibilities for Reducing Gas-Emission of Animal Husbandry

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## Abstract:

Our Institute has dealt intensively with development of animal husbandry, technical economical examination of animal farms and case studies of environmental loading since 1960s. A new technology of pig husbandry has been adapted for five years in our country by us. This is the littered sloping floor system that was studied in field tests by us cooperating with German experts. The results were favourable, eg. straw consumption was 0.2 – 0.3 kg per head and day; daily weight gain reached the value of 800 g while the feed conversion efficiency was 2.8 – 3.0 kg per kg. Last year we adjusted a new instrument for measuring gas-concentration to the duty of our research. Last year we accomplished examination on two sites, one was slurry technology and the other was the littered sloping floor system in reconstructed houses. Measured average gas concentrations were below the limit values eg. CO<sub>2</sub> values were between 1650 – 1750 mg/m<sup>3</sup>, and NH<sub>3</sub> ones were between 4,5 – 7,2 mg/m<sup>3</sup>. These new technologies with less environmental pollution are suitable for the Hungarian agriculture and are harmonising with the new directives of animal and environmental protection.

*Keywords: emission, pig, ammonia, environment*

## Introduction:

Our pork producing industry have lagged behind the developed west countries since the early 80's while some firm marketable to the best pork producing plants of EU. It is because of the deterioration of mechanical-technological conditions and reduction of the number of pigs. Therefore mechanical and technical innovation is required in this industry in order to all national pig husbandry be marketable in the EU (Horn,1999). Decisive importance at development of buildings and technologies of pig husbandry that it met the biological requirements of pig better and better (Barótfi,1998).

In point of view evaluation and development of new technologies and building construction the gas emission is an important factor in our days. From livestock manure originated on animal farms especially on ones that possess huge number of animals lot of nitrogen get to the air as ammonia (NH<sub>3</sub>) or different Nitrogen oxides. Ammonia emission beside washed out nitrogen and denitrification<sup>3</sup> is one of the most important Nitrogen losing in the Agriculture (Borka,1998).

Lots of national and international, (Europewide) researches have dealt with environmental effects and extent of ammonia emission and opinions are different (Klaassen,1994). It is generally admitted that ammonia emission contributes to acid rain, odour effect is significant and the main source of emission is livestock farming. Hungarian researches used a foreign study to estimate the national ammonia emission. This ammonia emission model was adapted for Hungarian circumstances in 1999. In accordance with their results the national collective ammonia emission of pig, cattle and poultry » 18885,77 tNH<sub>3</sub>-N/year (Fenyvesi,1999). Farms who raise pigs must face up to a lot of problem on the point of view environment protection. For example, consumption of manure or its

utilization for plant cultivation, odour and ammonia emission. Experts have to provide technologies for farmers that positively influence animal welfare and don't damage economical indexes. Most part of ammonia (cca 30 %) leave during storage and (cca 30-50 %) is emitted at spreading on farmland, Volume of ammonia emission connected to outgoing air is sometimes overestimate (Jungbluth,1996).

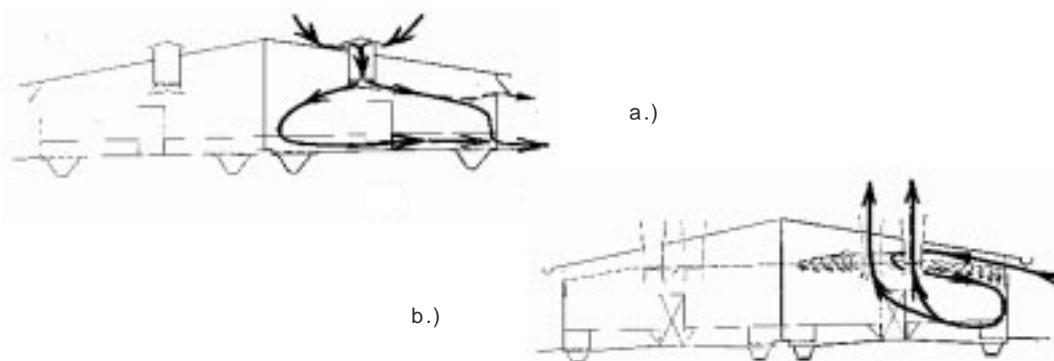
Animal husbandry technology has a very considerable role in that how much ammonia is originated per number of animals.

Summing up features of ammonia emission inside the loading of environment of animal husbandry and summing up its effects we can say:

- 1.) Livestock farming mostly pollute the air with the decomposition parts of manure, according to some estimates 80-90 % of total ammonia emission can be originated from it.
- 2.) Place of gas production:
  - buildings
  - place of handling and storage of manure
  - during the spreading and after that from the land
- 3.) Effects of gas production
  - environmental damages of pollutant gases in the atmosphere
  - odour effects
- 4.) Reasons of researches of ammonia emission
  - nitrogen losing
  - point of view of environmental protection
  - animal health
  - human hygienics (odour effect)

## Circumstances and method

Some pig farm changed their technology because of the pressing technological advance. Main reasons were the protection of animal and environment, changes of relations of production, economical and other factors. So pig farmers moved towards more environment friendlier, less water consuming breeding methods with their existent slurry technologies or changed the whole technology. Field tests and spreading of an advanced, EU conform technology has started in our country at the same time with cooperation FVM Műszaki Intézet (HIAE) and German researchers. This littered slopping floor system mixes the centuries old (littered) and the new industrial-like housing systems. This system requires custom-built floor (house) construction. Under the building or rebuilding of pig houses machines and equipment's of new manure removing-, feeding- and ventilation systems can be built. Last year the Agricultural Cooperation of Jászapáti reconstructed



one of its pig houses that used slurry housing system. (1 figure). Following the field test of this new technology we could examine the new ventilation system and we could measure gas-emission here.

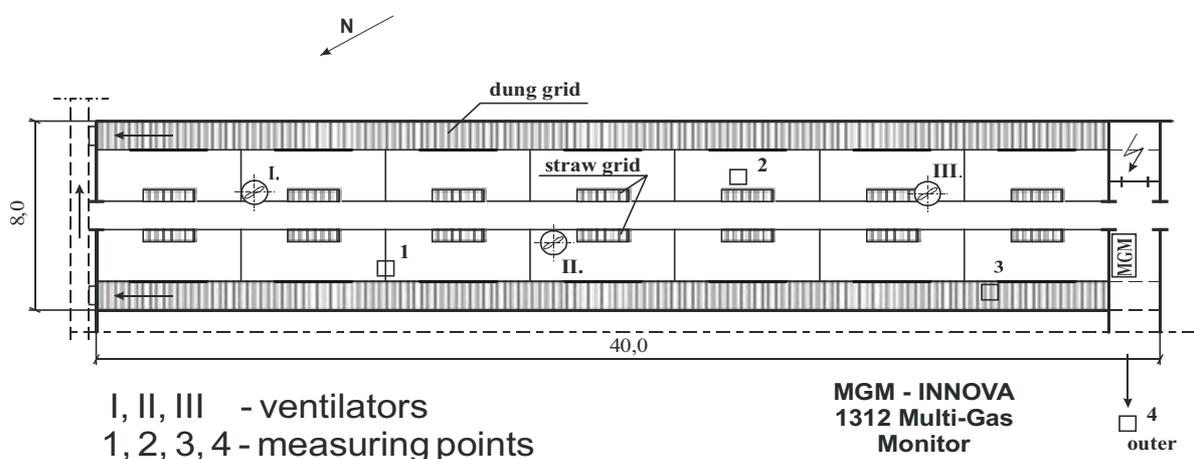
*Fig 1. Mezõpanel system fattening house, before (a) and after (b) rebuilding*

Comparing it to conventional littered technology the fundamental part of the system is the slotted (5-7 %) floor, in which the bedding material and manure is trod down to the manure canal located at the end of the slope. Regularly the manure leaves directly into a trailer or to a storage place made of concrete from it by a mechanical manure mover equipment. Pigs themselves pick out straw from straw grating so in that way that “bed down” themselves. In this cooperation the under-pressure ventilation system has been changed to overpressure one.

We have been changing out a 2 years long research task on this rebuilt housing system and its emission correlations.

### Measuring method

Last year we adjusted a new instrument for measuring gas concentration to the duty of our research. We worked out a measuring system in details so we can measure gases (ammonia, carbon-



dioxide, methane) emerging in animal houses. This system is suitable to detect gas concentration of sample coming from any location, even over 60 m of the house.

*Fig 2. Location of measuring points in a fattening house*

Main parts of the measuring system:

- INNOVA 1312 Multi-Gas Monitor
- CBISS MK-2 sampling system (8 channel)
- THOMAS air pump
- TESTOSTOR-175 sampler
- PC
- Sampler tubes

### Results, conclusion

In the examination term the measured average values of gas concentrations were below the

limit values and neither the maximum values overstep them.

Denomination	Unit of measure	Fattenings			Limit value	
		I.	II.	III.		
T <sub>k</sub>	Av.	°C	26	25	25	
T <sub>b</sub>	Av.	°C	27	27	28	18-20
φ <sub>k</sub>	Av.	%	58	53	55	
φ <sub>b</sub>	Av.	%	59	50	53	60-75
CO <sub>2</sub>	Av.	mg/m <sup>3</sup>	1,647	1652	1,777	5500
NH <sub>3</sub>	Av.	mg/m <sup>3</sup>	7,05	4,63	7,14	21
CH <sub>4</sub>	Av.	mg/m <sup>3</sup>	11,8	14,43	8,80	-
<b>Emission results</b>			<b>I.</b>	<b>II.</b>	<b>III.</b>	
Air-flow [m <sup>3</sup> /h]			39810	50370	25428	
CO <sub>2</sub> [g/h,AU]			560	538	580	
NH <sub>3</sub> [g/h,AU]			3,68	2,25	3,5	

Table 1: Summarizing table of the air characteristics and emission results according to our calculations of CO<sub>2</sub> and NH<sub>3</sub> emission:

**Footnotes:**  
 I.: Litterless fattening house with flushing slurry removal system in Jászapáti.  
 II.: Litterless fattening house with totally slotted floor and under floor slurry storage system in Kisigmánd. (They use odour decreasing agent: Alltech-DeOdorase, USA of origin)  
 III.: Littered fattening house with slope floor and mechanical manure removal system in Jászapáti.  
 T<sub>k</sub>; T<sub>b</sub>: outer and inner temperature  
 j<sub>k</sub><sup>k</sup>; j<sub>b</sub><sup>b</sup>: outer and inner relative humidity  
 CO<sub>2</sub><sup>k</sup>; NH<sub>3</sub><sup>b</sup>; CH<sub>4</sub><sup>b</sup>: inner concentration of the nominated gases

This results can be account with the differences between ventilation system and measuring conditions. For the point of view of ventilation we found dead spaces in the rebuilt house where the fresh air couldn't arrive at the level of pigs nose. We made diagrams of process of changing gas concentrations against time (24 houses). They shows the changes of gas emissions intensity in different periods of the day.

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