Literature review on NH$_3$ and GHG emitted by pig production
Part 2: storage, treatment and spreading

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Part 2 – storage, treatment and spreading

Building

Storage

Spreading and treatment
Reminder:
- The database includes data on gaseous emissions
- A data concerns gaseous emissions of NH3 or GHG (CH4, N2O) and CO2

Data from 22 countries

<table>
<thead>
<tr>
<th>Nb data</th>
<th>NH3</th>
<th>N2O</th>
<th>CH4</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
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<td>58</td>
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</tbody>
</table>

Causes of exclusions for treatment:
- Type of manure (slurry with straw)
- No information on manure composition
- Type of manure (mixed of pig and cattle)
- Time of experimental monitoring (< 1d)
- Type of manure (slurry with straw)
- No information on manure composition
- Type of storage (non representative of French conditions : lagune)
Informations collected in the database

- Information on the gaseous emissions
  - EF with the unit of the article
  - EF with standard unit
  - Emissions in % of the N or C input

- Metadata:
  - Nb for storage : 72
  - Nb for treatment : 62
  - Nb for spreading : 73

Building informations:
- Type of manure
- Physiological stage
- Feeding strategies
- Type of building

Slurry mass balance:
- N default
- C default
- K2O default
- P2O5 default

Manure composition:
- DM
- SV
- SS
- COD
- C/N
- N tot
- TAN
- C tot
- C org
- P2O5
- K2O
- pH

Geography:
- Period of storage
- Localisation
- Time of storage
- Outside temperature
- Rain

Type of storage:
- Quantity of manure stored
- Amount of N stored
- Surface of storage
- Type of inputs
- Frequency of inputs
- Cover (Y/N)
- Type of cover
- Brewing
- Temperature of the manure

Gaseous measurements and analysis:
- Type of measurements
- Time of measurements
- Frequency of measurements
- Methodology of sampling
- Methodology of analysis
- Type of concentration measured
- Type of concentration calculation

Flow rate:
- Type of flow
- Methodology of measurement
- Value of the flow
- Air speed on the slurry surface in the dynamic tunnel

Emissions:
- Type of emissions calculated
- Methodology
- Extrapolation

Exemple of the storage

66th EAAP, Warsaw (Poland)
Emissions for storage (1)

- **Unit selected to express results**: \(/m^3/d\) or \(/t/d\) = the main unit of the publications except for the emissions of NH$_3$ for the slurry (in m$^2$/d)

- **N emissions** of the solid manure higher than for the slurry.
  - Partly due to the duration of the emissions (less than one month for the solid manure and for several months for the slurry).
  - Still the emissions expressed in % of N input are higher for solid manure (17% of the N input) than for slurry (6%)

- **CO2 emissions** of the solid manure also due to the degradation of straw.
The results confirm the incidence of main factors on ammonia emissions:

- presence of cover
- temperature
- air speed on the slurry surface

Main technique used to measure N emissions for slurry is a dynamic tunnel. Very few publications with the information on air speed and it is shown to be very important.

Importance of the metadata (average composition of the slurry higher for some modalities because of fattening pig slurry).
Three main treatments in publications
- Slurry
  - Biological treatment
  - Composting with straw
- Solid manure
  - Composting

93 data concerning biological treatment but:
- A lot of phases (phase separation, reactor, decantation, storage of solid phase of separation, storage of sludge, storage of supernatant)
- All data come from a unique scientific team

The data for treatment concern very different processes: few data per process
Emissions for Treatment (2)

- **N emissions** in g N/m³(or t)/d
  - Mainly N emissions on NH3 form
  - More NH3 emissions for the slurry composting with straw

- **C emissions** in g C/m³(or t)/d
  - As for the storage, very low CH4 emissions for manure with straw

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Mainly data on slurry application (235 data selected vs 14 data for solid manure)

- For all the different types of spreading

Data selected

Emissions for spreading (1)

- % data / type spreading for solid manure
  - Manual application
  - Solid manure spreader
  - Injection

- % data / type spreading for slurry
  - Manual application
  - Broadcast
  - Band spreading
  - Injection

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Emissions for spreading (2)

**N emissions** in g N/ha/d

- Mainly N emissions on NH₃
- Emissions higher for slurry than for solid manure but with a very important variability

**C emissions** in g C/ha/d

- No CH₄ emissions during spreading.
- No data on CO₂ emissions of solid manure during spreading
Results confirm the incidence of the type of spreading on NH3 emissions

Again: importance of metadata on the application rate and the nitrogen input per ha
Conclusions – Part 2

- **N : main losses on NH3**
  - during storage of solid manure (18%)
  - During spreading of slurry (16%) and solid manure (14%)
  - During treatment by composting slurry with straw (30%)

- **Important lack of data**
  - Less than 10 data for
    - storage of solid manure
    - spreading of solid manure
    - For all process of treatments
  - Composition of slurry, measurement duration, air speed for storage
Global conclusions

- Several steps: building, storage, spreading and treatment
- A big lack of informations
- Most of the times on very influential parameters (nutritional strategy, manure management, etc.)
- Great technical diversity in pig farms = increasing the number of EF to define pig farms in inventories
- Data base = useful tool to identify « black boxes » and to achieve new studies...
Updating our tool

Merging with others database developed by partners

Pigs but also poultry and cattle production

Not only NH₃ and GHG but also on particles and odors

Future tool in English

One name to remember: **ELFE**

[https://www6.inra.fr/animal_emissions/ELFE](https://www6.inra.fr/animal_emissions/ELFE)
Thank you for your attention

www.ifip.asso.fr