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Effect of manure treatment on greenhouse gas emissions from agriculture: the case of the Netherlands

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Introduction

- The main manure treatment technologies used in the Netherlands which affect greenhouse gas emissions are identified.
- Actual and expected amount of manure treated is presented.
- The main emission sources related to manure treatment systems are identified.
- Measurement methods to estimate emissions from these sources are described.
- Technologies are rated based on available emission data. This refers to both the treatment process and the rest of the manure chain (storage and application of manure products).

Manure treatment techniques

Figure 1 and Table 1 give an overview of the main treatment techniques in the Netherlands with the actual and expected amounts of manure involved in 2015 [1], when manure treatment is forced by legislation.

Figure 1. Manure treatment in the Netherlands.

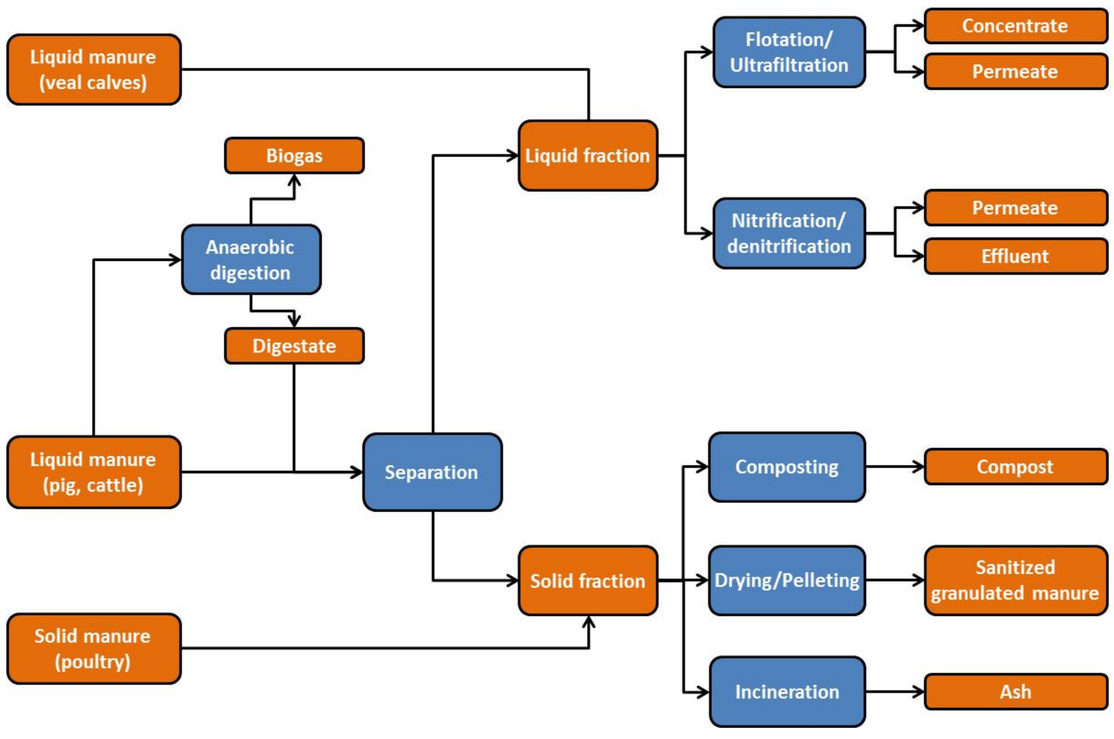

Table 1. Overview of the main treatment techniques in the Netherlands with the amount of manure treated in 2009 and expected treated manure in 2015 [1].

Treatment	Main type of manure	Amount of manure treated in 2009 (ton)	Expected amount of manure treated in 2015 (ton)
Anaerobic digestion	Pig and cattle manure	1 200 000	3 000 000
Nitrification/denitrification	Veal calf manure	795 000	795 000
Incineration	Poultry manure	353 000	400 000
Composting/drying/pelleting	Poultry and horse manure and solid fraction	302 000	405 000
Production of mineral concentrates			
Flotation	Pig manure	200 000	850 000
Ultra filtration	Pig manure	50 000	95 000
Solid/liquid separation	Digestate from anaerobic digestion	152 000	2 700 000
	Cattle manure	n.a.	500 000

Emission sources

Greenhouse gases (and other pollutants) may be emitted from a large number of emitting sources (Figure 2). These sources should be characterized to determine the effect (Table 2) of applying a technique on the emissions of methane (CH_4), nitrous oxide (N_2O) and other pollutants (e.g. ammonia, NH_3).

Figure 2. Example of different emission sources and measurement equipment at a manure treatment installation [2].

Table 2. Effect (+: emission increase; -: emission reduction; +/-: effect is not consistent; n.a.: not available) of applying a technique on the emissions of CH_4, N_2O and NH_3 during the whole manure chain. Based on a literature study reported in [1].

Treatment	Methane (CH_4)	Nitrous oxide (N_2O)	Ammonia (NH_3)
Anaerobic digestion	-	+/-	+/-
Nitrification/denitrification	+/-	+	-
Incineration + DeNOx	-	-	-
Composting (intensive, incl. air scrubber)	-	+	-
Drying/pelleting	-	+	+
Production of mineral concentrates	n.a.	+	n.a.
Solid/liquid separation	-	+	+/-

Conclusive remarks

- Reliable emission factors for CH_4 and N_2O from the main treatment processes applied in the Netherlands are not sufficiently available.
- To improve these emission factors, two options are available:
  1. More emission measurements
  2. Model approach based on average emission factors for each link of the chain
- The current model, limited to the treatment process only, should be extended to the whole manure chain.

References

[1] Hoeksma, P., J. Mosquera and R.W. Melse (2012). Monitoring methane and nitrous oxide reduction by manure treatment. Wageningen UR Livestock Research Report 627.

[2] Mosquera, J., J.M.G. Hol, P. Hoeksma and C.M. Groenestein (2010). Emission measurements from manure treatment installations (in Dutch). Wageningen UR Livestock Research Report 402.

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