SINGLE-IMPACT FICHE
MANURE PROCESSING TECHNIQUES

IMPACT: EUTROPHICATION (LCA)

Data extracted in July 2021
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Note to the reader: This fiche summarises the effects of Manure processing techniques on EUTROPHICATION (LCA). It is based on 1 synthesis paper[1] containing 23 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

Manure processing techniques, namely anaerobic digestion of manure, have variable effects on eutrophication potential according to the reviewed synthesis paper (**Table 1**).

The table below shows the number of synthesis papers with statistical tests reporting i) a significant difference between the Intervention and the Comparator, that is to say, a significant statistical effect, which can be positive or negative; or ii) a non-statistically significant difference between the Intervention and the Comparator. In addition, we include, if any, the number of synthesis papers reporting relevant results but without statistical test of the effects. Details on the quality assessment of the synthesis papers can be found in the methodology section of this WIKI.

- According to the reviewed synthesis paper, anaerobic digestion of manure alone (mono-digestion) had a positive effect (i.e. a decrease) on eutrophication potential, when compared with conventional manure management without treatment.
- Non-significant effects on eutrophication potential resulted in the case of anaerobic co-digestion of manure and other substrates and anaerobic digestion coupled to integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping).

The selected synthesis paper included studies conducted in Europe (see **Table 2**).

Table 1: Summary of effects. Number of synthesis papers reporting positive, negative or non-statistically significant effects on environmental and climate impacts. The number of synthesis papers reporting relevant results but without statistical test of the effects are also provided. When not all the synthesis papers reporting an effect are of high quality, the number of synthesis papers with a quality score of at least 50% is indicated in parentheses. The reference numbers of the synthesis papers reporting each of the effects are provided in **Table 3**. Some synthesis papers may report effects for more than one impact or more than one effect for the same impact.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease eutrophication (lca)	Eutrophication (LCA approach)	Anaerobic digestion	Conventional management	1	0	1	0

QUALITY OF THE SYNTHESIS PAPERS

The quality of each synthesis paper was assessed based on 16 criteria regarding three main aspects: 1) the literature search strategy and primary studies selection; 2) the statistical analysis conducted; and 3) the evaluation of potential bias. We assessed whether authors addressed and reported these criteria. Then, a quality score was calculated as the percentage of these 16 criteria properly addressed and reported in each synthesis paper. Details on quality criteria can be found in the methodology section of this WIKI.

2. IMPACTS

The main characteristics and results of the 1 synthesis paper is reported in **Table 2** with the terminology used in those papers, while **Table 3** shows the reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**. Comprehensive information about the results reported in each synthesis paper, in particular about the modulation of effects by factors related to soil, climate and management practices, are provided in the **summaries of the synthesis papers** available in this WIKI.

Table 2: Main characteristics of the synthesis paper reporting effects on Eutrophication (LCA).

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref1	Dairy farm manure	Global	23	1) Anaerobic digestion (general); 2) Anaerobic monodigestion (only manure); 3) Anaerobic mono-digestion (only manure) + integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping); 4) Anaerobic co-digestion (manure + other substrates)	No treatment	Eutrophication	All types of waste-to-energy (anaerobic digestion) pathway could have a consensus on reducing eutrophication. Uncertain results (for lack of sufficient data) resulted for anaerobic co-digestion.	62%

[1] Synthesis research papers include either meta-analysis or systematic reviews with quantitative results. Details can be found in the methodology section of the WIKI.

Table 3: Reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease eutrophication (lca)	Eutrophication (LCA approach)	Anaerobic digestion	Conventional management	Ref1		Ref1	

3. FACTORS INFLUENCING THE EFFECTS ON EUTROPHICATION (LCA)

Table 4: List of factors reported to significantly affect the size and/or direction of the effects on Eutrophication (LCA), according to the synthesis papers reviewed.

Factor	Reference number
NA	Ref1, Ref1, Ref1, Ref1, Ref1, Ref1, Ref1 and Ref1

4. KNOWLEDGE GAPS

Table 5: Knowledge gap(s) reported by the authors of the synthesis papers included in this review.

Ref Num	Gap
Ref1	It was not possible for the present study on account of huge differences among publications and the lack of key information.

5. SYNTHESIS PAPERS INCLUDED IN THE REVIEW

Table 6: List of synthesis papers included in this review. More details can be found in the summaries of the meta-analyses.

Ref Num	Author(s)	Year	Title	Journal	DOI
Ref1	Zhang J., Wang M., Yin C., Dogot T.	2021	The potential of dairy manure and sewage management pathways towards a circular economy: A meta-analysis from the life cycle perspective	Sci. Total Environ. 779, 146396.	10.1016/j.scitotenv.2021.146396

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