

SINGLE-IMPACT FICHE

MANURE PROCESSING TECHNIQUES



IMPACT: ECOTOXICITY

Data extracted in July 2021

Note to the reader: This fiche summarises the impact of manure processing techniques on ECOTOXICITY. It is based on 1 peer-reviewed synthesis research paper¹, including 23 individual life-cycle assessment (LCA) studies about the overall manure and farming sewage waste-to-energy pathway.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

Manure processing techniques, namely anaerobic digestion, have variable effects on ecotoxicity according to the configuration of manure processing (see **Table 1**). The number of synthesis papers reporting positive, negative or no effect is based on the statistical comparison of the intervention and the control. The number of synthesis papers reporting relevant results, but without statistical test of the effects is labelled as "uncertain".

Anaerobic digestion of manure alone (mono-digestion) showed a positive effect (decrease of ecotoxicity), when compared to conventional manure management without treatment.

In contrast, the reviewed synthesis paper reported uncertain results for anaerobic co-digestion of manure and other substrates, and of mono-digestion coupled to integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping), due to lack of data to conduct a proper statistical analysis.

The reviewed synthesis paper include data collected in Europe (see **Table 2**).

Table 1. Summary of effects. The effect with the higher score is marked in bold and the cell coloured. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be found in the next section.

Impact	Intervention (Technique)	Positive	Negative	No effect	Uncertain*
Decrease ecotoxicity	Anaerobic digestion	1 (1)	0	0	1 (1)

* Number of synthesis papers that report relevant results but without statistical test comparison of the intervention and the control.

- QUALITY OF THE SYNTHESIS PAPERS: *The quality score summarises 16 criteria assessing the quality of three main aspects of the synthesis papers: 1) the literature search strategy and studies selection; 2) the statistical analysis; 3) the potential bias. Details on quality criteria can be found in this document [→](#).*

As shown in the "Quality score" in **Table 2**, the quality level of the synthesis paper was of 62%. The following quality criteria were not satisfied in this synthesis paper: "Number of studies at each step", "Individual effect sizes", "Dataset available" and "Publication bias analysed".

2. IMPACTS

¹ Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results


The main characteristics and results of the synthesis papers are summarized in **Table 2**. Detailed results of each synthesis study are reported in the summary reports .

Table 2. Main characteristics of the synthesis papers reporting impacts of manure processing techniques on ecotoxicity. The references are ordered chronologically with the most recent publication date first.

Reference	Population	Scale	Num. papers	Intervention (technique)	Comparator	Metric	Conclusion	Quality score
Zhang, J; Wang, M; Yin, C; Dogot, T; 2021	Dairy farm manure	Global	23	Manure and farming sewage waste-to-energy pathway (anaerobic digestion, including mono-digestion (only manure), co-digestion (manure+ other substrates) + integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping).	No treatment. The only difference of reference and treatment system is implementing an improved strategy. The rest of the two systems remains the same, such as functional unit, system boundaries, LCA methods adopted, and farming practices.	Ecotoxicity (LCA approach)	All types of waste-to-energy (anaerobic digestion) pathways could have a consensus on reducing ecotoxicity. However, anaerobic co-digestion and anaerobic mono-digestion + integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping) did not show significant effects, for lack of data.	62%

3. KNOWLEDGE GAPS

Zhang et al.	It was not possible for the present study on account of huge differences among publications and the lack of key information. It was not possible to conduct a proper statistical analysis for anaerobic co-digestion and for anaerobic mono-digestion combined with integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping) due to the lack of data.
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4. SYSTEMATIC REVIEW SEARCH STRATEGY

Keywords	<p>TOPIC: (manure OR slurry OR digestate OR (digested near/3 manure)) AND TOPIC: (management OR storage OR lagoon* OR "anaerobic digest*" OR tank* OR treatment OR process* OR technolog* OR techni* OR (soil near/3 application) OR (soil near/3 distribution) OR (soil near/3 amend*) OR biogas OR precision) AND TOPIC: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")</p> <p>or</p> <p>TITLE-ABS-KEY: (manure OR slurry OR digestate OR (digested W/3 manure)) AND TITLE-ABS-KEY: (management OR storage OR lagoon* OR "anaerobic digest*" OR tank* OR treatment OR process* OR technolog* OR techni* OR (soil W/3 application) OR (soil W/3 distribution) OR (soil W/3 amend*) OR biogas OR precision) AND TITLE-ABS-KEY: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")</p>
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Search dates	No time restrictions
Databases	Web of Science and Scopus, run in July 2021
Selection criteria	<p>The main criteria that led to the exclusion of a synthesis paper were if the paper: (1) was out of the scope; (2) did not deal with manure processing techniques or dealt with other stages of manure management (e.g. storage, land application, animal housing techniques); (3) reported studies with absolute values of emission factors, without comparing processing techniques with a reference management scenario; (4) did not clearly state the intervention and comparator; (5) was not either a systematic review or a meta-analysis; (6) was not written in English. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on paper-by-paper basis.</p> <p>The search returned 269 synthesis papers potentially relevant for the practice object of our fiche. Searches for other farming practices added another 8 potentially relevant synthesis papers. From the 277 potentially relevant synthesis papers, 207 were excluded after reading the title and abstract, and 53 after reading the full text according to the above-mentioned criteria. Finally, 17 synthesis papers were selected for manure processing techniques, from which 1 was relevant for this impact.</p>