Greenhouse gas emission and reduction in biological treatment of agricultural organic solid wastes toward resource recycling

*Submitted to **Agronomy***

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Supplementary materials and methods

Data acquisition

Two separate literature searches were conducted for composting and anaerobic digestion (AD) studies published between 2000 and 2024. Peer-reviewed publications were retrieved from Web of Science, Google Scholar, and the China National Knowledge Infrastructure (CNKI) using the search terms (TS=(("composting" OR "anaerobic digestion") AND ("greenhouse gas emission" OR "GHG" OR "CH_4" OR "N_2O" OR "global warming potential")). The search was not restricted by language, although the final corpus included only publications in English and Chinese (last searched on 15 March 2026). A PRISMA flow diagram was used to document the study selection process (Figure S1).

Studies were included if they met all of the following criteria: (I) original experimental studies, field monitoring reports, or life cycle assessment (LCA) studies; (II) focus on the biological treatment of defined agricultural organic solid wastes (AOSW), including composting or anaerobic digestion; (III) quantitative reporting of greenhouse gas emissions (e.g., CH_4, N_2O, NH_3) and/or global warming potential (GWP), expressed in kg CO_2-equivalent per ton of dry or wet matter; and (IV) investigation of GHG mitigation strategies, such as process optimization or the use of additives.

When the same data appeared in multiple publications, it was entered into the review database only once. For each paper, we collected information on geographic location, treatment type, and the type and composition of AOSW (e.g., swine manure, dairy digestate), as well as direct measurements or LCA-based GWP values. Numerical values shown in figures were extracted using GetData (Graph Digitizer 2.26) when necessary.

In total, 86 peer-reviewed studies were included in the literature synthesis: 42 on composting and 44 on anaerobic digestion of livestock manure and related

agricultural organic solid wastes. These studies were conducted at more than 65 experimental sites in 17 countries [1-86] (Figure S1).

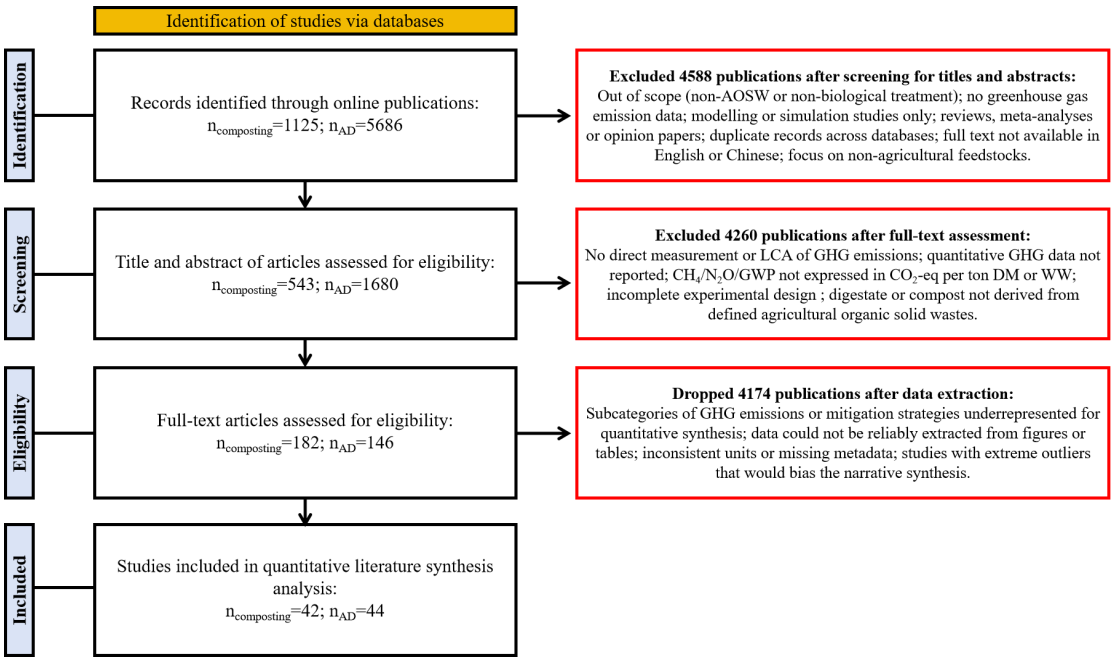


Figure S1. The PRISMA Flow Diagram. “n” refers to the number of relevant studies.

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