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Greenhouse gas emissions from different sewage sludge treatment methods in north

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1   7617 words

2   **Greenhouse gas emissions from different sewage sludge treatment methods in**

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11   **Abstract**

12   The most sustainable method for treating sewage sludge depends strongly on the situation and local

13   circumstances. In sparsely populated northerly areas are demanding boundary conditions, e.g. cold

14   and long winter, long transport distances and low amounts of generated sludge. In this study,

15   commonly used calculators and emissions coefficients for calculating the greenhouse gas (GHG)

16   emissions from sewage sludge treatment methods were assessed to create a calculator suitable for

17   the Northern Finland context. The calculator was then used to determine which sewage sludge

18   treatment method (composting, anaerobic digestion (AD), incineration (with and without thermal

19   drying)) resulted in the lowest emissions of the GHG gases in different situations in Northern

20   Finland. GHG gases included carbon dioxide (CO_2; including biobased), methane (CH_4) and nitrous

21   oxide (N_2O), measured as carbon dioxide equivalents (CO_2eq). According to the calculator, AD

22   generated the least CO_2eq emissions of all treatment methods studied. The second best option was

23   incineration of sludge without thermal drying, while the third best was composting or incineration

24   of sludge after thermal drying with e.g. fossil or other fuels. Most of the emissions were generated

25   from the treatment process itself and the share of emissions generated during transport was

26   minimal, despite the long transport distances when all CO_2 emissions (incl. biobased) were

27   considered. The role of users of the end-products and the possibility to use the CO_2 generated were

28   highly important when considering environmental perspective. These results can be utilized when

29   selecting the locally most suitable method. In future, some of the treatment methods (i.e. AD,

30   incineration) with CO_2 capture could be considered carbon sinks, as they also remove biobased CO_2

31   emissions.

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33   **Keywords:** greenhouse gas emissions; carbon dioxide equivalent; sewage sludge treatment; north;

34   calculator