LCA applied to residual organic fertilizing materials - An overview of emission inventory data at the spreading operation

C. Déchaux, Marilys Pradel

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Claire Déchaux, Marilys Pradel, Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization, June 5-10 2016, Cetraro, Italy

Implication of the application of a residual organic fertilizing material in LCA

Inventory issues at the spreading operation in LCA case studies

air emissions: N, C

C sequestration
Trace metals

run-off and leakage: N, P

Literature review

- LCA case studies of residual organic fertilizing materials (digestate, compost) including spreading
- Details on land spreading emissions

N, P, C and trace metal emissions

C sequestration

- **How are these emissions expressed at the spreading operation?**
- **What are the units used?**
- **Which emission rates?**

Emissions linked to the application of residual organic fertilizing materials

Consensual value ranges from IPCC

Infrequent but needed to check N balance consistency

[8-9% of N_{tot}]

N_2

[0,1-2%] of N_{tot}

direct

1% of NH_3-N and NO_x-N
[0,75-2%] of NO_3^--N

Indirect

N_2O

Expressed as a % of direct and/or indirect N_2O emission produced during denitrification

[0,1-1,2%] of N_{tot}

NO_x

biogenic **CO_2**

Very low considerations

Spreading operation

Great sensitivity to pedoclimatic conditions. A pedoclimatic model should be used.

NH_3

[1-25%] of N_{tot}

C sequestration

[4-14%] of C_{bio}

Trace metal elements

Very low consideration
To explore (→ toxicity and ecotoxicity)

PO_4^{3-}

[1,7-10%] of P
Many sources

NO_3^-

Great variability on:
- the emission rate values
- the different forms the emission is expressed

Influence of the spreading emissions on LCA results in the case studies

Main contributions

- NH_3 → acidification
- NH_3 and nitrate → eutrophication

Other less often detected contributions

- N_2O → climate change
- phosphate → eutrophication
- NO_x → particulate matter formation

Learnings from the LCA literature review

- N_2O, NH_3, NO_3^-, PO_4^{3-} emissions more often considered than NO_x, N_2, C, trace metal elements in the case studies.
- When possible, proposition of value ranges for P-based and N-based emissions. When not possible, variability has been highlighted.
- Infrequent consideration of carbon fate and trace metals in LCA case studies.
- A heavy impact of the inventory emissions on results → recommendation for LCA practitioners to pay particular attention to the inventory emissions.

National Research Institute of Science and Technology for Environment and Agriculture

CONTACT :
Claire Déchaux - *claire.dechaux@irstea.fr*
Tél. +33 0(2) 23 48 21 10

www.irstea.fr

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Member of AgorACV

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