Understanding animal bedding heterogeneity for the advancement of manure-based biorefineries

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Introduction

Animal bedding has great potential as feedstock for biorefineries (manure to biogas and straw to ethanol) but its heterogeneity is a barrier for its use as such.

We have hypothesized that manure heterogeneity can be explained as a mixture of several layers at different degradation stages.

![Diagram showing the mixture of layers](image)

Conclusions

- Long-term layers have lower quantity and quality of fiber.
- Manure and straw are more intertwined in long-term layers.
- Manure washing can be predicted through the layer mixture hypothesis.

Methods

Animal bedding was collected at 13 different points in the stable. At each point 4 samples were collected: mixed bedding and each of the 3 layers separately.

![Diagram showing sampling points](image)

Bedding samples were washed 10 times consecutively with fresh water. Manure removal was evaluated through a total solid analysis of the suspensions.

![Diagram showing washing process](image)

The compositions of the washed samples were analyzed according to the NREL methods.

![Diagram showing composition analysis](image)

Results

Short-term layers have 45% of fermentable carbohydrates, compared to 30% in long-term layers.

![Graph showing washing efficiency](image)

Short-term layers require 3 washings to remove 85% of the manure, compared to 4 washings in long-term layers.

Discussion

The straw in long-term layers is at a higher state of degradation, which decreases the efficiency of the washings and the ethanol potential.

The layer mixture hypothesis can explain both manure heterogeneity and its washing. Thus, it could be a powerful tool to characterize manure and overcome its challenges as feedstock for biorefineries.

![Image of original and washed bedding](image)