Compositional changes in swine manure fibers treated with aqueous ammonia soaking (AAS) resulting in increased methane potential

Jurado, Esperanza; Hansen, Mads A.T.; Gavala, Hariklia N.; Skiadas, Ioannis

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Structural and molecular changes in swine manure fibers pretreated with aqueous ammonia soaking (AAS).

Esperanza Jurado*[1], Mads A.T Hansen[2], Hariklia N. Gavala[1] , Ioannis V. Skiadas[1],

[1]Section for Sustainable Biotechnology, Aalborg University Copenhagen (AAU-Cph)

Web address: www.sustainablebiotechnology.aau.dk , email*: eje@bio.aau.dk

[2]University of Copenhagen, Danish Centre for Forest, Landscape and Planning, Rolighedsvej 23, DK- 1958 Frederiksberg C.

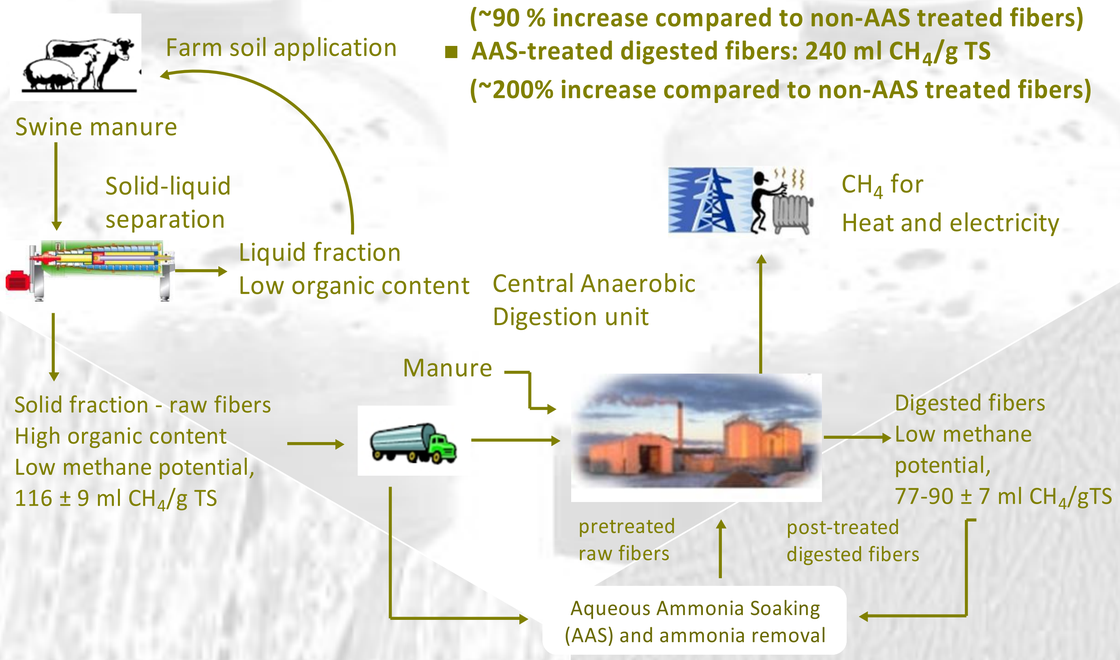
Aqueous ammonia soaking (AAS) as pretreatment

Ammonia is a weak base and has high selectivity toward the lignin reactions, preserving thus the carbohydrates. It cleaves the ether bonds in lignin and the ether and ester bonds between lignin and hemicellulose. **Aqueous ammonia soaking (AAS)** and subsequent ammonia removal has been successfully applied for increasing methane productivity of raw and digested manure fibers (Jurado et al 2013). The present study investigates the structural and molecular changes that AAS had on raw and digested manure fibers.

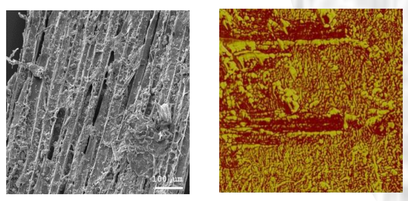
Process

Methane yield obtained after continuous AD:

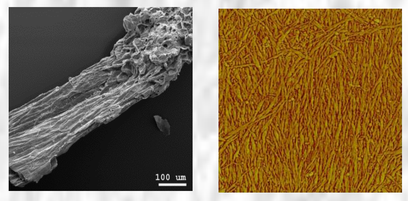
- **AAS-treated raw fibers : 230 ml CH_4/g TS**
  (~90 % increase compared to non-AAS treated fibers)
- **AAS-treated digested fibers: 240 ml CH_4/g TS**
  (~200% increase compared to non-AAS treated fibers)



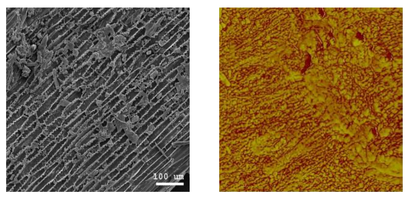
Raw- untreated



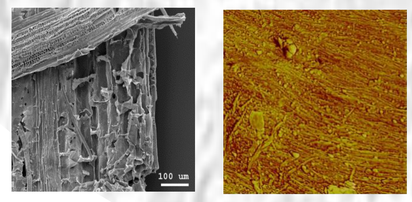
Raw-AAS treated



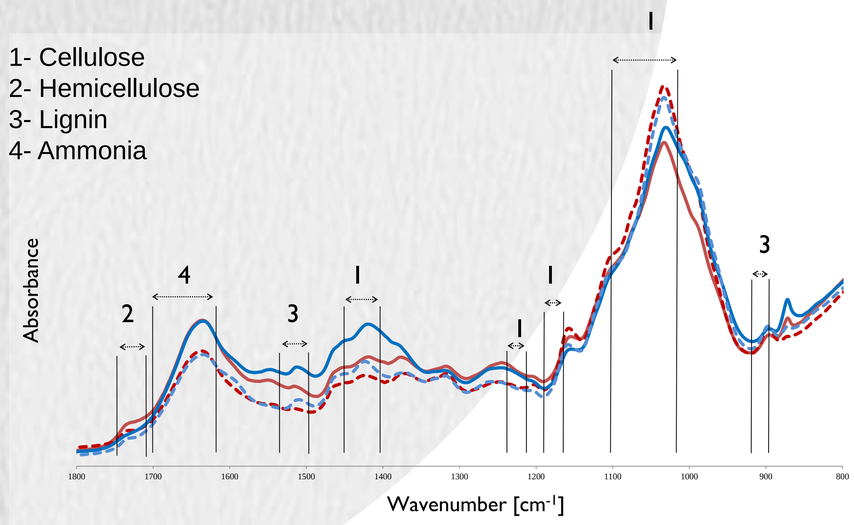
Digested-untreated



Digested-AAS treated



SEM microcopy



ATR-FTIR analysis

Conclusion

- AAS increase methane potential using raw and digested manure fibers.
- SEM and AFM images of the same samples showed intact plant tissues and microfibrils and surfaces cleansed of debris, supported by IR spectra that indicated more cellulose had become exposed on the surface.
- delignification is not strictly necessary for increasing methane potential; increasing cellulose accessibility is a larger factor in increasing biogas potential and productivity.

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Reference

E. Jurado, I.V. Skiadas, H.N. Gavala. 2013· Enhanced methane productivity from manure fibers by aqueous ammonia soaking pretreatment .Applied energy , vol. 109, 104-111.