

Cellulosic Ethanol Yield from Ensiled Corn Plant Residues

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Abstract:

As the food vs. fuel debate ensues, many in the scientific community are turning to lignocellulosic ethanol for the answers. Ensilage, traditionally used by farmers, is an effective way to preserve this material prior to saccharification and fermentation. However, the effects of ensilage on the downstream have yet to be determined. My study investigates the effect that ensilage has on ethanol production coupled with the determination of which part of the corn plant (stover vs. cob) will generate the most yield. The results of these simple comparisons can serve as a cornerstone in the on-going investigation of the most efficient use of bioethanol feedstock.

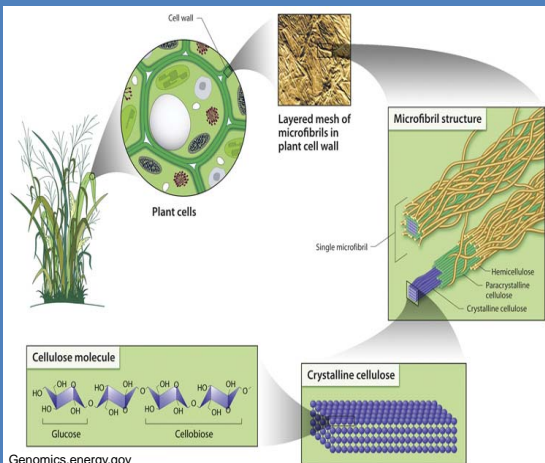


Figure 1: Composition and complexity of plant cell walls

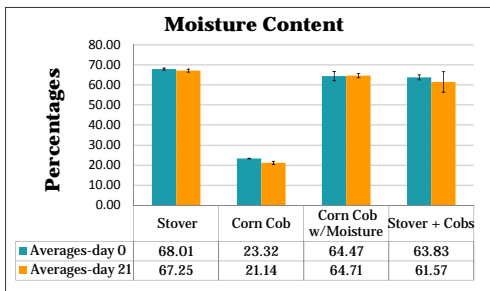
Figure 2: Ensiled samples in incubator.



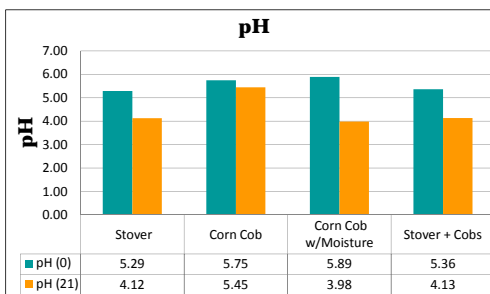
Methodology:

- Corn stover was ensiled for 21 days and compared with fresh material from day 0. Materials tested included: corn stover (excluding cob), corn cob, corn cob with added moisture, and a mixture of corn stover and corn cob.
- Compositional analysis was performed to determine extractives as well as lignin and structural carbohydrates.

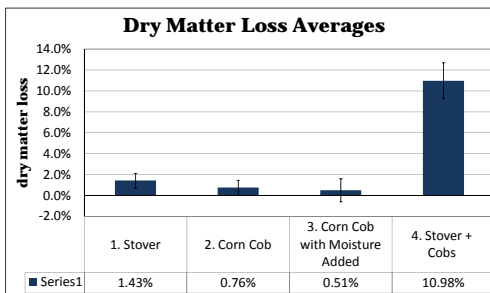
Initial Observations:



❖ Moisture Content experiences negligible changes from day zero to day twenty-one.



❖ Ensiling samples for twenty-one days significantly lowers pH, with the exception of the naturally dry cob.



*Dry matter losses for corn cobs and corn cobs w/moisture do not include outliers as determined by z=3 standard deviations method.

❖ Although there is some variability within each sample category, it is clear from the graph that the most dramatic dry matter loss occurs in the mixture of corn stover and cobs

Ongoing Work:

- Pretreating each sample using an Accelerated Solvent Extraction System.
- Performing chemical hydrolysis on pretreated samples followed by enzymatic hydrolysis and fermentation (SSF).
- Determining ethanol production after fermentation using ion chromatography.



Summary:

- pH reduction was more significant in wetter materials, like the stover and wet cobs, but for drier materials, like the natural cobs the change was not as dramatic.
- Dry matter loss magnified in the corn stover and cob mixture although the two materials separately had smaller loss.

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