ABSTRACTS (MASTER THESIS)

Characterization of cell wall phenylpropanoids of grass bioenergy plants

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Lignocelluloses are produced mainly by trees and large gramineous plants such as *Erianthus* spp., switchgrass, nepier grass, miscanthus etc. Generally, the biomass production by fast-growing trees such as *Cryptomeria japonica* (Japanese cedar) in Japan and *Acacia mangium* in Indonesia is about 10 and 20 tons ha^{-1} $year^{-1}$, respectively, whereas that of *Erianthus arundinaceus* in Thailand and Japan reaches up to 80 and 30 tons ha^{-1} $year^{-1}$. In addition, the large gramineous plants, such as *Erianthus* spp. are not used for food. Therefore, they are drawing attention as potential materials for biofuel and industrial feedstock production.

Recently, *E. arundinaceus* was characterized in detail in terms of lignins, *p*-hydroxycinnamic acids, enzymatic saccharification efficiencies, and minerals in the ash of the inner and outer parts of the internode and the leaf blade and sheath (Otake 2012; Yamamura et al. 2013). Interestingly, they found out that the inner part of the internode did not show a negative correlation between lignin contents and enzymatic saccharification efficiencies, indicating that the enzymatic saccharification efficiency of the inner part was affected by not only lignin contents but also other factors. This suggested that the lignocellulosic supramolecular structure of the inner part was different from that of the outer part. Cross-linking of grass cell wall components through diferulate residues has been known to reduce the enzymatic saccharification efficiency. However, the amounts and effect of the structure on enzymatic saccharification efficiency has not been reported for *E. arundinaceus*.

This study established a system to quantitate diferulates in cell walls of various grass bioenergy plants using a stable isotope dilution method. In this study, the author synthesized various deuterium-labeled and unlabeled diferulates (Figure 1), and showed that some diferulates are rather unstable; the unstability was partially eliminated by the introduction of protecting groups: acethylation of the phenolic hydroxyls and ethyl ester formation from the carboxyls. Diferulate **4**, which is stable, was quantified using stem of switchgrass and *E. arundinaceus* in this study, and its amount in the cell walls was found to be very small; 124 ng mg^{-1} cell wall residue (CWR) in switchgrass stem, 52.2 ng mg^{-1} CWR in *E. arundinaceus* inner part of internode, and negligible in *E. arundinaceus* outer part of internode. The present result suggested that the role of the diferulate residues as the obstacles of enzymatic saccharification of *E. arundinaceus* internodes may be insignificant.

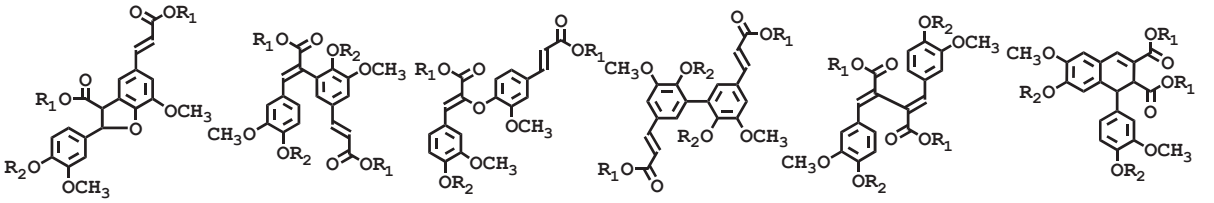

Figure 1 The structures of synthesized diferulates

References

[1] Y. Otake, "Characterization of lignocellulose in *Erianthus ravennae*", *Master thesis*, 2012.

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