ABSTRACTS (MASTER THESIS)

Characterization of lignocellulose in *Erianthus ravennae*

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Erianthus spp., an energy-producing plant, belongs to the tribe Andropogoneae, under the grass family Gramineae. Members of this genus are perennial grasses and are used worldwide as breeding material for sugarcane, a close relative. *Erianthus* spp. show better growth even under unfavorable environmental conditions, such as submersion, acidic soil, and dry-season soil drought. In addition, *Erianthus* spp. yield huge amounts of biomass; the yearly dry-matter yield is in the range of 40 to 60 ton ha^{-1} yr^{-1}. For these reasons, *Erianthus* spp. are receiving much attention as a potential biofuel and industrial feedstock. Surprisingly, despite the importance of *Erianthus* spp. as feedstock, detailed chemical analyses of its cell-wall constituents have not been reported. In gramineous plants, it is known that enzymatic hydrolysis or saccharification of the cell wall was inhibited not only by lignin but also by ferulic acid esters, which cross-links lignin and polysaccharides. Moreover, the states of being of their compounds in the cell wall were varied among plant species and even among organs with single plant species. Therefore, to exploit the potential of *Erianthus* spp., we must analyze lignins and cell-wall linked *p*-hydroxycinnamic acids including ferulic acid. In this study, *Erianthus ravennae*, a hardy *Erianthus* species originated from Mediterranean region and southwest and east Bulgaria that can be cultivated in Japan, was selected as a plant material, and especially the stem of *E. ravennae* was analyzed. The inner and outer parts of the *E. ravennae* stem differed distinctly in specific gravity and apparent hardness: the outer part was highly dense and very hard compared to the inner part. Thus, the author characterized the lignocellulose components and examined the enzymatic saccharification efficiency in the inner part and outer part of each internode of *E. ravennae* and profiled the variation among internodes and variation within a single internode.

Lignin contents of different internodes were 18.4–27.3 % in outer part and 17.1–24.5% in inner part. In addition, lignin aromatic components (S/V ratios) ranged from 0.63 to 1.13, and 0.43 to 0.96 in outer part and inner part, respectively. Lignin contents and S/V ratios roughly increased from top to bottom internodes. The amount of ferulic acid in both outer and inner parts slightly increased from bottom to top internodes, while that of *p*-coumaric acid had no tendency. Enzymatic saccharification efficiencies were 2.8–30.9% in outer parts and 17.5–38.6% in inner part, and increased from bottom to top internodes. Correlation analysis indicated that outer part of internodes showed a negative relationship between lignin content and enzymatic saccharification efficiency, whereas inner part did not. It indicates that there should be other factors that impede enzymatic saccharification than lignin content in inner parts. This is a new finding about lignocellulose components. The elucidation of the supramolecular structure of lignocelluloses in *E. ravennae* requires further studies including analysis of ferulate dimers crosslinking between carbohydrates.

The data of characteristics of lignin and related components in each internode of *E. ravennae* is helpful to further studies of *E. ravennae* aiming to improve the efficiency of lignocellulose utilization. Pretreatment such as alkaline treatment would be effective for the part with low saccharification efficiency. In addition, energy gaining from the parts with high lignin contents by direct burning should be considered to maximize the energy output/input balance. Taken together, the information obtained in the present study will help us to understand comprehensively the lignocellulose supramolecular structure and to improve the efficiency of lignocellulose utilization from grass plants.