RECENT RESEARCH ACTIVITIES

Approaches towards wood biorefinery using whole cell wall components by microwave reactions

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Production of biofuels, chemicals and materials from woody biomass is important for sustainable development of our society. In wood biorefinery including enzymatic saccharification and fermentation, lignin should be separated from the cell wall polysaccharides, accommodating increase in the hydrolyzability of (hemi)celluloses and use of the lignin as an aromatic feedstock [1]. To establish the environmentally friendly biorefinery process, we have been studying production of bioethanol and aromatic chemicals using microwave processing [2]. For industrial production of bioethanol, cost of the processing facilities should be minimized. In our NEDO project, we developed an ultra-low cost bench-scale microwave reactor which enabled highest level of energy transfer from commodity-use magnetrons to a reaction vessel without use of a matching tuner, isolator and power monitor [3]. A high-performance SHF and SSCF processes using ethanologenic bacteria, *Zymomonas mobilis* and *Zymobactor palmae* [4] and lignin-derived adsorbent for fermentation inhibitors have been developed for bioethanol production. We constructed a bench scale plant for the wood biorefinery (Figure 1), and demonstrated coproduction of bioethanol and lignin with minimum chemical modifications. The bioethanol produced was distilled, and its high quality as a transportation fuel and raw feedstock for propylene production was demonstrated.
As a value-added product from lignin, we studied production of ultraviolet (UV) absorbers by microwave reactions with Kao Corp. By extensive screening of degradation products from lignin, we isolated and identified lignin oligomers with high absorbance in UV-A and UV-B regions [5]. Recently we found that finely divided wood meal was dissolved in α-keto acid, pyruvic acid, and two aldehydic carboxylic acids, namely, glyoxylic acid and formic acid, at room temperature [6]. The wood solution was fractionated into cellulosic porous solid and other soluble components by addition of 2-methyltetrahydrofuran. The simple dissolution and separation technology coupled with the microwave processing in the presence of reaction catalysts will expand the wood biorefinery processes using whole cell wall components of wood.

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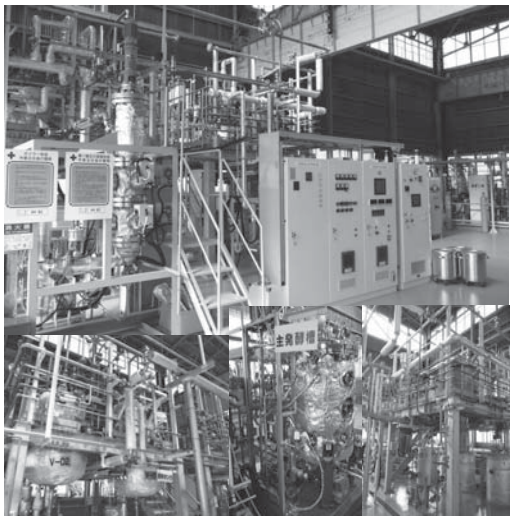

Figure 1 A bench-scale MW plant for 2nd generation bioethanol and biorefinery

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