

**Research and Development of Microwave Irradiation Systems
for Pretreatment of Woody Biomass**

(Graduate School of Engineering, Laboratory of Applied Radio Engineering for
Sustainable Humanosphere, RISH, Kyoto University)

Hiroaki Suzuki

Toward ethanol production from woody biomass, there are two main processes: saccharization and alcohol fermentation. Microwave irradiation pretreatment to the woody biomass before the enzyme saccharification process induces dissociation of cell wall components and increases enzyme reactive area. These effects improve efficiency of the enzyme saccharification. The objective of the present study is development of highly-efficient microwave irradiation systems for the pretreatment of the woody biomass. Two types of microwave irradiation cavities were studied: a batch-process type, shown in Fig.1, and a continuous-process type.

Internal electric fields and Specific Absorption Rate (SAR) values distribution were simulated with 3D electromagnetic simulator. New cavity models were developed for 2.45GHz irradiation and for 5.8GHz irradiation that showed more even SAR values distribution than that of the previous batch-type cavity model. Then, the simulation results were compared to heating efficiency of practical experiments. It is found that there was temperature distribution in the mixture from the practical experiments of the batch-type cavity.

A continuous-type cavity was also developed for the sake of continuous pretreatment of woody biomass. After developing the continuous-type cavity, total electric energy balance per a practical treatment was measured. From measurement results, we evaluated heat efficiency and effects of heat loss and power absorption at a glass plate, which was inserted into microwave irradiation port in order to heat woods and solvents under a high pressure. To improve these losses, various shapes of dielectric materials were put in front of the glass plate. Some shapes of teflons were very effective to lower a reflection ratio.

References

[1] Suzuki H., T. Mitani, N. Shinohara, M. Oyadomari, T. Watanabe, T. Tsumiya and H. Sego, "Study on a Microwave Irradiation Cavity for Pretreatment of Ethanol Production from Woody Biomass", 2008 Global Congress on Microwave Energy Applications, pp.411-414, 2009.

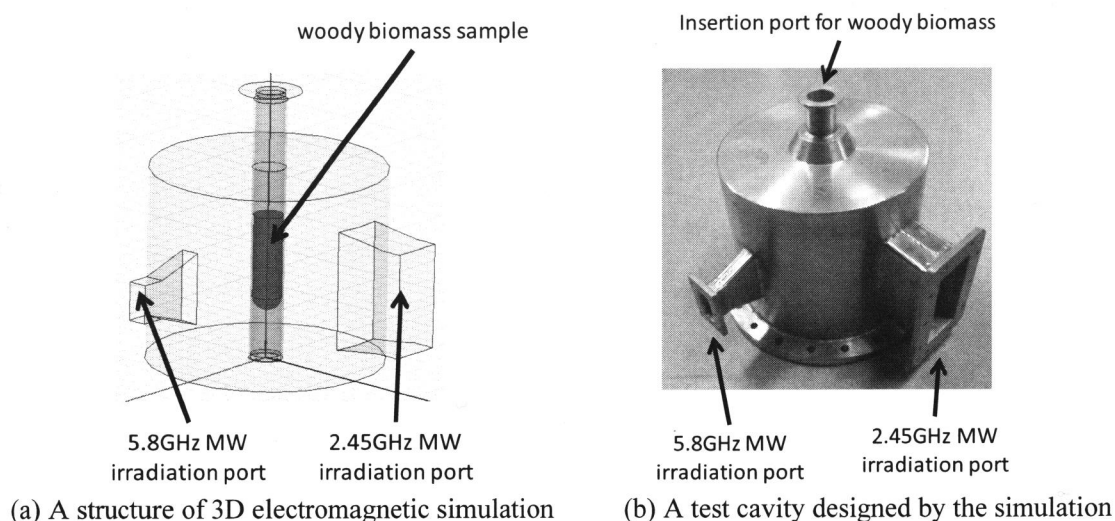


Figure 1. Development of a batch-type microwave irradiation cavity.