

A fundamental study of a microwave pretreatment system for wood biomass conversion

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Microwave heating is one of the microwave applications close to our daily life, as typified by a microwave oven. While conduction heating can only reach the surface of a material, microwave heating can reach the inside of a material directly and uniformly, hence it spends less time heating.

Microwave heating is also known as one of effective pretreatment methods for converting wood biomass into bio-ethanol (e.g. [1]). The objective of the present study is to develop a microwave pretreatment system for wood biomass. The microwave pretreatment system requires (1) high DC-microwave conversion efficiency, (2) high heating efficiency, (3) short heating time, (4) productivity per time, electric power and cost, etc.

A fundamental design study on a container for a microwave pretreatment system is currently being conducted. The container is designed with 3D electromagnetic simulator called HFSS (High Frequency Structure Simulator). Fig. 1 shows the simulation results of cross-sectional electric field distribution in a container at a frequency of 2.45GHz. The difference between Fig. 1(a) and Fig. 1(b) is the container size. From these results, electric field intensity is uniformly strong inside as shown in Fig. 1(a); whereas it is uneven in the center of the container as shown in Fig. 1(b). Therefore, the container size of Fig. 1(a) is more effective for microwave heating than that of Fig. 1(b). The results also indicate that a slight change of the container size greatly affects electric field distribution.

For future works, a design study on a container with high overall efficiency will be conducted at a frequency of 5.8GHz as well as 2.45GHz.

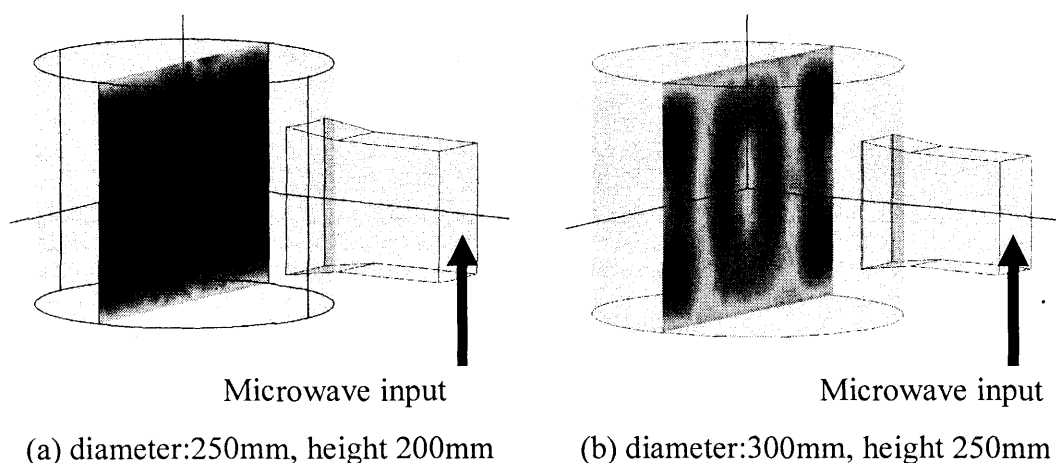


Fig. 1. Simulation results of cross-sectional electric field distribution in a container for a microwave pretreatment system at a frequency of 2.45GHz. The dark color shows that electric field intensity is strong there.

REFERENCES

- [1] Azuma, J., F. Tanaka and T. Koshijima, "Microwave Irradiation of Lignocellulosic Materials I –Enzymatic susceptibility of microwave-irradiated woody plants-", Mokuza Gakkaishi Vol.30, No.6. pp.501-509, 1984