Commercialized Drier Processing Using a Combined Unsymmetrical Double-Feed Low Power Microwave and Vacuum System

(ระบบบอบแห้งเชิงพาณิชย์โดยใช้ไมโครเวฟกำลังต่ำที่ป้อนคลื่นสองตำแหน่งร่วมกับระบบสุญญากาศ)

Gold Prize "Seoul International Invention Fair (SIIF) 2011"

Dr. Phadungsak Rattanadecho (Professor)

Mr. Kusturee Jeni and Mr. Mudtapha Yapa and Mr. Wiroj Jindarat

Research Center of Microwave Utilization in Engineering (R.C.M.E.), Department of Mechanical Engineering , Thammasat University, Pathumthani 12120, Thailand

Tel: 66-2564-3001-9, Fax: 66-2564-3010,

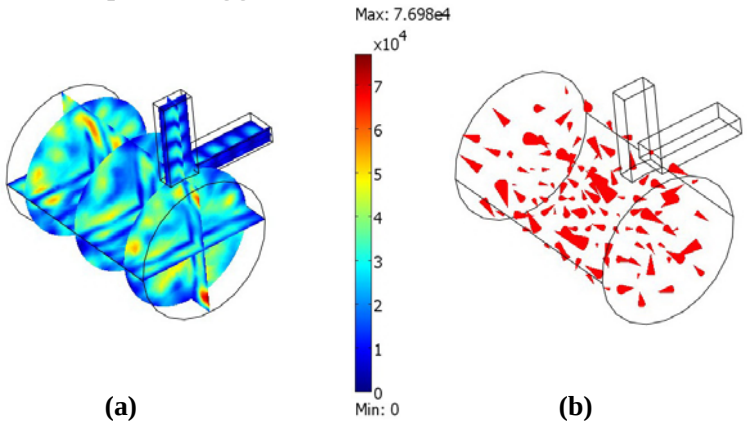
*E-mail: ratphadu@engr.tu.ac.th

RCME RESEARCH CENTER OF MICROWAVE UTILIZATION IN ENGINEERING

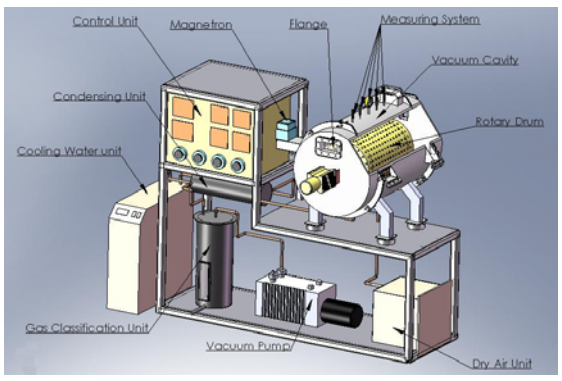
The Highlight of this Invention:

Microwave-vacuum (MV) drying is **a novel alternative method** of drying, allowing to obtain products of acceptable quality. As compared to conventional drying methods, microwaves penetrate into much greater depths. If the penetration depth is bigger than the product dimensions, this is so-called volume heating with the following advantages:

- Low temperature drying provides gentle treatment for the product due to low vacuum pressure,
- Faster product heating because the double magnetrons are used; this advantage corresponds to the better microwave power distribution, with can penetrate further into the multi-plane of material,
- Environmental friendliness at low temperature due to the absence of drying medium,
- Avoids the defect of internal crack and interior burning caused by excessive heating and acquires a wide range of application on the pharmaceutical and food industries,
- Immediately ready for operation and control of heat capacity without delay,
- Low specific energy consumption and high energy efficiency.



Simulated electric field distribution and arrow plot in multimode cavity with unsymmetrical double-feed two magnetrons



The commercialized Drier Processing Using a Combined Unsymmetrical Double-Feed Low Power Microwave and Vacuum System (Thammasat university, Thailand)

Description of the Invention:

In the system, the microwave was conveyed through a series of rectangular (11.0 x 5.5 cm) wave guides to a metallic vacuum cavity of 0.13 m^3 in which the materials to be dried can be rotated by rotary drum in the cavity. The rotary drum was made of polypropylene with dimensions approximately of 30 cm radius and 50 cm length and the rotation speed of the rotary drum was controlled about 10 rpm in order to enhanced the interaction between microwave and dielectric load. The maximum vacuum degree was about 50 torr. The system can be operated automatically either in continuous or intermittent mode in each experiments. The pulsed microwave operating mode of 60 s on/60s off was performed in each run. Optical fiber (LUXTRON Fluroptic Thermometer., model 790, accurate to ± 0.5°C) was employed for measuring the averaged temperature of bulk load in cavity.

Outstanding, Invention Award, Office of the National Research Council of Thailand, 2011*: *(Getting Award from Thailand Prime Minister)

Tea leaves which were dried with pulsed microwave operating mode at 800 W magnetron power

Chili which were dried with pulsed microwave operating mode at 800 W magnetron power

An infrared camera was used to control the temperature in the cavity. A Multimeter™ Series Digital with PC interface was used to monitor the temperature inside the cavity and to facilitate feedback control of process. An infrared camera was used to measure the surface temperature of the samples (accurate to ± 0.5°C). In MW-vacuum process, the leakage of microwaves was prevented by the countermeasure in double with a combination of mechanical blocking filter and microwave absorber zone filter to be provided each at the both covers end. The microwave leakage was controlled below the DHHS (US Department of Health and Human Services) standard of 5 mW/cm^2.

Previously Awards:

Outstanding, Invention Award, Office of the National Research Council of Thailand, 2011

"Commercialized Drier Processing Using a Combined Unsymmetrical Double-Feed Low Power Microwave and Vacuum System"

Outstanding, Research Project Award, The Thailand Research Fund (TRF), 2011

"Commercialized Drier Processing Using a Combined Unsymmetrical Double-Feed Low Power Microwave and Vacuum System"

Publication and Patent:

-Jeni, K., Yapa, M. and Rattanadecho, P., *"Design and Analysis of the Commercialized Drier Processing Using a Combined Unsymmetrical Double-Feed Microwave and Vacuum System(Case Study: Tea Leaves)"*,Chemical Engineering and Processing: Process Intensification, 49, 2010, pp.389-395: Impact factor 1.518

-Patent: Registration No. 0901000780

Acknowledgement: Thailand Research Fund and Office of the National Research Council of Thailand for providing research grant in this project