Application of Microwave in Food Preservation

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ISSE 2017
40th International Spring Seminar on Electronics Technology
10-14 May 2017, Sofia, Bulgaria

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Introduction

Food preservation has become nowadays a major priority. Classical methods of storing food relies on controlling the temperature and humidity in storage areas. The present work is proposed another method which relies on complete air purification storage space. It is known that leading to food spoilage is the presence of bacteria and microorganisms. The presented method is based on purifying the air by destroying them using three tools: air is passed through a chamber where they are generated electromagnetic waves in the microwave range, knowing that they are destroying microorganisms and is then exposed to ultraviolet light and last through a process of ozonization. In this work the command of the magnetron that generates microwaves and ozone generator are presented. The device has been designed to allow a control them more flexible that they can be tested as many dosages microwave, ozone or ultraviolet light so they can be experienced as many scenarios in order to obtain a storage times as long as possible and also power consumption reduction.

The system is controlled by a microcontroller and is equipped with a keyboard and a LCD display, and it is connected via RS485 with a sensors circuit placed in the storage area. A PWM circuit controls the command transistor of a fly-back transformer. The block diagram is shown in Figure 1. To generate high voltage at the Flyback transformer's output we need a driver for its command. Integrated circuit SG3525 allows changing the duty cycle and frequency of the signal that controls the switch. The IRFP250 MOSFET transistor is used as switch that supports a drain-source voltage of 200V and a current of 33A. At the flyback output we find a 18 kV voltage and a current consumption of 1.4 A from the input. The electrodes that are connected to the output of flyback source to generate high voltage consist in two copper grid separated by a dielectric material. The total equivalent capacitance of the grid is about 330nF.

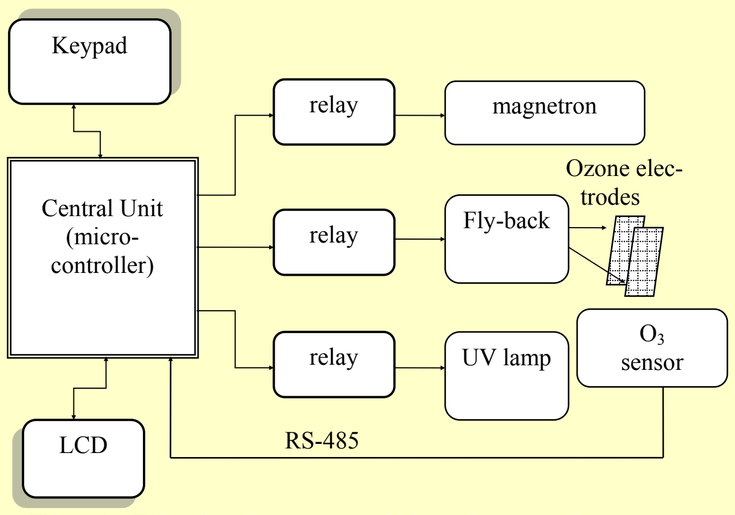

Fig. 1. Block diagram of the electronic system.

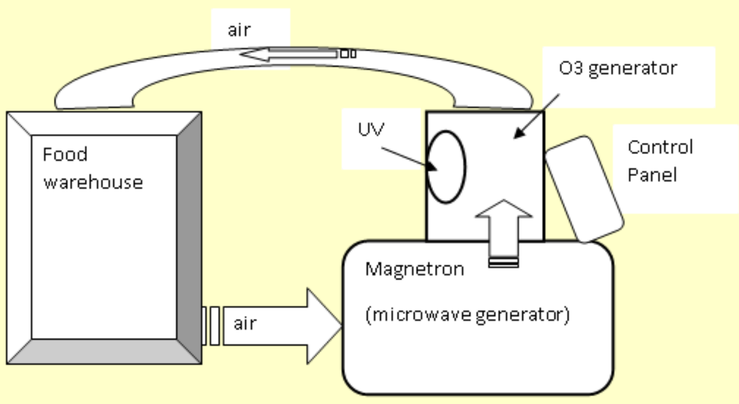

Fig. 2. Air purification system

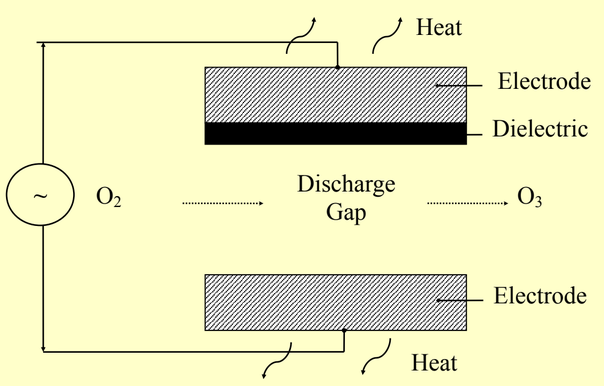

Fig. 3. Ozone production principle

Results

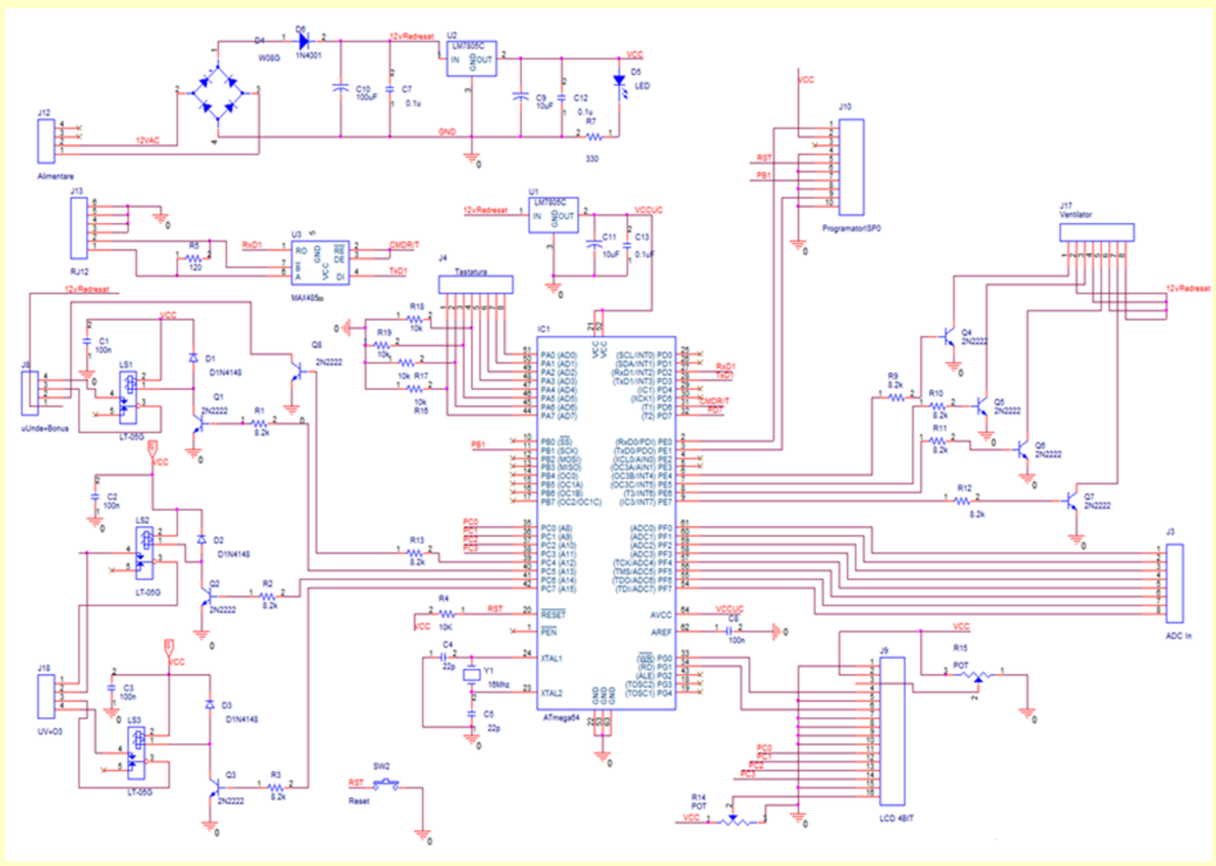

Fig. 4. Electrical schematic of the main system

Microwave systems for food treatment have the advantage of volumetric heating, selective heating and hot-spot effect. Three power levels was tested: 500 W, 250 W and 125 W; also four application levels was tested: continuously, last 5 minutes, last 2.5 minutes and 1.25 minutes of each 10-minutes-cycle.

Using a commercial microwave oven it is possibly to completely destroy viruses, mycobacteria and some types of spores in a time interval about one to five minutes.

The results confirm that 2.5 minutes/cycles are sufficient to disinfect of E. Coli. These results are confirmed also by the scientific literature.

Inclusion of a UV irradiation system is advantageous for air recirculation systems due to its effectiveness for a wide range of pathogens, small size and low cost of the equipment and relatively short contact times. The ultra-violet source is basically a fused silica quartz tube, 20 mm diameter and 1000 mm long.

On the market there are many methods and air purification systems for food storage warehouses, but this paper uses a combination of three of the most successful and ecological methods, ensuring the destruction of a wide range of bacteria. Due to its flexibility, the system can be adapted to different types of food and storage warehouses.

Acknowledgments

The work of the last author was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI–UEFISCDI, project number PNIII-P2-2.1-BG-2016-0378, 54BG/2016, within PNCDI III.

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