

**UNIVERSITY GRANTS COMMISSION
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Final Report on the Minor Research Project

Title of Research Project: Development of Microwave Sterilization Unit for Poly Ethylene (PET) Cans

UGC Reference No. F.: MRP-6024/15 (SERO/UGC) & Dt: 31/10/2016

Design: During the two year period the project is implemented as per the schedule proposed in the report. The microwave sterilization unit consists of four different units.

1. Microwave source –Magnetron
2. Magnetron power supply unit & control unit
3. Microwave chamber
4. Mechanical supporting structure

A magnetron with frequency of 2448 MHz and 1500 W power is used. A power supply unit with following specifications is also used for driving the magnetron for correct operation. A rectangular wave guide is used to connect the magnetron output to the chamber. The output cavity of the magnetron is connected to the closed end of the waveguide and the other open end of the wave guide is directly fed in to the heating chamber. The microwave signals generated by the magnetron are fed into the chamber.

A control unit along with timer setting is used to heat the chamber for the specified duration. The control unit regulates the current for the magnetron from 1 to 9 Amps and there by controls the magnetron output power.

Fabrication: A chamber to place the bottles for heating is designed and fabricated for dimensions LxWxH of 32x32x34 inches respectively. Stainless steel sheets of grade 316 and 2mm thickness are used and the chamber is mirror polished to enhance the conductivity, reflectivity and thereby reduce the heating time. The stainless steel sheets used are corrosion resistive and is used in many industrial applications because it is non-reactive.

Finally the structure to assemble the chamber and the electronic circuits is made using carbon steel materials. The unit is assembled using carbon steel square pipes and the outer body is covered with carbon steel sheets.



Figure: 1 Total Unit



Figure: 2 Mirror Polished Chamber to keep the bottles



Figure:3 Control Panel

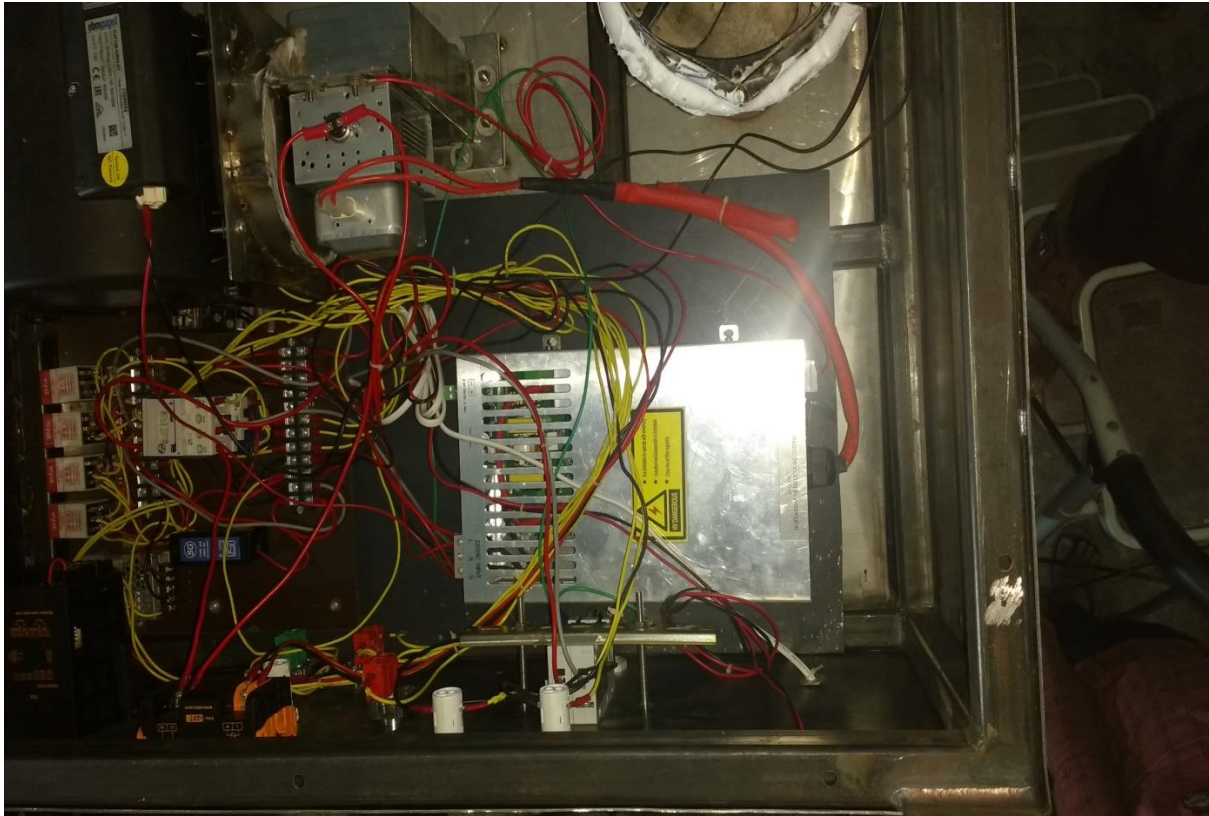


Figure: 4 Magnetron and Power Supply Unit

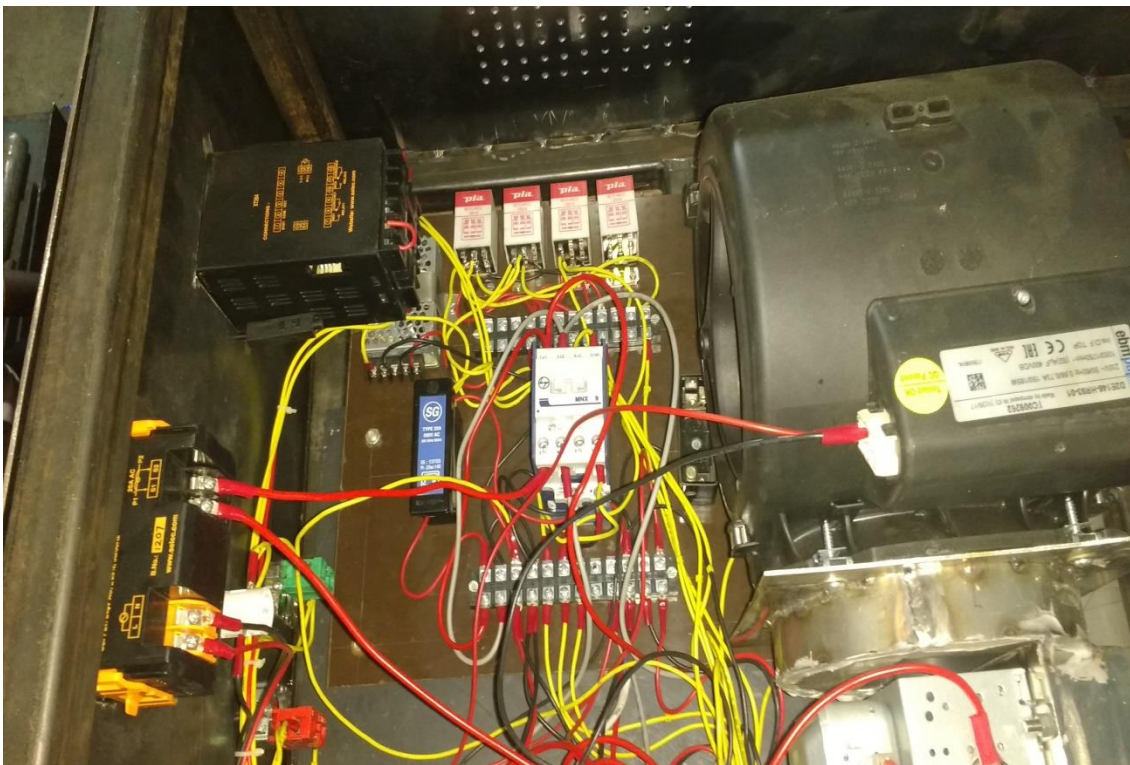


Figure: 5 Timing and control unit

Figure:1 to Figure:5 shows various sections of the fabricated unit

Working: The unit is tested for different temperatures and is working satisfactorily. Different dielectric materials are placed in the chamber and heated for different time settings and is working well. Temperatures as high up to 90 degrees are reached in a short time. The polyethylene cans are placed with water consisting of coliform and heated up to 60 degree temperatures and the bacteria count is completely nullified after heating. Hence the objective of sterilization is achieved. This unit is also tested for demoiurisation of food items such as bread, pizza, food grains by preheating them at prescribed temperatures to preserve long time. The microwave heating is also used to dry the medical waste before final disposition to remove the harmful bacteria.

Conclusion: The Design, Development and fabrication of the microwave sterilization unit is completed as per the schedule. The fabricated unit is tested for its performance and is functioning normally. The funds are utilized as per the norms given. It is confirmed by trials conducted and experimentation microwave heating eliminates the bacterial like coliform from the food items effectively. This method can also be extended to other areas of food sector for preservation by preheating.

I sincerely thank the University Grants Commission (UGC) for financially supporting this project. This unit is applied for patent (Application No.201841047296) under intellectual property India and is also enclosed herewith for your kind consideration

(Dr.C.Subba Rao)
Principal Investigator