Variable high frequency voltage source for an ohmic heating process

ABSTRACT

Heating is an important step in food processing. A new method of heating uses the natural electrical resistance of the food to generate heat. In this method electrical energy is transformed into thermal energy. This kind of food heating processing operation is called ohmic heating. The rate of ohmic heating critically depends on the Electrical Conductivity of the food during the process. Reviewing a number of researches shows that the usage of direct current for ohmic heating process causes electrolyze in liquid beverages. Moreover, usage of alternating current eliminates the probability of adverse electrochemical reaction. In addition, when the frequency increases, the risk of oxidation in electrodes will decrease. In this regard, for heating different kinds and sizes of food, it is necessary to have an electrical power source with variable output voltage and frequency. This research attempts to design and simulate the variable voltage and frequency electrical power source to feed a 10 kW ohmic heating process at high frequency (10 kHz). The ohmic heating load is simulated by three-phase resistive load. According to Joulepsilas first law, the temperature in heat generation process is closely related to electrical power and time of process. Hence, in this simulation, the value of temperature is controlled by value of power that is generated by current which flows through resistive load with control of the time period and the duty cycle. Furthermore, one of the most important things to have an effective ohmic heating process is supplying the continuous current during the process. The result of this study indicated a simple method to supply a continual current for load during the ohmic heating process.

Keyword: Electrical conductivity; Electrolyze; Food processing; High frequency; Ohmic heating; Oxidation; Power electronics