Characterization of meat cooking kinetics in convective ovens by infrared thermography and image analysis

DI MONACO R. (1,2), CAVELLA S. (1,2), FALCIANO A. (1), FIORILE G. (1), FIDALEO M. (3), MASI P. (1,2)
1 Department of Agricultural Sciences, Food Science and Technology Division, University of Naples Federico II, Portici , Italy
2 Center of Food Innovation and Development in the Food Industry, University of Naples Federico II, Portici, Italy
3 Department for Innovation in Biological, Agofood and Forest Systems, University of Tuscia, Viterbo, Italy

Cooking accounts for about 40% of the total energy consumed in the developing world. Thus, understanding cooking kinetics is essential to develop methods with better efficiency and less energy consumption. The aim of this work was to develop a thermal image system for the acquisition of surface temperature of a meat ball during oven-cooking, useful to study and model cooking kinetics.
An infrared window was installed in the door of a professional convection oven to allow a heat camera to capture thermal images of food during cooking. A hemispherical sample (diameter and weight of 12 and 6 cm, respectively) made up of grounded beef meat was used as a model meat product. Two cooking methods were standardized by setting the oven temperature at 180°C with or without oven pre-heating and time at 40 min. For each cooking method, the surface temperature of the meat determined from the thermal images was acquired as a function of time. To assess the degree of browning and the water loss as a function of cooking time, samples were cooked for 10, 15, 20, 25, 30, 40, 45 min and used to measure respectively the color distribution on the external surface and cross-section by using a high-resolution imaging visual analyzer and to measure their weight by a scale. The developed system together with the experimental data acquired formed the basis for the development and validation of a coupled heat and mass transfer mathematical model capable of describing the evolution of beef color during oven cooking.