ABSTRACT

Pineapple (Ananas comosus L.) is a tropical or subtropical fruit belonging to Bromeliaceae family. India is the fourth largest producer of pineapple with an annual output of 1.96 million tonnes. Concentration of fruit juices, a major unit operation in food processing industries, is used to reduce transportation, packaging and storage cost, to extend storage time and to ensure off-time availability of juices. An alternative process for concentration of pineapple juice was developed using volumetric heating of juice inside microwave oven and its evaporation under vacuum. A microwave assisted vacuum evaporator (MAVE) consisting of six main parts including microwave power source, microwave-food interaction assembly, vapour chamber, condenser, vacuum pump and water cooler was developed. To know the suitability of pineapple juice for microwave heating its physical properties, thermal properties, dielectric properties along with electrical conductivity were determined for nine different concentration levels from 10.9–50 ˚brix in the temperature range of 10–90˚C. Numerical simulation of microwave heating of pineapple juice was done in finite element based software, COMSOL Multiphysics-3.3a, to predict heat absorption and temperature profile after 30 s of heating for three different conditions of pineapple juice placement inside microwave oven. The model was validated by comparing the simulated results with experimentally measured temperatures immediately after 30 s of heating. Process parameters (vacuum level and microwave power) were optimized for MAVE to get higher evaporation rate and less browning index. The optimum condition emerging from the study was 80 mm Hg vacuum and 100 % microwave power level (rated microwave power 900 W). Sensory quality attributes of reconstituted pineapple juice prepared in this project work were compared with the fresh pineapple juice and a packaged pineapple juice available commercially in the market. The reconstituted pineapple juice ranked higher in terms of sensory quality attributes than the pineapple juice sample taken from the market and was found comparable with sensory attributes of fresh pineapple juice. Performance of the developed MAVE system was evaluated based on the colour kinetics parameters (L, a, b and ΔE) and rate of evaporation at optimum condition and also compared with the conventional method of concentration of fruit juices in rotary vacuum evaporator (RVE).

Keywords: Pineapple juice concentrate, microwave heating, numerical simulation, microwave vacuum evaporation, sensory analysis, optimization, colour kinetics, evaporation rate.