ABSTRACT

Popped rice is a convenient rice based snack food, which are prepared by short time high temperature heat treatment of paddy. In the present study, influence of product and MW heating variables on popping characteristics: popping percentage (PP), expansion ratio (ER), commencement of popping (CP) and threshold energy (TE) of paddy were evaluated. Popping was carried out in a 28 L capacity domestic microwave oven with output power of 1000 W, frequency of 2450 MHz, cavity dimension of 336×349×241 mm, using different volumes of glass beakers (250 – 600 mL) with varying bottom surface spread area. Sample with different thickness (0.21 – 1.05 cm; corresponding to 1 – 5 layers of grains) and spread area (32.18 – 58.11 cm^2) were taken in different vessels, and placed at optimum radial distance of the turntable to study their effect on popping characteristics. Irrespective of the volume of the vessel, PP and ER decreased with the increase in grain thickness. PP decreased exponentially with the increase in spread area as the sample thickness increased. Both CP and TE increased with the increase in grain thickness and spread area. Popping was also carried out with single layer grain mass at different exposure times (20, 30, 40, 50, 60 s) and microwave power (600, 850, 1000 W) to evaluate the effect of intermittent and continuous microwave exposure on popping behavior. PP and ER increased with increase in exposure time at all levels of microwave power. The values of PP and ER were estimated to be 80.26% and 6.76, respectively. Salt coating on the surface of preconditioned paddy (husk) was carried out with spraying of salt solution onto it followed by thorough mixing manually and quick drying of the adhered solution in a fluidized bed dryer till the desired moisture content was achieved. This process prevented diffusion of salt into the kernel. Decrease in both CP and TE was observed with the increase in salt levels from 1 – 5% (w/w). PP increased gradually as moisture content increased from 12 – 14% (wb) but it decreased for moisture level between 16 and 18%. PP increased with the increase in salt level (0 – 3%) but decreased at salt level higher than 3%. Lowest value of ER (5.00) was at 18% moisture with no salt while highest ER (7.16) was at 14% moisture with 3% w/w salt. Browning index increased with the increase in heating time at fixed level of salt content and fixed level of moisture content. It also increased with the increase in salt levels at fixed value of moisture and heating time. A tristimulus colorimeter was used to measure the color of popped samples using standard color scales as L^*, a^*, and b^*. The derived parameters such as total color difference (ΔE^*), chroma (C^*), hue angle (H^*) and browning index (BI^*) were obtained for comparison of colors of samples popped under different treatment conditions. ΔE^* was found to have good fit to zero-

order model while *BI** followed a first order model. The value of rate constant (*k*) for *ΔE**and *BI** increased from 0.100 – 0 .162 min^{-1} and 0.011 – 0.015 min^{-1}, respectively with the increase in salt content. The effect of ageing and amylose content on popping characteristics was also evaluated. Four different varieties of paddy based on their amylose content were stored at ambient temperature for 18 months in closed plastic containers. Samples were taken out at two months intervals and amylose content for each was measured. They were conditioned to 15% moisture level and 2% salt and popped under optimized conditions viz., power level of 1000 W and heating time of 44 s. Changes in the PP and ER of popped paddy with the storage period were better explained with the first-order fractional conversion kinetic model. The microstructural study of paddy and popped rice were carried out using Scanning Electron Microscopy and X-ray Micro-Computed Tomography.

Key words: Paddy, popping of grains, microwave heating, optimization, salt coating, color, ageing kinetics, microstructure.