ABSTRACT

Aloe vera (*Aloe barbadensis*) is widely being used in different formulations for its medicinal and health promoting compounds which includes polysaccharides (more than 60% w/w), phenolic compounds, organic acids, enzymes, vitamins and minerals etc. High pressure processing (HPP) was used for quality retention of aloe vera and aloe vera-litchi based mixed beverage and shelf life extension.

HPP pre-treatments (300-500 MPa/5-15 min) on dehydration characteristics of aloe vera cubes (AVC), dried at 50-70 °C and air velocity of 1-2 m/s were studied. HPP pre-treatments led to improved drying rate and rehydration ratio. The drying rate and drying time were most significantly affected ($p < 0.05$) by the drying temperature, followed by air velocity, pressure level and dwell time. HPP enhanced the firmness of AVC with a maximum of up to 21% for the sample treated at 500 MPa/15 min. Microstructural analyses using scanning electron microscopy (SEM) indicated non-uniform structures in the pre-treated and dried AVC samples. Semi quantitative elemental detection (EDS) confirmed the presence of the considerable amount (14%) of calcium in aloe vera.

Effect of HPP and pH variation on rheological properties, pectinmethylesterase (PME) activity and microbiological characteristics of aloe vera juice was studied. Minimal changes in the physicochemical attributes (< 10%) and color ($\Delta E^* < 1$) as well as nutritional quality attributes such as ascorbic acid (< 15%), phenolics (< 15%) and antioxidants (< 10%) of aloe vera juice due to HPP were observed. The maximum inactivation of PME, PPO and POD achieved was 18, 15 and 30%, respectively. All the groups of microorganisms reduced to below detection limit (10 CFU/mL) for the samples treated at 600 MPa/10 min.

Rheological characteristics of aloe vera juice were correlated with the concentration (1.5-5.5 °Brix) and temperature (15-55 °C). Power law adequately described the flow behaviour for all the aloe vera juice samples. The concentrates above 1.5 °Brix showed weak gel characteristics as evidenced by dynamic rheological analysis. Both the untreated and high pressure processed aloe vera juice showed a shear thinning flow behaviour ($n < 1$) within the domain of 200-600 MPa/25 °C/10-30 min/pH 3-5. The rheological parameters viz. consistency index (K) and yield stress (σ_0) showed an increasing trend with pressure and ranged within 0.059-0.079 Pa.s^n and 0.12-0.18 Pa, respectively. However, the n value for treated aloe samples ranged between 0.64 and 0.70 and decreased with increase in pressure.

The similarity value based on fuzzy reasoning revealed that the mixed beverage composed of 85% litchi and 15% aloe vera juice was the optimum formulation for ALMB. The ALMB was processed using HPP and the optimum process condition obtained for ALMB was 600 MPa/56 °C/15 min which resulted in 74% retention of ascorbic acid content and 49, 69 and 64% inactivation of PME, PPO and POD, respectively. Based on the sensory quality, ascorbic acid retention (> 50%), and instrumental color difference ($\Delta E^* < 5$), the shelf life of HPP treated ALMB samples stored at 4, 15 and 25 °C was up to 100, 30 and 5 days, respectively, whereas for thermal processed ALMB samples shelf life was 80, 40 and 10 days, respectively.

Keywords: Aloe vera, Litchi, high pressure processing, rheological properties, fuzzy logic, shelf life