Development of osmotically dehydrated kachkal flour for incorporation in malpua mix powder

ABSTRACT

Optimization of osmotic dehydration of kachkal (plantain) banana in sugar syrup was done using response surface methodology to obtain the maximum water loss and weight reduction with minimum solid gain. Process parameters chosen were temperature, sucrose concentration, time and syrup: fruit ratio. The optimized condition for osmotic dehydration process was found to be: 60 °Brix syrup, 50°C temperature, 200 minutes immersion time and 10:1 syrup: fruit ratio. Mass transfer kinetics for water loss and solute uptake were studied under the optimized condition for 8mm slices using diffusivity models for flat slab. The average values of moisture and solute diffusivities (D_{eff}) were found to be 3.692×10^{-10} m^2/s and 1.32×10^{-10} m^2/s respectively. The activation energies for moisture and solute diffusivities were found to be 33.7 kilo Joule/ mole and 175 kilo Joule/ mole respectively. The OD plantain slices were tray dried and ground to make flour. Optimization of malpua batter formulation was done using mixture experimental design with percentage wheat flour, skim milk powder (SMP) and kachkal flour as variables and sensory score as criteria. The formulation securing the highest score was : kachkal flour(23.37%),wheat flour(46.62%) and skim milk powder(30%) which was the composition of malpua instant mix powder. Studies conducted on chemical and functional properties for kachkal mix powder and plain mix with no kachkal flour showed that incorporation of kachkal flour led to 25% rise in water absorption and 18% rise in oil absorption power and 9% rise in solubility while lowering of bulk density and swelling power. Kachkal flour substitution has led to an increase in mineral (0.56%) and fiber(by 1%) content while fat and protein content was lowered. Moisture sorption isotherm studies were conducted on the kachkal substituted mix at 40°C and Type IV isotherm was obtained. Out of four different models fitted to our data, Peleg model(R^2 = 0.819) and GAB (Guggenheim-Anderson-de Boer) model (R^2 = 0.79) gave the best fit to our data.

Keywords : kachkal, osmotic dehydration, response surface methodology, diffusivity, malpua instant mix powder, sorption isotherm.