CHAPTER VII

Conclusions from the present studies

In the present work studies have been carried out on electrical conductivity of potato and apple under different conditions. The conclusions drawn from the present studies are briefly summarized in this chapter.

XRF studies show the presence of iron, calcium, potassium, chlorine, silicon, sulphur, phosphorous, magnesium, sodium and oxygen in the samples of potato.

The measurement of electrical conductivity in air at room temperature with time shows that for both potato and apple the electrical conductivity first increases with time attaining a maximum value and then it decreases .Potato shows a maximum value of conductivity of 2×10^{-4} S/m after a time interval of 8400 seconds while apple attains a maximum value of 1.83×10^{-4} S/m after a time interval of 2700 seconds. All substances are more or less hygroscopic.The presence of small amount of water causes considerable increase in the conductivity of the samples because the impurities in the water dissociates into ions or the water with a high permittivity aids in the dissociation of the molecules of the matter itself. The acidity affects the ionic movement in the sample during ohmic heating. Ions present in plant tissue are potassium, proteins and organic acids such as ascorbic acid and citric acid. Electrical conductivity depends on the ions in solution. The difference in the conductivity of potato and apple is due to the difference in the concentration of ions in solution. Ohmic heating enhances drying rates and hence there is a decrease in conductivity with time.

Variation of electrical conductivity with temperature shows that for potato the electrical conductivity first increases nearly linearly with temperature from 299 K to 307 K. It then decreases upto a temperature of 325 K. From 338 K to 379 K the curve shows an enormous increase in electrical conductivity with a peak at 375 K. Apple shows a linear increase in electrical conductivity from a temperature of 301 K to 324 K. The electrical conductivity then decreases from 329 K to 334 K and finally an increase from 360 K to 373 K. The electrical conductivity values were found to decrease when the samples were allowed to cool down resulting in a decrease of temperature.

The increase in electrical conductivity values with temperature is due to reduced drag for the ionic movement. On the other hand, the decrease in electrical conductivity values is due to the evaporation of the sample juices with increase in temperature and also due to bubbling. Fruit juices are acidic resulting in the potential for electrolytic hydrogen bubble formation. The decrease in electrical conductivity is also due to increase in the drag for ionic movement when insoluble solid contents increases. Acidity also affects the ionic movement in the samples. The difference in the electrical conductivity values of potato and apple is due to the difference in the acidity of the samples. Starch transition and cell structure changes which occur during heating also affects the electrical conductivity. Diffusion of cell fluids in the samples due to the presence of an electric field increases the rate of change of conductivity with temperature. At high temperature structural changes results which causes an increase and decrease in electrical conductivity values.

The variation of electrical conductivity with different concentrations of NaCl solution shows that the electrical conductivity increases with increase in concentration upto a particular value of concentration and then decreases. electrical conductivity of potato is less than that of apple at the same concentration, but the nature of variation is the same. The electrical conductivity of potato increases with increases in concentration attaining a maximum value of 10.31 x 10^{-4} S/m at 5% concentration and then decreases reaching a minimum value of 1.52 x 10^{-4} S/m at 31% concentration while apple shows a maximum value of 17.54 x 10^{-4} S/m at 5% concentration and a minimum value of 0.67 x 10^{-4} S/m at 31% concentration.

Electrical conductivity depends upon concentration, temperature, particle size of the samples and location of the particles. The increase in electrical conductivity with concentration is due to increase in the number of ions contributing towards conductivity. The decrease in electrical conductivity is due to increase in viscosity of the sample juice with concentration which decreases the mobility of the ions.

The variation of electrical conductivity at different concentrations of NaCl solution with temperature shows similar behaviour for potato and apple samples. In case of potato the electrical conductivity at concentrations (%) 0.1, 0.23 shows an initial increase and then the curve becomes nonlinear showing decreasing and increasing values. At concentrations (%) 0.27, 0.31,0.36 and 0.45 an initial decrease and then increasing and decreasing values. Apple at concentration 1.38 % initially shows an increase and then a decrease and increase of conductivity values. While at concentrations (%) 0.38, 0.68, 0.80,1.00, 1.13 and 1.54

the curves initially shows a decrease and then the same nature of increasing and decreasing of electrical conductivity values.

The increase in electrical conductivity values with increase in temperature is due to increase in the mobility of the ions. The non-linear nature of the curve is a result of salt equilibration during the heating process. The change in electrical conductivity pattern with increase in temperature at different concentrations is due to starch gelatinization that occurs during heating. Heating results in phase change, dehydration and starch gelatinization which affects the electrical conductivity of the samples.

The variation of temperature with time shows that in case of potato the temperature increases slightly in the time interval of 0 to 120 seconds and then till 540 seconds there is an abrupt increase of temperature. On the other hand, in case of apple in the time interval from 0 to 180 seconds the temperature increases gradually and from 180 to 540 seconds there is a rapid increase of temperature.

The temperature distribution inside a food system is affected by heating and directly modifies the time-temperature relationship for enzyme deactivation.