CHAPTER 1

1.1 INTRODUCTION

Any attribute affecting the processing or handling of a food can be defined as an engineering property. The engineering properties of food are important in the process of design and manufacture of food products. They are classified as electrical (conductivity, permittivity); thermal (specific heat, thermal conductivity, diffusivity); optical (colour, glossy, translucency); mechanical (structural, geometrical & strength) and food powder (primary & secondary) properties. Most of these properties indicate changes in the chemical composition and structural organization of foods ranging from the molecular to the macroscopic level. A change in either composition or structure usually results in a simultaneous change in several properties. Hence it is difficult to control a single property in isolation. Both modern and more conventional measurement methods allow computation of these properties, which can provide information about the macro structural effects of processing conditions in fresh and manufactured foods.

Ohmic heating is a thermal process in which heat is internally generated by the passage of alternating electrical current through a food system that serves as an electrical resistance[1]. The main advantage of ohmic processing are the rapid and relatively uniform heating achieved[2], ease of process control, high energy efficiency[3],lower degradation of vitamin[4], together with the lower capital cost compared to other electro heating methods such as microwave and radio frequency heating[5,6]. Ohmic heating is defined as a process wherein electric current is passed through

materials with the primary purpose of heating them. Ohmic heating has been shown to enhance drying rates[7,8] and extraction yields[9] in certain fruits and vegetables. A large number of actual and potential applications exist for ohmic heating, including blanching, evaporation, dehydration, fermentation, extraction, sterilization, pasteurization and heating of foods to serving temperature, including in the military field or long-duration space mission. Additionally to heating, research data suggests that the applied electric field under ohmic heating causes electroporation of cell membranes.

Food materials or biological materials can display large compositional variation, inhomogeneties and anisotropic structures. Composition can change due to seasonal variation and/or environmental conditions, or in the case of processed foods , properties can be affected by process conditions and material history. Cereals that are puffed up under different moisture and temperature conditions can vary widely in density and cell size distribution and exposure of such products to moist atmosphere sometimes for short periods ,can have dramatic effects on their crispness. Therefore in many cases the data found in published lists for engineering properties of foods can only be considered as approximate values.

The world's food industry has focussed increasing attention on ohmic heating of pumpable foods. It is highly attractive technique for continuous food processing.

1.2 REVIEW OF SOME WORKS

Works related to engineering properties of food are numerous. Palanippan and Sastry[10] reported that electrical conductivity of the orange, carrot and tomato juices increased with temperature and decreased with solid content. Icier et al[11] studied the electrical conductivity for fresh grape juice . Amiali et al[12] found that the electrical conductivity increased linearly with increasing temperature for fruit juices (namely apple, orange and pineapple juices). Kong et al[13] found that the electrical conductivity changed significantly with temperature. The changes in electrical conductivity with temperature during ohmic heating was studied by Kemp and Fryer[14], Icier et al [11], Icier and Ilicali [15,16a,16b], Li et al[17] , Zaraifard et al[2] and Tulsiyan et al [18]. Kemp and Fryer [14]. Icier et al [11] reported that the increase in the electrical values with temperature has been explained by reduced drag for the movement. Similar observations were reported for grape juice by Icier et al[11] , apple and sour cherry juice by Icier and Ilicali[15]. Cristina et al[19] reported that the electrical conductivity was dependent on the concentration and the temperature for lemon juice. A linear increase in electrical conductivity with increase in temperature were found by Sarang et al[20], Tulsiyan et al[18], Legrand et al[21],Icier and Ilicali[16a,16b], Castro et al[22], Li et al[17], Zareifard et al[2] and Fiala et al[23]. , Castro et al[22] reported similarly that an increase of electrical conductivity with field strength was clear for strawberry pulps and strawberry filling, but not evident for strawberry topping and strawberry – apple sauce. They explained the effect of electrical field strength on electrical conductivity by increasing membrane destruction and fluid motion through the capillaries at higher electrical field strengths. Electrical conductivity and physical properties of Surimi-Potato starch under Ohmic Heating were reported by P. Pongviratchai and J.W.Park[24]

1.3 AIM AND OBJECTIVE OF THE PRESENT WORK

It was proposed to study electrical conductivity of potato and apple under different conditions viz at different temperatures and saturated with saline solutions of different concentrations.

The studies also include X-ray fluorescence (XRF) studies to know the sample compositions.

The proposed works were expected to throw some light on the conductivity and composition of potato (Solanum tuberosum) and apple (Pyrus Malus)