

Effect of Fruit Size and Processing Time on Vacuum Impregnation Parameters of Cantaloupe and Apple

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ABSTRACT

This study evaluated the effect of two fruit sizes (3.5×2.5×1.0 and 1.2×1.2×0.8 cm³) and processing time (impregnation and relaxation times; both for 10 and 20 min), on some vacuum impregnation parameters of cantaloupe and apple. Fruit size and processing time significantly affected the mass fraction of fruit occupied by impregnation liquid (X value) and the effective porosity (ϵ_e) of apples more than cantaloupe. High surface area of fruit and long processing times allowed for significant liquid penetration into the fruit. This study has shown that the effectiveness of vacuum impregnation is a surface-controlled phenomenon.

Keywords: Vacuum impregnation, Impregnation processing time, Fruit size, Cantaloupe, Apple

INTRODUCTION

Vacuum impregnation (VI) is a process that applies reduced pressure to a solid-liquid system, followed by restoration to atmospheric pressure. Vacuum pressure causes the gases inside tissue to expand and flow out of the extracellular spaces. When the pressure is restored, the residual gas is compressed and the external liquid flows into the product pores (Andrés et al., 2001; Krasaekoopt and Suthanwong, 2008). This process can be used to develop novel food products, especially fortified food products. The effects of vacuum impregnation on the properties of porous food materials, including fruits and vegetables, have been studied (Mújica-Paz et al., 2003a; Zhao and Xie, 2004). Some reports investigated using vacuum impregnation with different liquids for mineral fortification in fruits and vegetables (Fito et al., 2001; Gras et al., 2003; Zhao and Xie, 2004).

The quality of the final products after vacuum impregnation treatments was affected by several factors, such as the vacuum and relaxation times of the solid matrix (Derossi et al., 2010), mechanical properties of the materials, transport rate of hydrodynamic mechanism, food structure and size and shape of the sample (Zhao and Xie, 2004). The effect of vacuum impregnation on fruit was reported to be complicated, depending on types of the samples (Mujica-Paz et al., 2003b). However, the effect of fruit size, especially in cubic form, on vacuum