UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

THE DERIVATION AND CONVERSION OF DIMENSIONAL TO NONDIMENSIONAL OF MASS BALANCE EQUATION AND DISCRETIZATION USING THE EXPLICIT FINITE DIFFERENCE METHOD

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IN THE NAME OF ALLAH, (AL MIGHTY) THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

In this research, we focus on deriving a mathematical model of mass transfer equation proposed by Khalloufi et al. (2010) to a partial differential equations. Then the partial differential equations are converted to a nondimensional partial differential equations by substituting each nondimensionalized parameter into the derived partial differential equations. The nondimensional partial differential equations are discretized using the explicit finite difference method. The aim of our research is to derive the mathematical model and convert the derived model into a nondimensional equation then discretize it using the explicit finite difference method.

1 INTRODUCTION

Food plays an essential part in human life. With the increase in human population, society has adapt to mass produce food such as fruits, vegetables, and poultry to meet the needs of millions of people in this world. With that said, too much production can lead to food waste as not all food are long-lasting and have expiration date. These facts apply to mostly raw food such as fruits and vegetables. According to Karam et al. (2016), fruits and vegetables have proved to be essential for a balanced diet.

Progress in human technology has made it possible to make fruits and vegetables preserve longer through a process called food drying. Karam et al. (2016) said that fruits and vegetables are usually dried to extend shelf-life, enhance storage stability, minimize packaging requirements and reduce transport weight.Karam et al. (2016) also mentioned that drying is the one of the oldest, most common and most diverse food processing methods.Karam et al. (2016) cited from (Zhang et al., 2006; Argyropoulos et al., 2011; Kurozawa et al., 2012) said drying fruits and vegetables is a process where water removal halts the growth of spoilage microorganisms, as well as the occurrence of enzymatic or non-enzymatic browning reaction in the material matrix as . Ahmed (2011) cited by Karam et al. (2016), numerous processing techniques have been used for dry drying of fruits and vegetables.

One of the drying methods is supercritical carbon dioxide (SC-CO2) drying. This method use a supercritical fluid, a substance for which both pressure and temperature are above the critical point and can not be condensed even with extreme compression Khalloufi et al. (2010). The SC-CO2 used are odourless, tasteless, safe, chemically inert and stable, non-toxic, non-flammable, non-explosive, inexpensive fluid, easy to handle and obtain in pure form Khalloufi et al. (2010). The SC-CO2 pass through the food products and will absorb the moisture in the