UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

NUMERICAL ESTIMATION OF COOLING TIME OF ROASTED POTATO

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In the name of ALLAH, the most gracious, the most merciful

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TABLE OF CONTENTS

ABSTRACT

In this project, the numerical estimation time of cooling of roasted potato is determinel by using Newton's law of cooling. In order to estimate cooling time, t, we need to rearrange Newton Law of Cooling since the ordinary differential equation is autonomous differential equation. The three numerical technique are Euler's Method, Taylor's series of order two and Backward Differentiation Formula with order of two (BDF2) to determine the estimation time of cooling. The error accuracy is identified by comparing absolute relative percentage error to choose the best numerical estimation among those three method. Parametric study is done in order to determine how parameter such as ambient temperature, T_a and rate cooling constant, k effect the reading of time of cooling.

1 INTRODUCTION

1.1 INTRODUCTION

The studied about the cooling of different kinds of solid had been done by Isaac Newton in 18th century. This law was published in the year of 1701, when it was originally formulated (Catlett, 1973). Newton noted that the rate of temperature change is proportional to the difference in temperatures between its surroundings and the body. However, in order to clear the confusion between the concepts of heat and temperature, Newton give the final simplest version of the law.

The application of ordinary differential equation is used to determine the estimated time of cooling time of roasted potato. The model of Newton's Law of Cooling was measured when the temperature of an object is being heated and cooled at the surrounding temperature. The temperature of the object, T_a is assumed to be constant. This cooling law states that the rate of warm body cools is approximately proportional to the difference between the temperature of its surrounding and the temperature of the warm object.

1.2 PROBLEM STATEMENT

A general idea about this project is on how temperature affected the estimation of cooling time of roasted potato during the cooling process. In this research, we prepare to investigate the cooling time of roasted potato where the potato will baked in a conventional oven and taken out from the oven once a temperature of 194 °F is obtained. The roasted potato then allowed to cool in a room temperature and the temperature of potato will be taken every 15 minutes to determine how its obey the Newton Law of Cooling.

The heat lost transfer process was concerned with two different thing which are temperature of the roasted potato and the flow of heat in room temperature. Difference in the flow of heat in temperature will automatically affected the time of cooling, t of roasted potato.