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TITLE:

SELF HEATING ELEMENT ON FOOD-PACKAGING

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ABSTRACT

Self-heating food packaging consists of a heating pad and food itself which the food warmer provided to help reheat the ready to eat meals. The food warmer or heat pack is an active module with an ability to produce heat without external sources which called an exothermic reaction process. The most popular application of this self-heating technology is *Kembara* food pack. It is a suitable and convenient during travel innovation as it will help to re-heat the food easily and safely to eat within a few minutes only. Therefore, this study aimed to discover the best chemical composition of Calcium Oxide with Iron (Fe) and Calcium Oxide with Iron (Fe) with the presence of Sodium Chloride to develop a self-heating pack for re-heating purposed of food. The most suitable characteristic of an efficient heating pack is a reaction that can achieve the highest final temperature with lower duration to rise at highest temperature and longest duration sustained at the highest temperature. The reaction of Calcium Oxide and Iron (Fe) were activated with 100 ml,120 ml,140 ml and 200 ml of water with each of temperature reaction occur was recorded. The result in this study indicated that 60 g of Calcium Oxide with 10 g of Iron (Fe) activated with 120 ml of water exhibited the highest temperature 62°C with the duration taken to reach the highest temperature is 36 minutes. This combination duration sustained at highest temperatures is 10 minutes. Meanwhile, the lowest temperature recorded was 40°C and it took around 45 minutes to reach the highest temperature when 40 g of Calcium Oxide and 8 g of Sodium Chloride were combined with 100 ml of water. Meanwhile for the combination of Calcium Oxide and Iron (Fe) with the presence of Sodium Chloride the highest temperature that achieved were 74°C.The combination of 50 g of Calcium Oxide,15 g of Iron (Fe) and 10 g of Sodium Chloride (NaCl) took about 10 minutes to reach the highest temperature and sustain at the highest temperature for about 8 minutes. The lowest temperature recorded for this combination was 42°C and it took around 22 minutes to reach the temperature when 40 g of Calcium Oxide,8 g of Iron (Fe) and 10 g of Sodium Chloride (NaCL) were combined with 100 ml of water.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

Self-heating food packaging is a technology that allows food to be heated without the need for heat external sources. These packages typically contain a combination of chemicals that when mixed produce exothermic reactions that generate heat. This allows for convenient heating for food on the go, making it a popular option for camping, picnics, and other outdoor activities. Additionally, self-heating food packaging can also be used in emergency and disaster situations where access to traditional heating sources is limited. Typically, an exothermic reaction will produce the self-heating pad found in the outer layer enclosing the food and the heat. By adding a specific quantity of liquid, such as water, the exothermic reaction between the materials inside the self-heating pad can be started. For more than 50 years, self-heating food technology has been developed. In 1950, Caldwell and Gillies (Caldwell & Gillies, 1950) described research that resulted in a successful reaction mixture for heating food compositions built into cans that could hold soups or other liquid foods. While in the United Kingdom, it was reported that the self-heating can was initially developed as a wartime measure, then made available to the general population for use with products such as soups and beverages(Anon, 1960). Millions of these cans were used during the war.

The domestic market, which is becoming more and more focused on convenience, demands a way to heat all kinds of food and drinks, including highly viscous liquids and solid snacks like wraps, fajitas, prepared meals, rice, and stews. There are a range of commercially accessible self-heating products, including food and beverages, on the market today. Oliver-Hoya et al.(Oliver-Hoyo *et al.*, 2009) also implemented a classroom activity in which a self-heating beverage and Meals Ready to Eat (MRE) were utilized as examples of real-world chemical problems.

In creating the technology for self-heating food packaging, most research results are reported as patents. Most early self-heating system developers relied on Magnesium-Iron alloy for their systems' primary heat source. Using a powder mixture of Magnesium-Iron alloy, (Lamensdorf, 1997)Lamensdorf provided a flameless heater