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**TITLE:**

PRELIMINARY STUDY ON THE SELECTION OF SELF-HEATING ELEMENTS  
IN SELF-HEATING PAD

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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 heat sources which called an exothermic reaction process. The most popular application of this technology is *Kembara* food pack. This innovation really suitable and convenient during travel as it will help to re-heat the food easily and safe to eat within a few minutes only. Therefore, this study aimed to discover the best chemical composition of Calcium Oxide with Sodium Chloride to develop a self-heating pack for re-heating purpose of food. The most suitable characteristics of the heating pack is a reaction that can achieve higher final temperature with lower duration to rise and longest duration sustain at the highest temperature. The reaction of Calcium Oxide and Sodium Chloride were activated with 25 ml, 30ml, 40ml, 50ml, 100ml, 120ml and 200ml of water with each of temperature reaction occur was recorded. The result in this study indicated that the combination of 70g of Calcium Oxide with 10g NaCl in 100 ml of water exhibited the highest temperature 105°C with the time sustained at highest temperature is 1 minute and took about 5 minute to rise the highest temperature. Meanwhile, the lowest temperature was recorded is 28°C and it took around 20 minutes to reach the temperature when 10g of calcium oxide and 15g of sodium chloride were combined with 25 ml of water.

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# CHAPTER ONE

## BACKGROUND

### 1.1 Introduction

Self-heating food packaging uses a technique that eliminates the use of fire or other external heat sources so that we can enjoy hot meals. The food inside this active packaging is heated to extremely high temperatures using a heat-releasing chemical reaction which involved exothermic process reaction. An exothermic process is a thermodynamic action that transfers energy from the system into the environment, typically as heat but also as light, electricity, or sound. In this reaction, energy is transfer into surrounding rather than taking energy from its surrounding as in the endothermic reaction. An endothermic process, which often absorbs energy as heat, is the opposite of an exothermic process. In the physical sciences, the idea is widely used to describe chemical reactions in which chemical bond energy is transformed into thermal energy (heat). The heat that produced from exothermic reaction is used to re-heat the packaging food like in the *Kembara* meal. It consists of two different pack which are the food warmer and the food itself. The exothermic reaction will occur between the two types of different pack when the specific amount of liquid like tap water is added. The innovation of the self-heating really useful in our daily routine especially for people that love to travel. It is lightweight, portable and easy to fit in our backpack plus it also safe to use as it not releases any dangerous gases and safe for disposal with other trash. This self-heating food package has historically been utilised extensively in military operations, during natural catastrophes, or anytime there are insufficient supplies of conventional cooking equipment (Poonia & Singh,2015)

## **1.2 Literature Review**

### **1.2.1 History of Self-Heat Food Pack**

For more than 50 years, self-heating food technology has been researched and developed. A successful reaction combination for heating food components included in cans is the result of research on self-heating food technology in 1950, and many millions of these cans were utilised during the war (Caldwell & Gillies, 1950). While in the UK, it was revealed that the self-heating container was initially developed as a wartime convenience and made available to the general population, including foodstuffs like soups and drinks (Anon,1960). For up to 18 soldiers who are stationed in remote areas, the Unitized Group Ration-Express (UGR-E) module offers a full, hot meal (Ho., *et al.*,2010). Since 2007, it has been available for purchase and has received approval from every department of the Department of Defence. The Flameless Ration Heater technology, which the army used to heat the meals, served as the foundation for UGR-E (Ho *et al.*,2010) Fedorov, a Russian engineer, invented the first self-heating can, the self-heating tin, in 1897. The military MRE, or 'Meal, Ready to Eat,'<sup>TM</sup> was the first self-heating meal. This was a meal ration pack that included an entrée, healthful fruit and snacks, and everything a soldier would need to last a certain amount of time. MREs are small and lightweight, making them ideal for field use. Luxfer Magtech collaborated with the US military in the early 1990s to develop a portable and independent heat source capable of swiftly and successfully heating MREs in the field. The result was the Flameless Ration Heater (FRH), a lightweight heater bag that soldiers could use to heat their rations within 12 minutes of activating the FRH (Luxfer,2021).