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## Rechauffer

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### ABSTRACT

Rechauffer is an established innovation with an excellent heat insulator that applies the physics concepts such as Specific Heat Capacity and thermal contact. As we know, most of the food containers in the market are not great heat insulators. This causes the food that we put into the food container is not warm and it can't really maintain the temperature of the food for a long period. So, people lose interest in bringing the homemade food because of that issue and prefer to buy the food at the restaurant. We create the Rechauffer tiered. Thus, it can provide a lot of space for the users to bring a variety of food. Other features that were applied include, the materials and the weight of the Rechauffer. Rechauffer has a high potential to encourage people to bring the food from their home. Rechauffer comes with specifications that focus on helping the customer pack their food in the proper way possible and keep the temperature of the food whether it is cold or hot. Rechauffer has some integral improvements that can make our lives better as we can enjoy the food while at its desired temperature and have the best high-quality meal.

**Keywords:** Insulator; temperature; homemade food; thermal contact

### INTRODUCTION

As we know that we are advised to bring our own meals from home to maintain food hygiene and safety. There are a lot of benefits of bringing our own meals from home. For instance, we can prevent ourselves from facing food poisoning and we can choose the quality of food to eat. According to Dr Eileen Candy, Head of Department Nutrition and Dietitian said "Freshly cooked and consumed food has multiple health benefits" [1]. This statement proves that homemade meals are healthier than food that we buy at the restaurants. We created this Rechauffer to encourage people to bring their own meals from home. With this Rechauffer, all the people can bring their meals easily. Our group comes up with a market-beneficial-innovation for someone to keep their homemade food. Our Rechauffer is established with an excellent heat insulator that applies the physics of Specific Heat Capacity that can be defined as the quantity of heat (J) absorbed per unit mass (kg) of the material when its temperature increases 1 K (or 1 °C), and its units are J/(kg K) or J/(kg °C) [2]. Home-cooked food is said to be better for our health if we choose the right ingredients since we are in control of what we are adding to the food. When we bring our lunch, we're able to limit the temptations of add-ons that are loaded with fat, salt, and sugar. With Rechauffer, people can enjoy their homemade food while it's still hot since our product has a vacuum flask feature located in the internal surface of the box that puts a stop to heat transfer. For that reason, we can savour the original taste of our food items and be able to enjoy them when we get a moment.

There are a few problems that we considered before we decided to start our project. We have collected some data and done the research about why people didn't bring the homemade food from home. Based on the information that we got from them, most of the food containers in the market are not great heat insulators. For example, some workers bring homemade food to their workplace in the morning and eat the food for lunch. However, the food does not taste so good because it is not warm anymore. This will make people lose their appetite. Another example is the food will easily stale if we do not put the food in the food container that can maintain the temperature and have a good heat insulator. It will cause food wastage. Furthermore, due to Covid-19 pandemic people prefer to bring their food from home because it is more secure, but they can't choose the best food container to put their food. Thus, after considering all the problems regarding the current food container that we have in our country, our group decided to improvise and add some special features to the food container. By using the physics concept that we have learnt, we hope our Réchauffé can bring a lot of benefits to all users, and they will be happy and satisfied with our product.

## INNOVATION DEVELOPMENT

Rechauffer is a unique and innovative product that is inspired by thermos. This favors people who love to bring their own meal from home to keep warm for a long time and still taste good when we consume it. There are few physics theories that apply to this product as shown in Figure 1.

- The most important part of Rechauffer is the stainless steel as the box for food storage. The inner part of the food container is exposed to water and air. This greatly encourages the rusting process to occur in food containers. As we all know, rust is a very dangerous substance that can harm human health and contaminate food quality. Stainless steel is used because of its rust-resistant properties. Thus, the quality of food is protected. In addition, the shiny surface of stainless steel can prevent heat leaving or entering by reflecting the heat to food and can reduce heat loss. This can keep the food hot.
- Next, in Rechauffer there is a vacuum between the two layers of stainless steel and cork to prevent conduction [3,4]. Since a vacuum is a medium free of materials, it provides effective insulation. The phenomenon of heat transmission from food to stainless steel and cork is constrained by this.
- Another main part of Rechauffer is cork. Cork is a very good thermal insulator as it will reduce heat transfer [3]. In Rechauffer, cork layer and stainless-steel layer is used to create a vacuum condition between them. Cork also used to support food storage to prevent the surface of the food container from coming into direct contact with the PVC layer.
- The PVC plastic is the outermost part of Rechauffer. It is used as the lid, handle, outer part of the food container and lock of Rechauffer. It has low thermal conductivity which makes it a good insulator [5]. PVC is a very strong and long-lasting material. To add on, PVC is a lightweight material. This makes our product, Rechauffer durable and easy to carry as it is light.
- Silicone is used at the lid of Rechauffer to prevent food leakage because of its water resistance property and act as a sealant. Silicone is also used at the handle of Rechauffer. It has a rubbery texture that exhibits anti-slip and tends to be very grippy. It is more comfortable for the user to hold it and bring it anywhere.
- Rechauffer has 3 levels of compartments that are easy to install and remove. Each level is held together using a lock made of PVC. Consumers are free to use all levels or just one, depending on their individual needs. Other than that, it also has a handle that is made of PVC and silicone on the upper part of Rechauffer makes it portable. This is proven that

- Rechauffer is a user-friendly product.
- Rechauffer is square in shape with measurement  $17\text{cm} \times 17\text{cm} \times 10\text{cm}$ . The measurement of stainless-steel box is  $15\text{cm} \times 15\text{cm} \times 8\text{cm}$ . Due to its large volume, this product can store food in a large capacity. Approximately, up to 1.3 kg of cooked rice can be stored in one compartment of Rechauffer. It is estimated that 1.5 liters of soup can be filled in one compartment of Rechauffer. Describe the innovation development in sufficient detail with evidence to support the originality and novelty of the product. Illustrate a complete prototype/system/sample with images/figures complete with labels. Highlight the inventive features of the product.

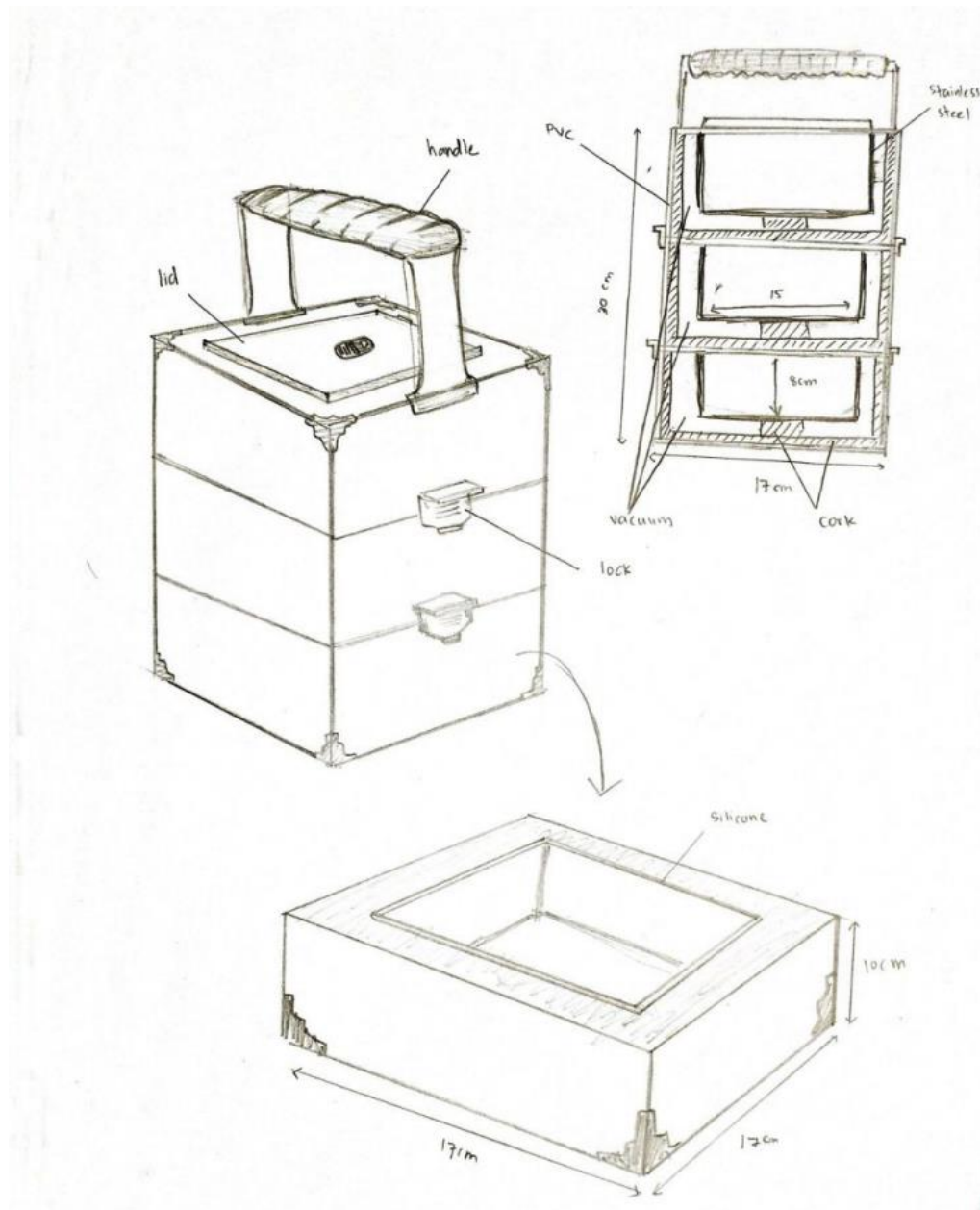


Figure 1

## COMMERCIAL POTENTIAL

We have made an analysis based on past research on the internet and our own past experiences and we have found that the affordable selling price of the invention is around RM105.00 taking into account a margin of 25%. The list of raw materials and prices are shown in Table 1.

**Table 1:** List of prices of raw materials

Materials	Quantity	Price /each
Wood board A3	4	6.90
Kertas pasir	1	1.50
Hot melt glue	1	3.80
Wallpaper	2	2.10
Needle and thread set	1	2.90
Linen tablecloth 150*180cm	1	23.90
Aluminum foil	2	5.00
Indoor mounting tape	1	13.50
Cork sheet	2	5.00
Double sided tape	2	2.50
Velcrotape	1	7.50
Loyang	3	10.00
	Total	RM 139.90

Our product has a great potential to be marketed. To make an example out of this, firstly we can advertise our product through competition on social media. This way we can attract a way larger marketing audience. Secondly, we can share an interesting poster on our product through email. Email is actually one of the fastest ways to share information, research also said that 82% of potential customers checked their email from time to time. Lastly, we can also advertise our product via sharing our customers' reviews. With great reviews we surely will buy ourselves a good reputation which will lessen our future customers' doubt and make it easier to buy our product.



**Figure 2:** Rechauffer

## CONCLUSION

Our product Rechauffer comes with specifications that focus on helping the customer pack their food in the proper way possible and keep the temperature of the food whether it is cold or hot. Rechauffer has some integral improvements that can make our lives better as we can enjoy the food while at its desired temperature for the next few hours and have the best high-quality meal. Rechauffer will continue to innovate by adding more features in the future. One of the prominent features that will be added to Rechauffer is its lid. Currently, Rechauffer has a lid made of silicone, in the future, Rechauffer would increase its security by adding a locking clamp to prevent accidental opening and secure our food.

## ACKNOWLEDGEMENT

First, we would like to thank God for letting us finish our innovation. We also have put all of our effort in order to complete this group project. Without our group members' cooperation, we cannot manage to complete this project within the given time. So, we would like to express our gratitude to all our group members for all of their hard work. We would also like to say thank you to our teacher, Mrs Nurul Huda Binti Mohd Noor who helped us a lot to finish this group work. Lastly, we also like to give our special thanks to our parents for supporting us throughout our hard time during this project.

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