



**School of Materials and Mineral Resources Engineering  
Engineering Campus, Universiti Sains Malaysia**

**Academic Session 2021/2022**

**Semester I**

**EBP 400**

**Polymer Product Design and Development**

**PROJECT PROPOSAL**

**Toothbrush with built-in toothpaste**

**Advisor**

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**Prepared by Group 7**

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### RUBRIC PHASE 1 (PROPOSAL)

	<b>Beginning (1-2)</b>	<b>Developing (3-5)</b>	<b>Accomplished (6-7)</b>	<b>Exemplary (8-10)</b>	<b>Weightage</b>	<b>Score</b>	<b>Marks (%)</b>	
<b>Introduction and Objective</b>	<p>Very little background information provided or information is incorrect.</p> <p>Objective misses major items (&lt;30%) of the project.</p>	<p>Some introductory information provided, but missing some major points.</p> <p>Objective contains of the major items (&lt;60%) of the project.</p>	<p>Introduction is nearly complete, missing some minor points.</p> <p>Objective contains of the major items (&lt;80%) of the project and the results obtained.</p>	<p>Introduction complete and well written; provides all necessary background principles for the project.</p> <p>Objective contains every major items (≥80%) of the project.</p>	20			
<b>Problem Analysis</b>	<p>Did not or poorly Identify and analyse given problem/task</p>	<p>Problem was partially identified and analysed properly.</p>	<p>Problem was identified and analysed satisfactorily</p>	<p>Problem sufficiently analysed.</p>	20			
<b>Design Consideration</b>	<p>Design Consideration misses major items (&lt;30%) of the ideas, lack of understanding.</p>	<p>Design consideration misses of the major items (&lt;60%) of the ideas such as quantity, variety, detail and creativity.</p>	<p>Design consideration contains of the major items (&lt;80%) of the ideas such as quantity, variety, detail and creativity.</p>	<p>The quantity and variety of ideas, depth of detail and creativity of ideas are clear and complete.</p>	20			
<b>Fabrication Approach</b>	<p>Incomplete discussion of suitable polymer processing and design strategies.</p>	<p>Some of the polymer processing and design strategies have been partially discussed.</p>	<p>Almost all of the polymer processing and design strategies have been satisfactorily discussed.</p>	<p>Polymer processing and design strategies are clearly mentioned and very appropriate.</p>	20			
<b>Design Milestone</b>	<p>Very incomplete and incorrect interpretation of design milestones.</p>	<p>Some of the tracks have been correctly interpreted and discussed; partial but incomplete understanding of milestone is still evident.</p>	<p>Almost all of the tracks have been correctly interpreted and discussed; only minor improvements are needed.</p>	<p>All-important tracks have been interpreted correctly and discussed.</p>	20			
<b>Total Marks (%)</b>								

## **1.0 Introduction**

The toothbrush with built-in toothpaste, allows us to have toothpaste just in seconds with the right amount of toothpaste on our brush at any time and place. It would also always be within reach because it can easily fit in your pocket. Brushing on the go means brushing after every coffee and meal, preventing tooth decay and periodontal disease from developing due to lack of brushing. Furthermore, if we are going on an adventure, such as camping or hiking, as well as travelling, it will be inconvenient to bring all of our toiletries with us, even if only for a short time. If we pack the toothbrush with built-in toothpaste in our suitcase, we will be able to reduce our packing by a smidgeon. The brush on this travel-friendly refillable toothbrush looks like any other, but the real deal is in the handle. It was created with the intention of being filled with your favourite toothpaste at the bottom. The tube can hold up to 30 serves of toothpaste, so you won't have to refill it for a long time. You wouldn't have to be concerned about forgetting your toothpaste while on vacation, either.

## **2.0 Objective**

- i) To improve the usage of toothbrush by designing it with toothpaste storage.
- ii) To produce an adjustable toothbrush from recycled material in order to enhance awareness and the good side of recycling material to produce new products.
- iii) To make user's life easier and fills with comfort.

## **3.0 Problem analysis**

Approximately 1 billion plastic toothbrushes are thrown out each year in the United States alone (about 3 brushes per person). Those 1-billion plastic toothbrushes add up, significantly, in total about 50-million pounds of plastic waste being added to the landfills each year. Toothbrushes are commonly made from polypropylene plastic and nylon and can take up to 500 years or more to decompose. These synthetic materials are what prevent plastic from decomposing naturally. If not recycled, plastic often ends up polluting the cities, sewage systems, and eventually the ocean. When this happens, plastic will begin to attempt decomposition. When plastic decomposes, it shrinks as it releases toxic chemicals into the environment. These shrunken pieces of decomposed plastic are called microplastics (small

plastic pieces less than five millimetre long) which can be harmful to our ocean and aquatic life. Figure 1 below shows how toothbrushes affect the environment.

#### 4.0 Concept of solution

From the discussion, we are planning to produce an adjustable toothbrush that comes with toothpaste. It consists of two parts which can be attached together before use. The upper part that comes with the bristles is replaceable. This way, can help to reduce the whole toothbrush which is made from plastic. Only the upper part can be replaced and the other part remains, and can be used for a longer time. On top of that, we are designing this product for easy handling (as it comes with toothpaste on the lower part), save time, and enhance awareness on using recycled material, especially plastic. Recycled material, if used in the right way to produce new products, eventually helps to reduce the waste of plastic itself in the landfill. Besides, the design product is light and small, which is easy to carry and does not occupy a lot of space as there is no need to carry an additional toothpaste.

#### 5.0 Product Development

Figure 5.1 shows the process of developing the product design.

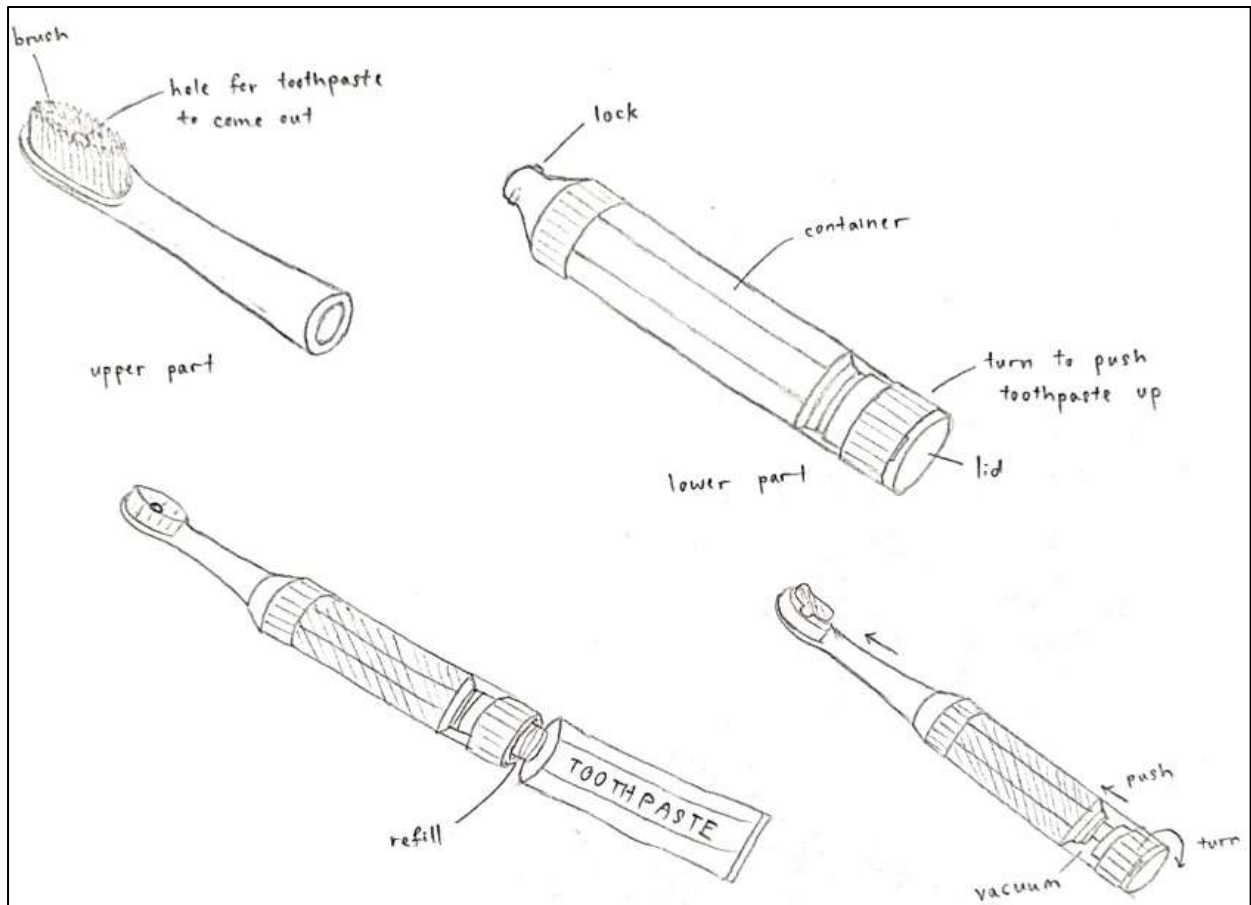


**Figure 5.1: The process of developing the product design.**

#### 6.0 Project Planning

##### 6.1 Design/sketch

Figure 6.1 shows the sketching of product design with the upper part (interchangeable brush heads) and the lower part (toothpaste container). Locks are used at the assembly points to prevent the loosen of the parts during application. In our design, toothpaste is pushed out through the hole at the brush head when an amount of pressure is applied by turning the bottom part. Lid at the bottom allows the toothpaste to be refilled.



**Figure 6.1: The sketching of product design.**

## 6.2 Design Consideration

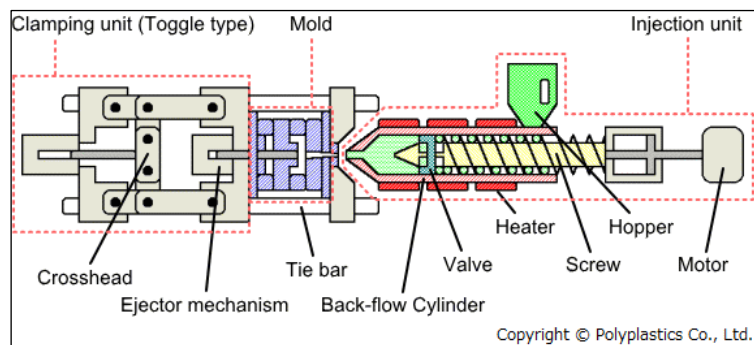
Table 6.2 below shows the design consideration for our product.

**Table 6.2:** Design consideration

Design Consideration	Description
<b>Performance</b>	<ul style="list-style-type: none"> <li>• Perfect for travel</li> <li>• Refillable and reusable toothbrush that fits up to 30 uses of toothpaste</li> <li>• Easy to use and lightweight</li> <li>• Can be use anytime and anywhere.</li> </ul>
<b>Features</b>	<ul style="list-style-type: none"> <li>• Device that combined functionality of toothpaste and toothbrush.</li> <li>• Replaceable toothbrush head</li> </ul>
<b>Reliability</b>	<ul style="list-style-type: none"> <li>• No batteries required.</li> </ul>
<b>Cost</b>	<ul style="list-style-type: none"> <li>• Manufactured cost below RM50</li> </ul>
<b>Packaging</b>	<ul style="list-style-type: none"> <li>• Attractive labelling consists of guideline on how to use.</li> </ul>

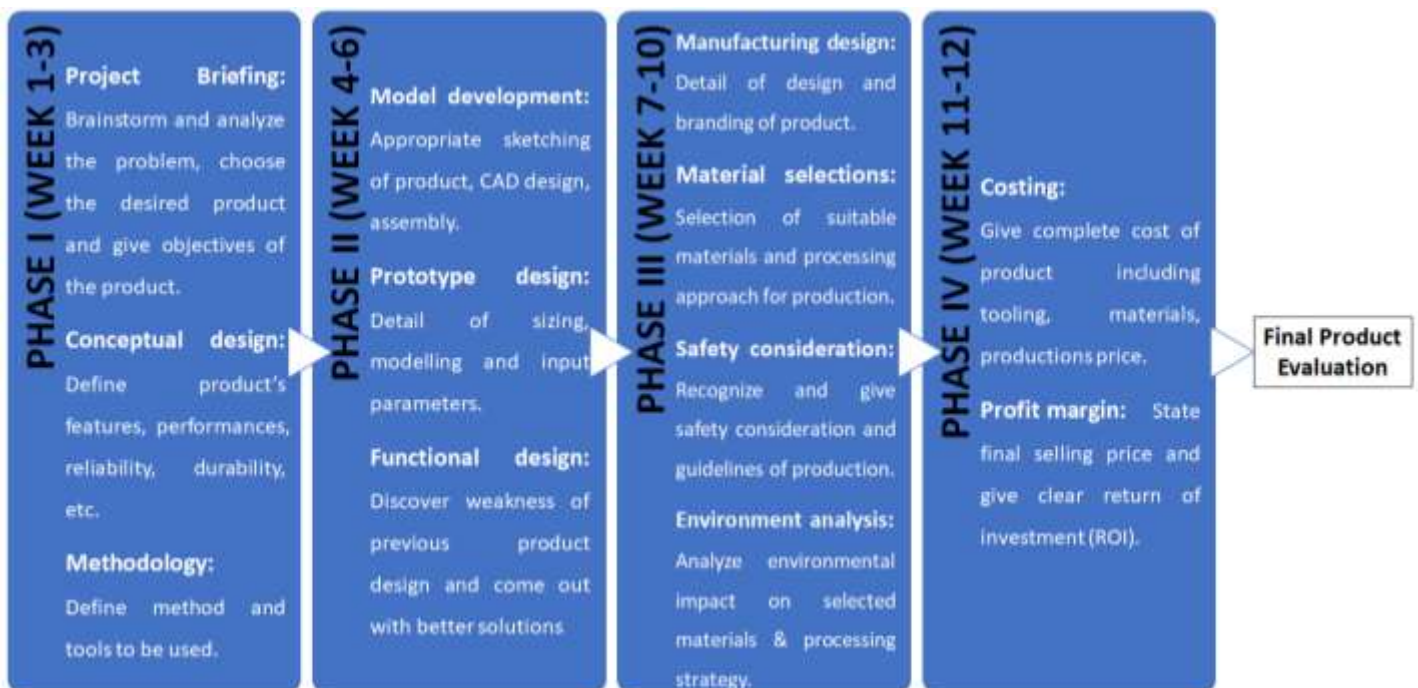
## 7.0 Fabrication process (Injection Moulding)

Injection moulding is a manufacturing process to obtain moulded products by injecting plastic materials molten by heat into a mould. Injection moulding machine is divided into 2 units (as shown in figure 7.1), clamping unit (opening, closing a die and ejection of products) and an injection unit (melt plastic by heat and inject molten into mould). The production method is basically based on the molten die-casting method. Heated liquid fills a mould followed by cooling to set and eject a piece as a solid shape. Injection moulding produces three-dimensional shapes that do not remain constant in a parallel line. Toothbrushes are typically manufactured using an injection moulding process. The injection moulding process is characterized by providing a mould (hollow metal block into which molten plastic is injected) in the shape of the toothbrush and injecting molten plastic through a hot channel nozzle into the mould. The toothbrush is then cooled and ejected from the mould. This method is suitable for the mass production of products with complicated shapes, and takes a large part in the area of plastic processing. The process of injection moulding is divided into 6 major steps: Clamping, injection, dwelling, cooling, mould opening and removal of products.



**Figure 7.1**

## 8.0 Project Milestone



## 9.0 Conclusion

In conclusion, we hope this design that combined functionality of toothpaste and toothbrush be able to make our user's life easier as it is light in weight, easy handling, and even perfect for travel. On top of that, our product is made from recycled material, therefore, can help to raise awareness to the public about the benefit of recycling plastic in a right way so that it is can be used to produces new product. At the same time, we are hope this can help to reduce the waste of toothbrush in a landfill by providing design that comes in two parts, where one side (lower part-handle) can be used for a longer time than the normal toothbrush.