



Faculty of Engineering

**ANALYSIS OF MOTOR PERFORMANCE FOR DABAI SEED CRACKING  
MACHINE**

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Final Year Project Report

Masters

PhD

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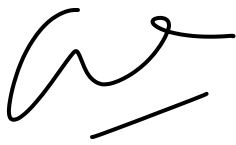
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**ANALYSIS OF MOTOR PERFORMANCE FOR DABAI SEED CRACKING  
MACHINE**

**Analysis Of Motor Performance For *Dabai* Seed Cracking Machine**

MOHAMMAD AMIRUL BIN JUMA'AT

A dissertation submitted in partial fulfilment  
of the requirement for the degree of  
Bachelor of Engineering  
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## **ABSTRACT**

The future Dabai seed cracking machine, which is now in the design stage, is the subject of this study's analysis of motor performance. This study's three main goals are to assess the Dabai seed cracking machine's design specifications; use MATLAB to analyze motor sizing based on power, torque, speed, and other parameters; and to create a conceptual model of the Dabai seed cracking machine system. The research is based on theoretical calculations and simulations because the machine has not yet been built. In order to evaluate the motor's performance under the expected operational circumstances, its efficiency at various rotational speeds was looked at. According to the findings, the motor was efficient at 500, 1000, and 1500 rpm, achieving values of 45.31%, 57.89%, and 81.76%, respectively. The motor will be chosen based on these findings, which offer insightful information about the motor's performance characteristics, in the upcoming design of the Dabai seed cracking machine. It is crucial to remember that after the machine is built, these efficiency metrics will need to be further validated. Real-world testing will guarantee that the motor operates as efficiently as possible under actual working circumstances. The findings of this study advance knowledge and aid in the creation of effective motor systems for seed-cracking equipment, increasing production and efficiency in the agricultural industry.

## **ABSTRAK**

Mesin pemecah benih Dabai masa depan, yang kini dalam peringkat reka bentuk, adalah subjek analisis prestasi motor kajian ini. Tiga matlamat utama kajian ini adalah untuk menilai spesifikasi reka bentuk mesin pemecah benih Dabai; gunakan MATLAB untuk menganalisis saiz motor berdasarkan kuasa, tork, kelajuan dan parameter lain; dan untuk mencipta model konsep sistem mesin pemecah benih Dabai. Penyelidikan adalah berdasarkan pengiraan teori dan simulasi kerana mesin masih belum dibina. Untuk menilai prestasi motor di bawah keadaan operasi yang dijangkakan, kecekapannya pada pelbagai kelajuan putaran telah dilihat. Menurut penemuan, motor itu cekap pada 500, 1000, dan 1500 rpm, masing-masing mencapai nilai 45.31%, 57.89%, dan 81.76%. Motor akan dipilih berdasarkan penemuan ini, yang menawarkan maklumat bernas tentang ciri prestasi motor, dalam reka bentuk mesin pecah benih Dabai yang akan datang. Adalah penting untuk diingat bahawa selepas mesin dibina, metrik kecekapan ini perlu disahkan lagi. Ujian dunia sebenar akan menjamin bahawa motor beroperasi secepat mungkin dalam keadaan kerja sebenar. Penemuan kajian ini memajukan pengetahuan dan membantu dalam penciptaan sistem motor yang berkesan untuk peralatan retak benih, meningkatkan pengeluaran dan kecekapan dalam industri pertanian.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction



Figure 1.1 *Dabai* ( *Canarium odontophyllum* Miq.)

As shown in Figure 1.1, *Dabai* fruit, also known as *Canarium odontophyllum*, is a tropical fruit native to Malaysia especially Sarawak. *Dabai* fruit is valued for its unique taste and nutritional properties. *Dabai* fruits are small to medium-sized, about the size of a plum or cherry, and dark purple to black on the outside. The skin is smooth and shiny, and the fruit contains one large seed. *Dabai* flesh is thick and creamy with a buttery texture that shows in Figure 1.2 below.



Figure 1.2 Fleshy fruit

*Dabai* fruit is commonly consumed in the regions where it is grown. It is often eaten raw or lightly cooked. Usually enjoyed with rice, this fruit is a popular ingredient in

local dishes and desserts. It has a unique flavor like a combination of avocado, olive and chestnut. *Dabai* berries are known for their nutritional benefits in addition to their delicious taste. *Dabai* are rich in healthy fats, especially monounsaturated fats, which may contribute to heart health and lower cholesterol levels. Fruits also contain various vitamins and minerals such as vitamin E, vitamin C, and potassium.

In recent years, the popularity of *Dabai* fruit has increased beyond its home state, and exports to other state in Malaysia are also increasing. It is highly valued for its unique taste and potential health benefits. However, due to its perishable nature, *Dabai* fruit are mostly available near where they are grown or at specialty markets.



Figure 1.3 Dabai seeds

When the fruit is mature, the skin and flesh are tough and inedible; to soften the skin, immerse the fruit unwarmed water for up to 10 minutes. Due to the flesh's creamy texture and fatty flavor, it has an avocado-like flavor as shown in Figure 1.3. Despite being rich in oil and edible, the kernel is typically thrown away. *Dabai*, which has great nutritional content and is healthy, is loved as a snack meal by the locals. Despite being widely available, *Dabai* fruit is regarded as an underutilized fruit since its potential has not been thoroughly investigated. [1] Overall, *Dabai* fruit is a tropical delicacy known for its unique flavor, creamy texture and potential health benefits. It continues to be valued as a popular local dish in Sarawak.

## 1.2 Problem Statement

There are two ancient methods of crushing *Dabai* seed which are by using stones mortar and hammers. *Dabai* seeds are placed on a hard surface and crushed with proper force. When split it, the nuts inside the seed is removed and can be eat it. It tastes like nuts, but is softer than regular nuts.

One problem that manually cracking could address is the time and effort required to crack or open *Dabai* seed. Labour-intensive for *Dabai* seed cracking would involve manually cracking the *Dabai* seed using tools such as hammers, nutcrackers, or pliers. It would also involve manual sorting and separating of the *Dabai* seed meats from the shells. The use of machinery or automation is minimal. This method is often used for small scale or artisanal nut production where the emphasis is on quality and traditional methods rather than efficiency and speed. Another problem is time consuming to cracked the *Dabai* seed. The current manual method of cracking *Dabai* seed is time-consuming, leading to low productivity and high labour costs. This is particularly problematic for large scale *Dabai* kernel production where efficiency and speed are important. There is a need for a more efficient and faster method of cracking *Dabai* seed that reduces labor costs and increases productivity.

Manual nut cracking presents hygiene challenges that impact nut safety and quality. These challenges encompass contamination and cross-contamination, arising from contact with unsanitary surfaces or equipment, which can introduce harmful substances. Insufficient hand hygiene among workers may contribute to the spread of bacteria or microorganisms onto the nuts. Additionally, maintaining proper temperature control during manual cracking is crucial to prevent *Dabai* kernel spoilage. These issues are especially critical in large-scale nut production where efficiency is prioritized. It is essential to address these concerns diligently to uphold the safety and quality standards of the produced *Dabai* kernel.

Finally, safety is an important consideration when designing any type of machine. The *Dabai* seed cracker machine should be designed with appropriate safeguards to prevent injuries to the operator, such as guards to protect against moving parts and emergency stop buttons to quickly shut off the machine in case of an accident.



### **1.3 Objectives**

The objective of this project are:

1. To evaluate design requirement for *Dabai* seed cracking machine
2. To analyse selection motor sizing based on power, torque and speed for *Dabai* seed cracking machine using MATLAB
3. To design the conceptual of *Dabai* seed cracking machine system using SOLIDWORKS software

### **1.4 Summary**

As a summary, this chapter describe about what *Dabai* is and the characteristics of *Dabai* fruit and its seeds. Apart from that, this chapter also tells about the problem that goes through when cracking *Dabai* seeds is done manually using old method. Therefore, the objective to make this project successful is shown in this chapter.

# CHAPTER 2

## LITERATURE REVIEW

### 2.1 Overview of *Dabai*

*Dabai* is a remarkable fruit that captivates with its appearance, taste, and cultural significance. With its small to medium-sized round fruit, glossy black or dark purple skin, and creamy, buttery flesh, *dabai* stands out as a unique delicacy. Its nutritional value, culinary versatility, and cultural importance make *dabai* a cherished fruit in Malaysia. Whether enjoyed as a snack or incorporated into various dishes, *dabai* offers a delightful and nutritious experience, leaving a lasting impression on those fortunate enough to savor its unique flavors.

#### 2.1.1 Structure of *Dabai* fruit

The *Dabai* fruit is oblong in shape and typically measures between 3.5 to 4.0 cm in length and 2.0 to 2.5 cm in width. It has a thin, edible skin that can range in color from pale green to deep purple or black when ripe. The flesh of the fruit can be white or yellow, and it has a triangular seed with three angles. The *Dabai* fruit has a texture similar to olives and a unique flavour. It can weigh up to 18 g and is made up of pulp, skin, and kernel. When unripe, the *Dabai* fruit is pale green, but it becomes a deep purple or black in colour when it matures. The pigment in the skin is primarily due to the presence of anthocyanin (cyanine-3-glucoside). The maturation process of the *Dabai* fruit is shown in Figure 1, starting from the emergence of fruitlets until the over-mature phase. [1]

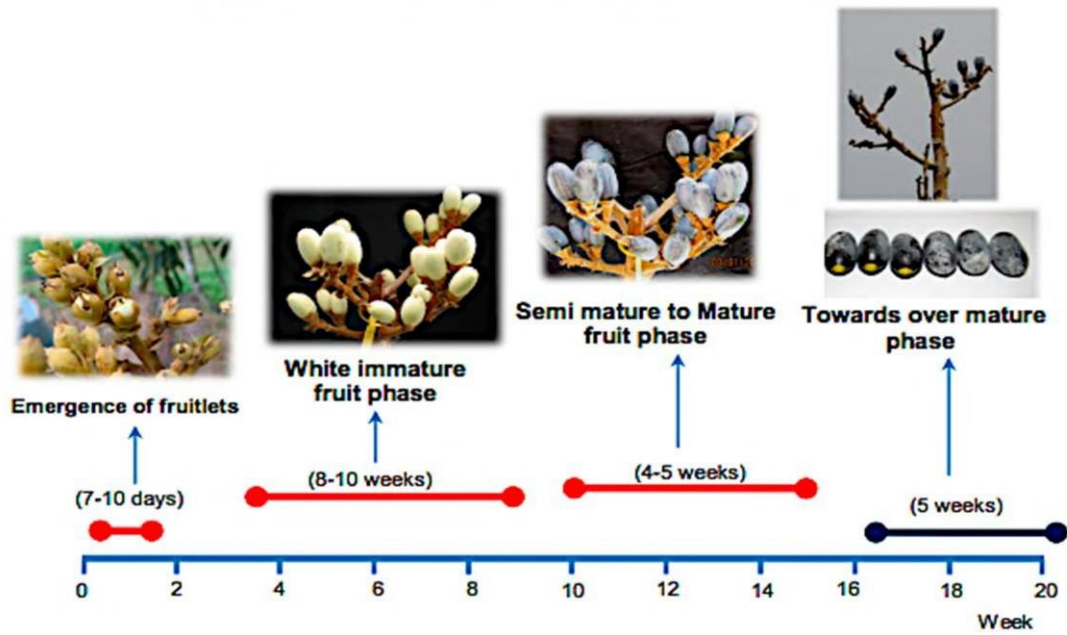


Figure 2.1 Maturation Process of *Dabai* [1]

The tree has a straight, cylindrical trunk and a dense crown of leaves. The leaves are dark green and glossy, and the tree produces small, white flowers.



Figure 2.2: cross section of *Dabai* fruit

The fruit is oval-shaped and has a green or yellowish colour when it is unripe. When it is ripe, the fruit turns brown and has a wrinkled appearance.

### 2.1.2 Structure of *Dabai* seed

The seeds of the *Dabai* fruit are encased in a hard, inedible outer shell. The seeds are oval-shaped and have a brown or dark reddish colour. The *Dabai* seeds are typically removed from the fruit and dried before used. The seeds contain a high level of oil, which is often extracted and used for cooking or for making soap and other products. The oil has a nutty flavour and is known for its stability and high smoke point, making it suitable for use in high-heat cooking methods. The seeds are also sometimes ground into a powder and used as a thickening agent in soups and other dishes.[2]



Figure 2.3: The kernel of *Dabai* seeds

"*Dabai*" is a seasonal exotic fruit found in Sarawak, and within its seed shows in Figure 2.3, is a nut with a unique taste similar to pistachios. These nuts have the potential to be sold as yet another indigenous Sarawak product. The edible nuts, which are produced from the seeds of the *Dabai* fruit, have a lovely and exquisite flavour that is comparable to pistachios. This finding, with appropriate utilisation and development, provides an exciting prospect for innovation, since it may be developed into another useful product. If fully utilized and capitalized on, the *Dabai* nut has the potential to become a distinct and sought-after item. This indigenous product has the potential to pique the interest of both domestic and international markets, appealing to culinary lovers and customers who enjoy distinctive and exotic flavours.

The seed of the Malaysian *Dabai* fruit is large in proportion to the size of the fruit and is typically about 2-3 centimeters in diameter. The seed is oval, with a smooth and

hard surface. The seed coat is dark brown in colour and is composed of a hard, woody endocarp, which surrounds the seed proper.[5]

The seed proper is composed of two main parts, the embryo and the endosperm. The embryo is the young plant that develops from the seed, and is made up of the radicle, the plumule, and the cotyledons. The radicle is the embryonic root, which develops first and forms the root system of the new plant. The plumule is the embryonic shoot, which develops next and forms the stem and leaves of the new plant. The cotyledons are the embryonic leaves, which are stored food reserves for the young plant, and are located at the base of the plumule.

The endosperm is the food reserve for the developing embryo and is located around the embryo. The endosperm is composed mainly of oil and starch and provides nourishment for the young plant until it can establish its own root system and start photosynthesizing.

The seed of the Malaysian *dabai* fruit is rich in oil, which is used in cooking, particularly in the preparation of traditional dishes such as sambal *dabai* and *dabai* curry. The oil is also used in traditional medicine, and is believed to have various health benefits, such as reducing inflammation and promoting wound healing. The seed is also high in protein and minerals, such as zinc and magnesium, which are essential for human health. The seed is also rich in antioxidants, which can help to protect the body against damage from free radicals and may have anti-cancer properties.

In conclusion, the seed of the Malaysian *dabai* fruit is a valuable food resource, as well as a source of oil for cooking and traditional medicine. It is rich in nutrients and antioxidants, and has various health benefits. The seed is large in proportion to the size of the fruit and has a hard, woody endocarp, with an oval shape, that surrounds the seed proper, which is composed of the embryo and the endosperm.

## 2.2 Product of *Dabai*

*Dabai* is a unique fruit native to Malaysia especially in Sarawak. Its small, oval round appearance and thick hard shell conceal a soft, oily kernel that holds a wealth of nutritional and industrial value. *Dabai* can also produce a food paste that is *Dabai* paste [4].

### 2.2.1 *Dabai* paste

In savory dishes, *Dabai* paste is often incorporated into curries, stews, and sauces. It lends a rich, nutty flavor and creamy texture to these dishes, creating a depth of taste that complements other ingredients. The paste can be added during cooking or used as a finishing touch to intensify the flavor before serving.



Figure 2.4 *Dabai* paste [2]

In sweet preparations, *Dabai* paste can be utilized in desserts, pastries, or as a filling for cakes and cookies. Its creamy consistency and unique flavor add a delightful twist to traditional sweets, offering a new and exciting taste experience.

*Dabai* paste is also used as a condiment or dipping sauce. It can be mixed with soy sauce or other seasonings to create a flavorful dip for snacks or as an accompaniment to grilled or fried foods.

Additionally, *Dabai* paste can be incorporated into dressings, marinades, or spreads, adding a distinctive flavor to sandwiches, wraps, or salads. Due to its concentrated form, *Dabai* paste is often used in moderation to balance the flavors in dishes. It is typically stored in sealed containers in cool, dry places to maintain its freshness and quality.

Overall, *Dabai* paste is a versatile ingredient that brings the unique taste and texture of *Dabai* fruit to a wide range of culinary creations. Whether used in savory or sweet dishes, it adds a rich, creamy, and buttery flavor that elevates the overall gastronomic experience.

### 2.2.2 *Dabai* kernel



Figure 2.5 *Dabai* kernel

High-quality fat was taken from *Dabai* kernel in Figure 2.5. Oleic (18:1), linoleic (18:2), and palmitic (16:0) acids are the most abundant fatty acids in the fruit, with percentages resembling those of palm oil. *Dabai* pulp and kernel oils were tested to look into the effects of oxidative stress, lipid profile, and lipid peroxidation on healthy rabbits.

While superoxide dismutase (SOD) and total antioxidant status (TAS) levels improved, plasma total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) levels decreased. The pulp oil increased the levels of SOD, glutathione peroxidase (GPx), plasma TAS, HDL-C, and TG, while decreasing the levels of LDL-C, TG, and thiobarbituric acid reactive compounds (TBARS).

It may be advantageous to take into account using kernel and pulp oils as part of a diet to enhance lipid and antioxidant profiles. This study demonstrates the potential for using *Dabai* fruit oil as a replacement for current vegetable oil [6].

### 2.2.3 *Dabai* Fruit Extraction

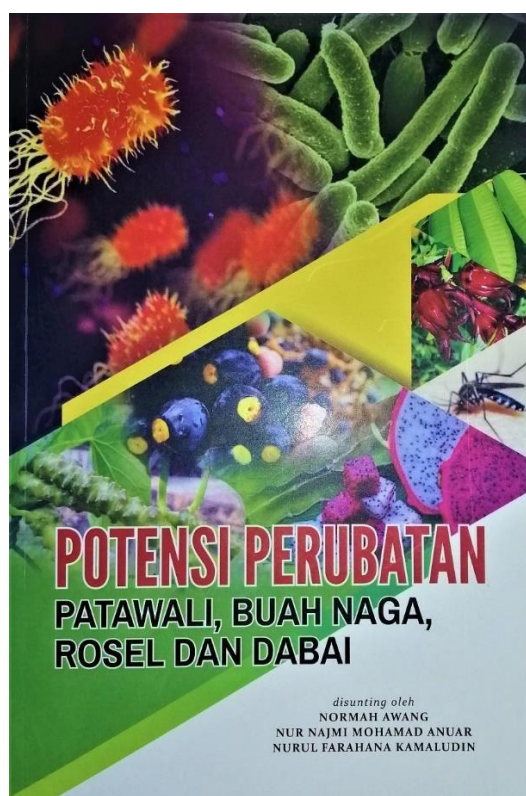


Figure 2.6 Books about *Dabai* that can be used for medical treating