DESIGN OF MINI PLANT FOR PROCESSING OF

COMPOST FERTILIZER FROM DRIED LEAVES

AHMAD NAUFAL HAKIMI BIN AMINUDDIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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AHMAD NAUFAL HAKIMI BIN AMINUDDIN

A report submitted in fulfillment if the requirements for the degree of Bachelor of Mechanical Engineering (Design and Innovation)

Faculty of Mechanical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DECLARATION

I declare that this project report entitled "Design of Mini Plant for Processing of Compost Fertilizer from Dried Leaves" is the result of my own work except as cited in the references.

Signature : ……

Name : ……

Date : ……

APPROVAL

I have declare that I have read this project report and in my opinion, this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design and Innovation).

Signature : .....

Supervisor's Name : .....

Date : .....

ABSTRACT

In many agriculture works worldwide, the need to keep up with production demands is becoming a necessity. However, there are some factors, which play a role in preventing the current agriculture processing machinery to synchronize with the fluctuating production demands. Regardless of these factors, many researches are creating new innovative designs that will deal with these factors effectively. The purpose of this thesis is to present a conceptual design of a mini plant for processing of compost fertilizer from dried leaves for large-scale production that will be used by the small farmers in the agricultural field. The research explores for the machine of the current literature and design approaches used to develop a conceptual design of mini plant for processing of compost fertilizer from dried leaves. This thesis also provides detailed methodologies to be used for concept selection, detail design, structural analysis and part simulation of the machine. The parts design, analysis and simulation are done by using CATIA V5R21 software and ANSYS software. The result of the static analysis, which is to find the bending total deformation, equivalent stress and factor safety at the analyzed parts. The results for the factor of safety is quite large because the compost fertilizer mini plant need to withstand high load. Besides that, some calculation are presented to show the bending moment diagram, sprocket ratio, sprocket torque, and shafts speed in the prototype. Moreover, a cost analysis for this product is calculated to get the exact selling price if the product managed to get into the market. Lastly, the thesis is concluded and some recommendations have been suggested for further studies on this project.

ABSTRAK

Dalam banyak kerja pertanian di seluruh dunia, keperluan untuk memenuhi keperluan pengeluaran menjadi keperluan. Walau bagaimanapun, terdapat beberapa faktor yang memainkan peranan dalam menghalang jentera pemprosesan pertanian semasa untuk menyegerakan tuntutan pengeluaran yang berubah-ubah. Walau tanpa faktor-faktor ini, banyak penyelidikkan mencipta reka bentuk inovatif baru yang akan menangani faktor-faktor ini dengan berkesan. Tujuan tesis ini adalah untuk menyampaikan reka bentuk konsel sebuah kilang mini untuk pemprosesan baja kompos dari daun kering untuk pengeluaran berskala besar yang akan digunakan oleh petani kecil di ladang pertanian. Penyelidikan ini meneroka mesin dari pendekatan pembacaan hasil penulisan dan reka bentuk semasa yang digunakan untuk membangunkan reka bentuk konsept tanaman mini untuk pemprosesan baja kompos dari daun kering. Tesis ini juga menyediakan metodologi terperinci untuk digunakan dalam pemilihan konsep, reka bentuk terperinci, analisis struktur dan simulasi bahagian-bahagian mesin. Reka bentuk bahagian-bahagian, analisis dan simulasi dilakukan dengan menggunakan perisian CATIA V5R21 dan perisian ANSYS. Hasil analisis statik adalah untuk mencari ubah bentuk jumlah lenturan, tekanan setara dan keselamatan faktor di bahagian yang dianalisis. Keputusan untuk faktor keselamatan agak besar kerana tanaman mini baja kompos perlu menahan beban tinggi sebelum gagal. Di samping itu, beberapa pengiraan dibentangkan untuk menunjukkan rajah momen lentur, nisbah sproket, tork pemancuan, dan kelajuan shaf dalam prototaip. Selain itu, analisis kos untuk produk ini dikira untuk mendapatkan harga jualan yang tepat sekiranya produk berjaya masuk ke pasaran. Akhir sekali, tesis disimpulkan dan beberapa cadangan telah diberikan untuk kajian selanjutnya mengenai projek ini.

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GDP	Gross Domestic Product.
MARDI	Malaysia Agricultural Research and Development Institute.
ICT	Information and Communication Technology.
R&D	Research and Development.
MPOB	Malaysian Palm Oil Board.
MAHA	Malaysia Agriculture, Horticulture, and Agrotourism International Show
SME	Small and Medium
TEKUN	Tabung Ekonomi Kumpulan Usahawan Niaga.
MARA	Majlis Amanah Rakyat.
PUNB	Perbadanan Usahawan Nasional Berhad.
NH_4NO_3	Ammonium nitrate.
$K_4P_2O_7$	Potassium pyrophosphate.
NH_3	Ammonia
NPK	Nitrogen-phosphorus-potassium.
PDS	Product Design Specification.
QFD	Quality Function Deployment.
HOQ	House of Quality.
CAD	Computer Aided Design.
SOP	Standard Operating Procedure.
BOM	Bill of Material.
CNC	Computer numerical control.
MIG	Metal inert gas.

FEA	Finite Element Analysis.
RPM	Round per minute.
STP	Standard for the Exchange of Product
FOS	Factor of Safety.

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CHAPTER 1

INTRODUCTION

This chapter covers the background of study, problem statement, objectives, scope of project, project significance and organization of report. The chapter overview is also included in this chapter.

1.1 Background of Study

The agricultural sector has played an important role in social and economic development in Malaysia. Before this, agricultural activities were subsistence and traditional farming. Until in1887, the industrial crops were introduced which was the industrial rubber planting in Kuala Kangsar, Perak. This has made Malaysia as the world's major natural rubber producer for centuries until the late 1980s. The advancement of technology has increased crop yields dramatically. This can be seen in Malaysia's GDP of 12% formed from agriculture. About 16% of Malaysians are involved in agriculture.

The government now focuses more on the agricultural sector because agricultural activity is not necessarily self-sufficiency anymore, but it has also benefited its entrepreneur. Now, agriculture can be as a business. It aims to transform Malaysia from an industrial country to an agro-industrial state. The government has made many changes to the development in

agriculture. This situation can be seen as one of the government's efforts to improve the standard of living of Malaysians and thus help increase the revenue of the country. Communities need to change their perceptions of the agricultural sector that is deemed to be of no benefit to them. This is because the government increasingly emphasizes the vision of 'Agriculture is a business' that the involvement of the people in this area will continue to thrive. Communities need to be more encouraged to take the risks and try to engage in agricultural activities and start serving the land. Agriculture is not limited to the age factor but needs to be cultivated by all levels of society.

The agriculture industry has played an important role in the early 1920s to the country through the rubber industry, which raised Malaysia's name as the world's major natural rubber producer until the 1980's. For developing countries like Malaysia, agriculture is the most important area for the country. The agriculture industry is an area that contributes to the nation's development and the country's economic growth in the post-independence era.

Nowadays, the agricultural sector is gradually silent with the rapid development and progress of the country. Young generation are no longer interested in continuing their hereditary works and are more keen to migrate to cities seeking more employment opportunities and offer higher and more secure income in the industrial sector. This is because the image of employment in the industrial sector is seen to be higher and has better social facilities. The Government has made various efforts to develop this agricultural field. The government wants to see that agriculture has a bright and profitable future. The field of agriculture can actually make a big contribution to the country. The National Agricultural Policy becomes the guideline for the development of this field.

Productive and efficient agriculture activities are important for the generation of abundant food resources. The importance of agriculture can be seen as high as demand for agro-based materials such as vegetables and other resources used daily. The agriculture industry supplies raw materials to the country's secondary economic sector and food processing. As a result of this agricultural field, inputs are used in the production process of foodstuffs which can be used as export products. Among the food exports that use agricultural products are butter, cocoa powder, black pepper powder and so on. Production costs can also be minimized as the price of raw materials supplied by agriculture is cheaper compared to international markets. In addition, the importance of agriculture to the country are:

i) Avoiding food supply crisis and ensuring adequate supply of food.

Malaysia is one of the countries that makes rice as a main food. The government has been trying to develop rice harvesting twice a year. Traditionally, paddy production in the past only once a year. However, with the advancement of technology and infrastructure has enabled paddy production for twice a year. This situation can accommodate the demand of the people of Malaysia and the government wants to reduce rice imports from Thailand. Reducing dependence on foreign countries can reduce currency flows to foreign countries and enhance the country's internal economy. The government is also conducting research to produce rice production five times a year. This is because of the growing population of the nation. In addition, Malaysia has land that is suitable for development in agriculture such as coffee, cereals and cocoa. If this requirement is sufficient to accommodate the needs of Malaysians, then materials imported from outside countries can be reduced.

ii) Creating job opportunities and reducing the number of unemployed.

The field of agriculture can provide broad employment opportunities to Malaysians. This is because our country has vast land to work on depending on the individual craft. Labor force can be supplied through open employment opportunities when land use for agricultural purposes is carried out. The definition of employment in agriculture not only works in farms but also includes processing and marketing. This field does not require high approval. Various government agencies related to agriculture are opening up courses offered to people interested in agriculture to gain knowledge and so on. Agriculture can reduce the number of unemployed countries and increase household income. The poverty gap can be achieved through the development of this agricultural field. Social justice and balanced wealth distribution can be achieved. As one of the effective government efforts is the Felda scheme where extensive agricultural land is distributed in equal proportions to the villagers to be developed.

iii) Increase national income and socio-economic community.

Farming is not only beneficial to its entrepreneurs but it can also increase the nation's income and subsequently socio-economic society. Countries will add gross domestic product (GDP) through the export of commercial crops such as oil palm and black pepper. Malaysia is the world's second largest producer of palm oil and palm oil production. The government through implementing agencies has made many changes in the aspects of process and machinery needs. Through the Malaysian Agricultural Research and Development Institute or MARDI, Malaysia has produced many new varieties, clones and plants with the latest ICT technology support. Consequently, farm operators can use these technologies and further increase the